JOURNAL OF SOCIAL SCIENCE

Volume 11, No. (2) 1984

University of Malawi

SMALLHOLDER AGRICULTURE IN THE LOWER SHIRE VALLEY : ANALYSIS OF THE EXPERIENCE WITH COTTON

By *David Colman*

The objective of this paper is to review the experience with smallholder cotton production in the Lower Shire Valley (LSV) of Malawi and to attempt to draw from it some pointers for strengthening the strategy for smallholder agriculture in the area. The main empirical analysis is based on an extensive survey (SOLV) performed some time ago, in 1972/73 (Colman and Garbett, 1974, 1976). Despite the lapse of time since its completion, more recent data suggest that there is a good deal of material of contemporary relevance which can be extracted from the original study. In addition, subsequent experience with rural development in countries other than Malawi enables fresh insights to be brought to the problems of smallholder agriculture in the LSV.

Basis of the Smallholder Cotton Scheme

The Chikwawa Cotton Development Project (CCDP) was started in 1968 as the result of rural planning initiated in the earliest days after Independence. Its central strategy was to capitalise upon the products of research into the control of cotton pests carried out at Makoka Agricultural Research Station in the 1950s. This research showed the possibility of significant gains in yield and the quality of cotton subjected to a regime of insecticide treatment during its cultivation. The possibilities this held out for raising the output of cotton and the incomes of smallholders must have been seen as presenting a very attractive opportunity for a rural development project in the Lower Shire Valley as well as in the cotton-growing areas, such as around Salima.

As the basis for a project in the LSV, sprayed cotton had a number of obvious merits: (1) Cotton was already the main cash crop of smallholders in the LSV, it had a well-established place in the farming system of the West Bank areas of Chikwawa in particular, and growers were used to growing it. (2) The technological basis of the project was apparently straightforward insofar as it involved simply applying sprays in a regular sequence using a hand sprayer, and it did not appear to require a complete transformation of the farming system. To the extent this was so, the technology was easy to explain and demonstrate, and the benefits were readily apparent in the form of higher yields. (3) The project did involve introducing new inputs into traditional agriculture in the form of seed, insecticide, and sprayers, and this could be used as the springboard for other changes, such as in cultivation practice, and hence serve as the basis for a more comprehensive modernisation. (4) Because the target crop could not be eaten but had to be sold for cash, the cotton-spraying inputs could be distributed as part of a credit scheme run via ADMARC markets with payment deferred to the

time at which cotton was delivered for sale to ADMARC. This facilitated a high level of credit recovery. (5) The dominant problem of agriculture in most parts of the LSV is that of adequate soil moisture as a result of the combination of low and uncertain rainfall and high rates of evapotranspiration. This favours the adoption of drought-resistant crops as the basis for rainfed agriculture, and cotton was and is one of the most important of these. By basing the first large-scale smallholder project on improving rainfed cotton yields, progress could be made while simultaneously exploring the possibilities for smallholder irrigated production and new crops as the foundations of later steps. (This strategy carried over also into the second phase project and was explicitly recognised in the proposal document (Malawi Government, 1972: p. 29): "It has been computed that there are 350,000 acres/140,000 hectares available for dryland arable farming *for at least the next ten years before large areas are developed for irrigated farming.*")

Inevitably, the expansion and modernisation of cotton production could not take place without the provision of supporting services and the improvement of infrastructure. Hence the original 1968-73 CCDP contained a number of elements in addition to those directly related to cotton production. These included: (1) the provision of boreholes for portable domestic water and insecticide-spraying use; (2) the construction of feeder roads and improvement of existing roads; (3) the construction of new markets; (4) the establishment of settlement schemes; and of course, most crucially, (5) an expansion of the agricultural extension services. In addition, the project proposal also stated that "There will be some improvement in the production of the staple food, maize." However, because there was no well-defined technological package at the time to raise maize yields, the contribution of maize to project benefits was intended to be modest by comparison with that of cotton; by year five (1972/73) of the project it was originally anticipated that the net annual benefit from maize would be £33,000 as against £258,000 from cotton. Thus the project was principally a cotton-growing project, but because of the need to improve services in the region it became a simple prototype of what became known later as an Integrated Rural Development Project. This of course signifies that there was a range of social benefits arising from the project, although the only ones explicitly recognised for appraisal purposes were those arising principally from extra cotton production and, less importantly, any resulting from extra outputs from improved maize. In the event, however, the attempt to introduce improved maize was delayed, and little progress was made in the early years.

Assessment of the Contribution of the First Phase Project to Cotton Production

Up to the time at which the SOLV survey (Socio-Economic Survey of the Lower Shire Valley) commenced in late 1972, the main agricultural development activities which had taken place were the first four years of the CCDP cotton project and the development of the sugar estate and

factory at Nchalo by the Sugar Corporation of Malawi. With the remit of conducting a wide-ranging socio-economic investigation of the changes occurring, it was inevitable that the initial focus of the survey was into the impacts of the CCDP, since this directly affected the welfare of large numbers of producers spread over a wide area. At that time the prevailing view was that the project had been outstandingly successful in meeting its primary targets of raising cotton production, and that a successful strategy had been identified to pursue into the second phase (1973/74 to 1977/78) project for the LSV as a whole. The basis for this assessment can be summarised by the data presented in Table 1.

