INNOVATION THEORY AND PATTERNS OF
RURAL DEVELOPMENT*

By David H. Humphrey

I

The study of innovation in smallholder agriculture has developed in two major
directions: firstly studying the process of adoption and diffusion of innovations, and
secondly examination of the effect of income and wealth differentials on the ability
to take risks and innovate, and the effect of changing techniques on the distribution
of income and wealth in society [11]. The first of these ran into diminishing
returns some years ago and awareness of the second has only recently become at all
widespread and needs further investigation. The purpose of this paper is to
discuss an area that has received relatively scant attention; the effect of innova-
tions on patterns of rural development and in particular on output per acre and
on labour input per acre and how this will affect the acceptability of the innova-
tion. Having outlined the analytical framework, data from a sample of 240
smallholdings in five different areas of Malawi are examined. Results indicate the
existence of differing patterns of rural development in these areas the likely causes
of which we examined and the implications for rural development policy discussed.

II

In a recent paper Yudelman et al. [12] used a simple identity to examine the
relationship between technical change and aggregate labour utilization in agri-
culture in Japan, Taiwan and Mexico. The identity was,

\[ Y = \frac{YL}{N} \]

where \( Y \) is total output, \( L \) land under cultivation, and \( N \) the size of the agricul-
tural labour force. Assuming that the hours worked per unit of labour and the
intensity of that work remain constant over time the identity is a simple way of
examining the effect of a technical change on yields, and on labour input per unit
of land area.

A new technique is likely to affect both output per acre (\( Y/L \)) and acreage per
unit of labour input (\( L/N \)) and might do so in any of the nine ways shown in
Table 1.

* The author wishes to thank John Connell, the Editors and an anonymous referee for a
number of useful suggestions they made for the improvement of this paper. They are not
of course to be implicated in any remaining deficiencies.

1 The literature on diffusion of innovations is vast. The classic is by E. M. Rogers [8], a
useful survey has been conducted by G. E. Jones [4] and the journal Rural Sociology has
devoted much space to the diffusion of innovations.

2 An attempt to salvage the approach from the often directionless empiricism that has often
characterized it has been made by N. Roling [9].

3 The approach borrows heavily from the framework recently used by M. Yudelman et al.
[12].
TABLE 1

Output and Factor Requirement Effects of New Techniques

<table>
<thead>
<tr>
<th>Output/acre (Y/L)</th>
<th>Increase</th>
<th>Constant</th>
<th>Decrease</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acreage/unit of Labour, (L/N)</td>
<td>Mixed effect</td>
<td>Intensifying</td>
<td>Intensifying</td>
</tr>
</tbody>
</table>

- Increase ... ... Mixed effect
- Constant... ... 'Extensifying'
- Decrease... ... 'Extensifying'

Inferior techniques

It is assumed that at any given point in time a basic condition for accepting a new technique is that it should result in an increase in Y/N by at least an amount sufficient to compensate for increased farm inputs to operate the new technique and for any risk premium required as a result of adopting the new technique. The nine different effects in Table 1 may be categorized into four distinct types of innovation. Firstly, four of the techniques may be labelled as 'inferior' as they result in output per unit of labour input falling or remaining constant. Secondly, the techniques that raise output per acre such as the introduction of new seeds, fertilizers, irrigation, etc., are labelled as 'intensifying' innovations. Thirdly, those that raise the acreage that a unit of labour can cultivate (e.g. the ox plough) are defined as 'extensifying' innovations, and finally any innovations able to raise both Y/L and L/N would exhibit a combination of 'intensifying' and 'extensifying' characteristics and hence are labelled as having a 'mixed effect'.

While this approach does generate some useful conclusions concerning aggregate labour utilization, its usefulness in understanding the process of innovation may be enhanced by disaggregating from a national basis down to a small number of like households basis, by measuring N in terms of hours worked rather than the size of the labour force, and by interpreting Y not as gross farm output as Yudelman did but rather as farm output net of purchased inputs. If hired labour is used then Yudelman's identity does not adequately define the smallholders' pre-condition for accepting an innovation. Using the subscripts f and h the labour input of the family is given as N_f and of hired labour as N_h, and the product accruing to the family as Y_f and to hired labour as Y_h. Total labour input and product are given as N_{f+h} and Y_{f+h}. In terms of the identity:

\[
\frac{Y_{f+h}}{N_{f+h}} = \frac{Y_f}{L_f} \frac{L}{N_{f+h}}
\]

which may be re-arranged to yield:

\[
\frac{Y_f}{N_f} = \left[ \frac{Y_{f+h}}{L_{f+h}} \frac{L}{N_{f+h}} \right] \frac{N_{f+h}}{N_f} - \frac{Y_h}{N_f}
\]

4 There are of course situations when Y/N may be falling in a community due to population pressure on land resources (due to rapid population growth or expropriation of land for other purposes) but in such a situation it would still be most unlikely that a new technique would be adopted that would exacerbate the falling Y/N; rather techniques will be searched for that offset the falling Y/N, i.e. techniques that intensify cultivation.

5 The highly aggregated data that Yudelman uses are not completely adequate to explain the effect of technical change in Mexico where, as he points out, there are two quite different agricultural sub-sectors. The aggregation yielded largely meaningless or misleading results that can only be explained by considering the two sub-sectors separately. A further problem of aggregation is that it ignores the seasonality of labour requirements which, if significantly different between areas, would affect the results.
This identity may be readily used to examine inter-area differences in net family farm income per unit of labour and the patterns of rural development that have generated these differences, and in particular to examine whether the production techniques used in an area are intensifying (high $Y_{f+h}/L$) or extensifying (high $L/N_{f+h}$) in nature.

III

The results presented in section IV were obtained from data collected by the Malawi Government [6] from 240 smallholders in five areas of rural Malawi in the 1969–70 crop season. Some details of the areas are given in the Appendix. Data collected in this survey on labour inputs, yields, income and expenditure were supplemented by a further survey of a socio-economic nature, particularly of smallholders’ attitudes and beliefs. Some results from this latter survey are used below but the main body of its results are reported elsewhere [3].

Two of the areas surveyed are on agricultural development projects; Hara in the north of Malawi is an irrigated rice project and Ngabu in the south in the hot and humid Shire valley is on a cotton project. Both of these areas are relatively well provided with educational and transport services and with markets, shops and boreholes. The other three areas, Masambanjati in the south and Karonga and Mbawa in the north, are more ordinary areas in that they are not subject to such great extension efforts as are the project areas and are not generally as well provided with infrastructure and services.

Labour input data were recorded by the Agro Economic Survey (AES) daily for all individuals in the household and for all hired labour. The labour input figures in Table 1 are given in man-hour equivalents for the period September 1969 to August 1970 (in the case of Hara the period was December 1969 to December 1970) for the smallholders’ family labour and for hired labour. The weighting system for conversion to man-equivalents was 1.0 for male heads of households and hired labour, 0.7 for females and children of 12 years or more, and 0.3 for children of 11 years or less. These weightings were based on observations of average work equivalents of these different categories of labour. Time spent on non-farm activities (e.g. funerals, beer drinking, housework) are not included in Table 1.

The output figures are expressed in Kwacha\(^6\) and include output both sold and consumed. Home consumption of a particular product was valued at the average price that the marketed portion of that product obtained. Expenditure on farm inputs (e.g. fertilizers, seeds) was netted out of the family income figure. Cash sales were recorded accurately but in some cases there was less precision in the yield measures and the value of payments made in kind to hired labour, and thus where possible the estimates were checked with other independent sources.\(^7\) One

\(^6\) $1 (sterling) = Kwacha 2.$

\(^7\) For example from the National Sample Survey of Agriculture [7]. If it was impossible to estimate the value of home consumed product from data given in the AES reports a value of K20 per man equivalent in the household was assumed. This approximation was arrived at from AES reports that did contain sufficient information and from national income accounts in conjunction with population census data.
category of farm output for which no measure was available was that of construction and maintenance activity on farm buildings and implements. This is not thought to be a significant source of error, however, given the relatively small amount of capital equipment used in Malawian agriculture and the likelihood that it is not highly variable between the areas studied.