Table 1. *Target and Actual Cotton Production Increases in the CCDP Project Area, 1968/69 - 1971/72 (short tons)*

	Target production[a]			*Actual production*		
Year	Level	Incremental increase	Cumulative increase	Level	Incremental increase	Cumulative increase
1968/69	7,500[b]	1,100[c]	1,100	7,540[b]	3,726[d]	3,726
1969/70	8,400[b]	900	2,000	10,551[b]	3,011	6,737
1970/71	11,000[b]	2,600	4,600	12,300[b]	1,749	8,486
1971/72	13,500[b]	2,500	7,100	12,577[e]	277	8,713

[a]It was assumed that, without the project, production would have increased by 3 per cent per annum. Thus of the incremental target of 9,100 extra tons of production by 1972/73, only 8,100 were expected to be due to the CCDP, and of the 7,100-ton target for 1971/72 only approximately 6,400 tons were expected to be due to the project.

[b]*Source:* Malawi Government (1972: p. 12).

[c]Figure derived from International Development Association document P-584.

[d]Based on estimate that 1967/68 production in the CCDP area was 3,814 short tons (Colman and Garbett, 1974: p. 59).

[e]Estimate from Colman and Garbett (1974: p. 59).

It is entirely understandable that in the early years of the CCDP the reaction by all concerned to the figures presented in Table 1 should have been little short of euphoric. For, in the first three years alone, production in the CCDP area increased by a total of 8,486 tons against a five-year target of 8,100 tons by 1972/73. However, deeper analysis as part of the SOLV exercise led to considerable reservations about attributing all of the production increase to the activities of the CCDP, and more

importantly it led to doubts about the likelihood of the substantial sustained further increases in cotton production which were envisaged in the proposals for both the first and second phase projects.

One immediate question which arose with respect to the data in Table 1 was how could the project achieve such dramatic results in its first year in particular, and also in its second year when this was the period of recruiting and training staff, and of building the facilities required for the main extension effort? While, as reports show, some 700 additional farmers began spraying cotton in 1968/69, the upsurge in cotton production far exceeded the contribution their estimated extra 2,100 acres could have produced. It is of course conceivable that this was recognised at that time, and that it might have been felt that the creation of the CCDP could have caused such a boost in confidence in cotton production that producers in general were prepared to increase the resources committed to it. However, this seemed unlikely, and slightly deeper analysis of the data suggested that this was not so.

Analysis suggests that there were many factors in addition to the activities of the CCDP which contributed to the upsurge in cotton production in 1968/69 and 1969/70. Production of seed cotton in the LSV as a whole had declined from 18,925 tons in the very high-yield year of 1964/65 to 9,503 in 1965/66 and 7,176 in 1966/67, and touched the ten-year low of 5,608 in 1967/68, the base-year prior to the inception of the project. A number of factors appear to have been responsible for this decline, including (1) a fall in average cotton prices due both to a reduction in official prices and a decline in quality because of weather factors; and (2) very low (November-to-February) rainfall in the three years 1965/66 to 1967/68, which considerably depressed yields. It seems highly probable, based on econometric results (Colman and Garbett, 1974: Ch. 5), that the improvement in average received cotton prices from 1967/68 onwards and the higher rainfall from 1968/69 to 1970/71 had a significant positive impact upon cotton production. In order to test that these and other unidentified factors were responsible for some part of increased production in the CCDP area, it was decided to examine the extent to which production within the CCDP area had increased more rapidly than in the adjacent cotton-growing areas of the LSV in which the credit-based spraying technology was not assumed to have been available. The procedure involved treating the CCDP area as an experimental plot and the surrounding cotton-growing areas of Chikwawa and Nsanje as the control area. Before conducting this test, however, some adjustment to the data in column 4 of Table 1 was needed to offset the fact that part of the increase in production noted there was attributable to the progressive expansion of the CCDP in the northern market areas of Sande, Sorgin, and Tomali. Accordingly, in Table 2 the production figures for the CCDP area in all years include the total sales in these market areas, plus a varying proportion of sales in Tombondera and Moses market areas to reflect CCDP assumptions of the proportion of the project's share of sales in these areas. The calculation shown in Table 2 was then made of the amount by which CCDP

project area cotton production exceeded the hypothetical level it would have been if output had grown at precisely the rate of growth in the surrounding "control" area.

Table 2. *Estimate of Additional Cotton Production Due to the CCDP - Method 1 (short tons)*

	Control area		*Production in CCDP area*		
Year	Actual production	Growth of production	Actual	Hypothetical[a]	Estimated contribution of CCDP
1967/68	1,795	-	3,814	-	-
1968/69	3,465	1.930	8,599	7,361	1,238
1969/70	4,475	1.291	11,596	9,503	2,093
1970/71	3,691	0.825	12,139	7,840	4,299
1971/72	4,160	1.127	12,575	8,820	3,755

[a]These figures (using growth rates to five decimal places) are derived as follows: 3,811 x 1.193 = 7,361, 7,361 x 1.291 = 9,503, 9,503 x 0.825 = 7,840, 7,840 x 1.127 = 8,820.