IV

Table 2 presents the output, labour input and acreage data for the five areas and the values of the ratios as given in the identity in section II.

<table>
<thead>
<tr>
<th>Area</th>
<th>L (Ares)</th>
<th>Nf (Man hrs)</th>
<th>Nh (Man hrs)</th>
<th>Yf (Kwacha)</th>
<th>Yh (Kwacha)</th>
<th>Yf × 100 =</th>
<th>Yf + Yh × 100 =</th>
<th>Nf + Nh × 100 =</th>
<th>Yh × 100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ngabu</td>
<td>11.45</td>
<td>4731</td>
<td>1123</td>
<td>234</td>
<td>30</td>
<td>5.66</td>
<td>73.32</td>
<td>118.59</td>
<td>0.726</td>
</tr>
<tr>
<td>Hara</td>
<td>2.45</td>
<td>3261</td>
<td>1483</td>
<td>45</td>
<td>45</td>
<td>4.35</td>
<td>78.63</td>
<td>133.62</td>
<td>1.380</td>
</tr>
<tr>
<td>Masambanjati</td>
<td>3.10</td>
<td>2035</td>
<td>499</td>
<td>13</td>
<td>15</td>
<td>5.06</td>
<td>78.11</td>
<td>103.12</td>
<td>0.737</td>
</tr>
<tr>
<td>Karonga</td>
<td>4.10</td>
<td>2550</td>
<td>350</td>
<td>11</td>
<td>3</td>
<td>3.73</td>
<td>75.92</td>
<td>109.24</td>
<td>0.431</td>
</tr>
<tr>
<td>Mbawa</td>
<td>5.14</td>
<td>2179</td>
<td>94</td>
<td>3</td>
<td>3</td>
<td>2.98</td>
<td>55.83</td>
<td>108.22</td>
<td>0.198</td>
</tr>
</tbody>
</table>

Sources [5]

Note: (1) Each part of the identity is multiplied by a factor of 100 to avoid very small numbers. Owing to rounding the identities are not precisely equal in all cases.

The picture emerging is one of a gradation of intensity of cultivation from most intensive at Hara (highest \(Y_{f+L}/L\)) to least intensive at Mbawa. There is an inverse relationship between intensity of cultivation as measured by output per acre and the ratio of land area to labour input. It is apparent that the agricultural economies of these areas are significantly different, with very labour intensive innovations being promoted at the Hara rice project, the major ones being double cropping of rice, irrigation in the dry season, a high level of fertilizer use, and rigorous weeding. This has resulted in a relatively high output per acre but a low land area to labour input ratio.

At the other end of the spectrum are Ngabu and Mbawa in which there is a high acreage cultivated per unit of labour input, there being, however, a considerable difference between the two in outputs per acre. Masambanjati and Karonga are intermediate in terms of both output per acre and labour input per acre.

These divergent patterns of rural development may have been generated by a large number of factors, such as the quantity and content of any government extension effort, proximity to markets and alternative sources of employment, population density, the fertility and terrain of the land, and climatic factors. A qualitative assessment of these factors is given in Table 3.

In considering these different development patterns and the factors determining these patterns it is convenient to start with Mbawa as it is this area that has been least subject to external influence and which probably most resembles the low productivity techniques that characterized original shifting cultivations and the gradually more settled agricultural systems that evolved from the shifting form. As well as there being a low level of government agricultural extension input in Mbawa, marketing facilities and soil fertility are poor, there is a relatively large
Some Factors Influencing Development Patterns

<table>
<thead>
<tr>
<th></th>
<th>Ngabu</th>
<th>Hara</th>
<th>Masambanjati</th>
<th>Karonga</th>
<th>Mbawa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Government extension input b</td>
<td>High</td>
<td>High</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Marketing facilities a</td>
<td>Very good</td>
<td>Very good</td>
<td>Good</td>
<td>Moderate</td>
<td>Poor</td>
</tr>
<tr>
<td>Availability of alternative employment c</td>
<td>Low</td>
<td>Low</td>
<td>High</td>
<td>Low</td>
<td>Very low</td>
</tr>
<tr>
<td>Availability of land d</td>
<td>High</td>
<td>High</td>
<td>Low</td>
<td>Very low</td>
<td>High</td>
</tr>
<tr>
<td>Belief in the possibility of raising crop yields e</td>
<td>Very low</td>
<td>Moderately high</td>
<td>Moderately high</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Conditions for crop growth f</td>
<td>Moderately good</td>
<td>Very good</td>
<td>Very poor</td>
<td>Moderately good</td>
<td>Very poor</td>
</tr>
</tbody>
</table>

Notes:

a These factors have been assessed on the basis of responses to the survey reported in [3] and to some extent on judgment based on familiarity with the areas. Results are stated in this qualitative way as each factor was assessed by a number of different questions (which acted as checks and also examined different aspects of the factors) that are too extensive to report fully here.

b Based on the numbers of smallholders having contact with various agents of innovation (broadly interpreted to include agricultural officers, radio talks, film shows, demonstrations, leaflets etc.) and the frequency of that contact.

c Marketing facilities for the farm product and availability of consumer goods and farm inputs. This assessment takes account of both geographical distances and availability of transport.

d Objective population density figures are not relevant here; rather the smallholders' felt availability of land will be a more relevant factor influencing attitudes to land use. Felt availability of land was assessed by asking whether smallholders could obtain more land if they wanted (i.e. whether there was uncultivated land available), and whether there would be sufficient land for their children.

e Assessed by means of attitude statements with which smallholders agreed, disagreed or stated uncertainty, concerning the necessity or otherwise of having more land in order to grow more crops.

f This is a highly subjective assessment taking account of climate, soil fertility, terrain, incidence of erosion and other factors that are thought to influence the suitability of the area for cultivation.

amount of cultivable but uncultivated land available and most smallholders surveyed considered that output could only be increased by extending the area of land cultivated. These conditions have resulted in Mbawa having the lowest output per unit of labour input of all the areas considered and also in it having the least intensive agricultural system. It seems probable that the other areas being considered were in the past broadly similar in agricultural practices to the present situation in Mbawa and hence the reasons for inter-area differences may be looked for in the sort of factors given above. If this assessment of original rough similarity between areas is incorrect then this approach to analysing differential development patterns loses some of its validity.

Comparing Ngabu (which has the highest $Y_f/N_f$ of all the areas) with Mbawa it is seen that labour input per acre does not differ much between the areas but that output per acre does. In terms of Table 1 Ngabu belongs to the category constant $L/N$ and increased $Y/L$ relative to Mbawa, which stands in contrast to the other three main areas which fall within the category of decreased $L/N$ and increased $Y/L$. It seems likely that this situation exists in Ngabu as a result of a combination of and interaction between the type of advice and inputs being offered by agricultural officers in this area which is part of a cotton project and the beliefs of smallholders concerning land availability and cultivation practices. Along with the introduction and promotion of cotton growing, project officers emphasized the importance of spraying and ridging the crop. Spraying is a fairly labour intensive activity (knapsack sprayers and a high volume water based spray are used) and it has a highly significant yield increasing effect that appears to make it a broadly acceptable technique. It is often difficult for the smallholders to save sufficient
to buy a sprayer outright and thus the project provides them on credit on condition that smallholders undertake to ridge their land. Ridging in this area is strongly opposed because it is a highly labour intensive activity showing in the eyes of the smallholders only negligible benefits. Even if benefits of soil conservation are perceived this may not be considered significant in Ngabu as there is a strong belief that land is in plentiful supply and more may be obtained if their existing land is eroded away. The result appears to have been an acceptance of increased cash cropping of cotton, acceptance of new varieties, but a resistance to spraying which when linked with the ridging requirement would result in a disproportionately large increase in labour requirements. Hence labour input per acre has remained similar to that in Mbawa but output per acre is higher as a result of improvements in varieties and crop husbandry promoted by the cotton project and also as a result of Ngabu exploiting its comparative advantage in cotton production. This has been made possible by ensuring that adequate supplies of maize have been imported into the Ngabu area (where maize grows only very poorly) to meet the demand of those smallholders choosing to specialize in cotton production.

At Karonga production is more intensive than at either Mbawa or Ngabu but family output per unit of labour input is not very high. The major forces that appear to have shaped development at Karonga are the lack of any very marked government agricultural extension activity and the realization amongst smallholders that unused but cultivable land is very scarce in the area and that it is possible to increase output by yield raising innovations. It is postulated that in Karonga it was the combination of moderately fertile land and the pressure of population on the land that has led to an output per acre slightly greater than that at Ngabu and almost double that at Mbawa.

Masambanjati represents a further step in the gradation of increasing intensity of cultivation. Compared with Karonga it is somewhat surprising that Masambanjati manages to achieve such a high output per acre and output per unit of labour input because at first sight it appears to be more disadvantaged than Karonga. In addition to only a low level of extension input the environment at Masambanjati is hilly, subject to erosion and not particularly fertile. Despite these problems there has been a successful intensification of agricultural production due probably in part to the low felt availability of land and the realization of the possibility of raising crop yields, but also it seems likely that market proximity and the availability of alternative employment opportunities played a significant role. Intensification of production requires working capital for fertilizers, seeds, etc. and may also require new farm equipment, which in the absence of government help as in Masambanjati has to be financed by the smallholder. To a predominantly subsistence farmer it may be almost impossible to raise the necessary

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8 It may also in part be due to lingering resentment towards the compulsion that colonial authorities exercised in trying to make smallholders ridge their crops. This has been well documented by Kettlewell [5].

9 The importance of working capital as a factor in rural development has recently been analysed by Waters [10] who suggests that the remittances of migrants are likely to be important in this context.
finance unless wage employment is available. Of the five areas considered Masambanjati is the nearest to the major industrial and commercial centre of the country (Blantyre) and also there is a large amount of employment available on the nearby tea estates.\textsuperscript{10} Wages so earned could provide the means of a successful intensification and proximity to markets would aid the process of specialization in cash crops.

Hara is the most intensively cultivated of the four areas with an output per acre double that of Masambanjati, the next most intensive, and almost six times that of the 'least' intensive Mbawa. However, due to the very high labour input per acre Hara has only a moderately high output per unit of labour input. This development pattern can safely be attributed to the very intensive rice cropping settlement scheme at Hara. This is the only area in which the smallholders believe that more land is available for them if they want it and at the same time recognize that output can increase by raising yields. This is probably attributable to the higher level of formal education amongst the settlers on this scheme as compared to the average smallholder, and also due to the educative effect of working on such a project where practices such as double cropping of rice and high levels of fertilizer input are being promoted, that contrast strongly with more traditional forms of agriculture.

Given the nature of the evidence available the relationships above are suggestive rather than conclusive. It does however appear that the differential patterns of rural development in these five areas can be consistently explained in terms of advice and inputs offered by agricultural development officers, the degree of acceptance of which is tempered by, among other things, attitudes of smallholders towards the availability of land and the possibility of yield increasing innovations. These latter two factors also appear important in their own right as movers of agricultural change.\textsuperscript{11} The other factors considered are of course important but appear more to be modifying conditions rather than prime movers in themselves.

One further aspect of the economies of these five areas deserving attention is the wage paid to hired labour, which we can assume approximates to the marginal

| Source: Table 2. |

<table>
<thead>
<tr>
<th>Area</th>
<th>Wage to Hired Labour</th>
<th>Wage to Hired Labour</th>
<th>Wage to Hired Labour</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$\frac{Y_h}{N_h} \times 100$</td>
<td>$\frac{Y_f}{N_f} \times 100$</td>
<td>$\frac{Y_{f+h}}{N_{f+h}} \times 100$</td>
</tr>
<tr>
<td>Ngabu</td>
<td>...</td>
<td>2.66</td>
<td>5.66</td>
</tr>
<tr>
<td>Hara</td>
<td>...</td>
<td>3.04</td>
<td>4.35</td>
</tr>
<tr>
<td>Masambanjati</td>
<td>...</td>
<td>3.01</td>
<td>5.06</td>
</tr>
<tr>
<td>Karonga</td>
<td>...</td>
<td>3.15</td>
<td>3.73</td>
</tr>
<tr>
<td>Mbawa</td>
<td>...</td>
<td>3.19</td>
<td>2.98</td>
</tr>
</tbody>
</table>

\textsuperscript{10} Smallholders in Malawi who go to find work either in towns or on estates generally do so only on a temporary basis, later returning to their smallholdings. Even the more settled urban workers will usually retain their right to cultivate land in a village and will often employ labour to run the smallholding.

\textsuperscript{11} The role of population pressure on land as a stimulus to inventiveness and change has been excellently analysed by Boserup [3].
product of that labour. This wage, given by \( \frac{Y_h}{N_h} \) in Table 4, is lowest in Nubga and highest in Mbawa, but the differences between areas are small and whether they should be considered significant is doubtful. If these differences between areas in the marginal product of hired labour (MPL) were thought to be significant it should be possible to explain them in terms of the underlying production functions for the areas. Although these production functions are not known we can examine what the data appear to imply for the production functions and assess whether the implications are reasonable, and if unreasonable whether too much is being read into the differences in MPL. Firstly, there is a reasonable, but far from perfect, negative correlation between MPL and total labour input which is as would be expected. Secondly, for all areas except Mbawa the average product of labour \( \left( \frac{Y_{f+h}}{N_{f+h}} \right) \) is greater than the MPL which is again a normal property. The situation in Mbawa (which had a lower total labour input per acre than any other area) could conceivably be explained in terms of the average smallholder being on a part of his production function exhibiting increasing returns to labour.

However, there are reasons to doubt whether any significance can be attached to the differences in MPL. Firstly, the variance of MPL is very low, both absolutely and also relative to the variances of APL and \( \frac{Y_f}{N_f} \) (which are respectively about 50 and 80 times the variance of MPL). This low variance of MPL coupled with the inevitable inaccuracies in survey data of this type suggest that the calculated differences in MPL should not be considered significant. Secondly, there is a high degree of labour mobility in Malawi, both within the country and to other countries. This mobility would tend to equalize the marginal product of hired labour between areas, while the marginal product of the family labour would be likely to continue to differ between areas because of the differing production techniques between areas and the social barriers that commonly prevent immigrants to an area obtaining land usage rights from the tribal authority of the area who usually dispenses such rights.

On balance it thus seems likely that the marginal product of hired labour does not differ significantly between areas and that the area differences in value added per unit of family labour result from differences in production techniques between areas. These differences in \( \frac{Y_f}{N_f} \) are likely to persist (assuming no further technical change) because of problems of land usage rights for immigrants as noted above, and because of the existing production technique differences and resultant differences in factor inputs between areas which will mean that \( \frac{Y_f}{N_f} \) not only incorporates a return to family labour but also to other factors of production owned by the family.

From these considerations certain questions about and implications for rural development policy arise. First, there is an apparent bias towards intensification in production; in two areas out of necessity due to pressure on land and in the

\[ \text{About 15–20 per cent of the male population of Malawi is thought to be working abroad at any given time.} \]
other two areas as a deliberate act of policy. At Hara the intensification was successful but at Ngabu although a higher output per acre was achieved than at Mbawa attempts to introduce techniques requiring a higher labour input per acre were resisted. It is very common in Malawi as in many other African countries, to find that the innovations being most vigorously promoted by government agencies are those requiring an intensification of production. These techniques have usually been developed in and for land scarce economies in which they have produced very good results. Because of this success, because of the educational bias often existing in those who decide which techniques to promote, and because of lack of recognition of the problems of a land surplus economy there may be a tendency to blindly promote intensifying innovations without giving sufficient consideration to the complete range of possibilities. Labour saving techniques such as the use of draught animals in cultivation are less commonly promoted.

If there is in fact a greater bias towards intensification of production than would be warranted by actual factor scarcities it might be argued that it does not matter, providing that the techniques promoted are going to increase labour productivity. Up to a point it is probably true that providing the innovation can raise $Y_t/N_t$ subject to the social, political, legal and economic constraints within which the smallholder is operating he will find it acceptable. However in a situation where the smallholder perceives there is surplus land and where he has in the past been accustomed to increasing output only by increasing the acreage cultivated, there may well be a bias in his mind towards extensifying innovations. It was indeed found that smallholders who believed themselves to be in a land surplus situation expressed a very much stronger interest in ox-ploughs and carts than smallholders in land shortage areas [3]. In such a situation it may be much easier for agricultural officers to ‘put over’ an extensifying technique than an intensifying one.

In terms of the areas studied any development effort at Karonga and Masambanjati has little choice but to promote intensifying innovations given the land shortage in these areas. At Hara the very great intensity of cultivation has been successful in terms of output per acre but productivity is not particularly high and after this survey was conducted it became apparent on the project that double cropping of rice was not feasible, partly due to its very intensive nature (but mainly due to there being insufficient time between crops for adequate pest control).

At Ngabu and Mbawa there is a bias amongst the smallholders in favour of extensifying innovations and a scepticism about the viability of yield increasing innovations. This suggests that a search for productivity increasing techniques that enable more land to be cultivated would have a better reception than techniques that increase yields but which at the same time may require an increased labour input or a reduced farm size. Further, the promotion of extensifying innovations may well aid the promotion of erosion control that is of concern to agricultural officers in Ngabu. By extending the area of land cultivated smallholders will eventually perceive there to be a land shortage which immediately gives them a strong incentive to prevent deterioration of their land through erosion. Failure to give due consideration to extensifying innovations may
largely stem from the technological bias introduced by the basically Eurocentric views and training of agricultural advisers who promote changes that will increase net return per acre, whereas in the land surplus economy a more appropriate objective may be to raise net return per unit of labour by enabling that labour to cultivate more land with yields remaining constant or even falling.

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APPENDIX

Some physical details of the five areas is given below.

<table>
<thead>
<tr>
<th>Area</th>
<th>Number of Smallholdings Sampled</th>
<th>Average Rainfall (inches)</th>
<th>Mean annual Temperature (°F)</th>
<th>Altitude (feet)</th>
<th>Vegetation Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ngabu...</td>
<td>...</td>
<td>50</td>
<td>25</td>
<td>300–325</td>
<td>Shrub savanna</td>
</tr>
<tr>
<td>Hara</td>
<td>30</td>
<td>50–60</td>
<td>75</td>
<td>1550–1800</td>
<td>Marshland</td>
</tr>
<tr>
<td>Masambanjati</td>
<td>60</td>
<td>57</td>
<td>70–75</td>
<td>2200–2600</td>
<td>Woodland savanna</td>
</tr>
<tr>
<td>Karonga</td>
<td>...</td>
<td>50</td>
<td>71</td>
<td>1500–1800</td>
<td>Savanna and low altitude marsh grasslands</td>
</tr>
<tr>
<td>Mbawa</td>
<td>50</td>
<td>34</td>
<td>69</td>
<td>3900–4100</td>
<td>Sparse woodland and seasonal marsh</td>
</tr>
</tbody>
</table>

Ngabu is located in the hot and humid lower Shire valley that leads into the Zambezi and is about 60 miles south of Blantyre, the major commercial centre of the country. The major cash crop is cotton, the villages being on the Chickwawa Cotton Project that was started in 1968. Maize does not grow well in the climatic conditions of this area and food has to be brought into the area to meet requirements.

Masambanjati is also within the Southern Region and about thirty miles south of Blantyre. Terrain in this area is very hilly and a great mixture of crops is grown—maize, millet, potatoes, groundnuts, pulses, bananas, cassava, sugar cane, and vegetables being the major ones.

Hara, like Karonga and Mbawa, is in the Northern Region and is located on what was previously unusable marshland near the shore of Lake Malawi. Irrigated rice is the major crop but smallholders do grow small amounts of cassava, groundnuts and vegetables. The area is a rice project managed by the Chinese (Nationalist) and the smallholders on the project have been settled on it from surrounding areas and also from farther afield.

The Karonga villages are located on a narrow and relatively densely populated lakeshore plain of Lake Malawi, the land being flat and prone to flooding. Major crops are rice, maize, cassava and groundnuts.

Mbawa is in an isolated position about 35 miles southwest of Mzimba township and near Malawi’s western border with Zambia. Communications and services in this area are not particularly good. Major crops are maize, groundnuts, millet, pulses and tobacco.
REFERENCES