As noted in a footnote to Table 1, the expected contribution of the CCDP project was somewhat less than the cumulative target increase shown in column 3 of that table because of an allowance for a natural growth rate of production. Nevertheless, comparison of the estimated additional output in Table 2 with the cumulative target and cumulative gross production in the CCDP area provides a markedly less favourable estimate of achievements, with gains by 1971/72 running well behind target and only 3,755 out of a gross production increase of 8,713 short tons actually attributable to the project. For many reasons laid out in the full study (but not completely reviewed here) this estimate did not appear to be biased against the project. Firstly, it was clear that in 1968/69, and to a lesser extent 1969/70, there had been a massive rebound in production outside as well as within the project area. Some of the "control" area in Nsanje was facing acute problems of land pressure and land degradation, and cotton production there had declined throughout the period of recovery. Furthermore, major deficiencies were identified in the CCDP statistics relating to the difference between sprayed and unsprayed cotton yields, and in the acreage under production and number of growers. These deficiencies came to light as a result of the detailed survey work undertaken after the setting up of the project's Evaluation Unit in 1971. The report by Oblitas (1973) suggested that statistics presented hitherto had portrayed an upwardly biased picture of the impact of spraying upon yields. It also became

apparent that spraying farmers were, season to season, progressively reducing the number of sprayings below the recommended number. With the availability of these new data it was possible to adopt an alternative procedure to estimate the project's contribution to output. This second method set out to use the data on spraying farmers, their cotton acreage, and the data on the difference between sprayed and unsprayed yields - the latter being downwardly biased - to calculate the additional output from spraying. The key assumptions made were (1) that all spraying farmers would in any case have grown the same cotton acreage had the new technology not been available - to the extent they would have grown less, this biases the estimate downward; and (2) that without spraying they would have only obtained the average unsprayed yield - as better farmers they might have produced better yields, in which case this assumption biases the estimates upwards.

Table 3. *Estimate of Additional Cotton Production Due to the CCDP - Method 2*[a] *(short tons)*

Source of additional production	1968/69	1969/70	1970/71	1971/72
Registered spraying farmers	1,146	1,789	3,371	2,613
Aerial spraying farmers (1)[b]	-	102	376	277
Aerial spraying farmers (2)[b]	-	53	172	99
Unrecorded spraying farmers	313	435	685	441
Total incremental production	1,459	2,379	4,604	3,430

[a]Details of the assumptions, data, and calculations are presented in Colman and Garbett (1974: Appendix III.2).

[b]Item (1) is the incremental production from aerially sprayed plots. Item (2) is the extra production from the knapsack-sprayed plots of growers participating in the aerial spraying programme.

Because of the upward bias in the estimated yield gap between sprayed and unsprayed cotton for the years 1968/69 to 1970/71, the Table 3 estimate of the CCDP contribution for these years could certainly be considered to be overestimated, and alternative calculations were made. However, setting this aside, the most important fact is the measure of agreement between the two alternative estimates of the CCDP's impact upon cotton production. In view of the entirely different routes employed by the two methods, the similarity of the results appeared to be very striking.

The calculations presented suggested that it was necessary to revise downwards estimates of the impact of the CCDP upon cotton production. Also,

at the time they were produced, they raised doubts about the feasibility of achieving the cotton output targets for the LSV of 22,905 tons in 1974/75 and 41,540 tons in 1978/79 as envisaged in the Phase II project proposal (Malawi Government, 1972: Annex 3, p. 7); these seemed particularly unrealistic in view of the impression gained from the estimates in Tables 2 and 3 that the rate of impact of the project was already declining by 1970/71 and 1971/72 and from data revealing a decline in

Table 4. *Seed Cotton Purchased, Estimated Areas, and Yield, Lower Shire Valley, 1964/65 - 1979/80*[a]

Year	Seed cotton purchased (whole valley) (short tons)	Cotton acreage (000 acres)	Cotton yield (lbs/acre)
1964/65	18,925	42.0	901
1965/66	9,503	44.6	426
1966/67	7,176	45.2	317
1967/68	5,608	41.0	274
CCDP - Phase I			
1968/69	11,984	62.0	387
1969/70	16,075	53.8	598
1970/71	16,004	68.9	465
1971/72	16,764	77.5	433
1972/73	11,236	65.0	346
SVADP - Phase II			
1973/74	16,714	73.0	458
1974/75	10,589	70.0	303
1975/76	8,378	74.0	226
1976/77	10,643	49.0	427
1977/78	10,965	49.4	444
1978/79	10,771	74.0	226
1979/80	10,117	49.0	490

Source: Green (1978: p. 5), for data up to 1976/77.

[a]The acreage figures, and hence the yield figures, are unreliable, very much so in the early years.

estimated yields of sprayed cotton. However, in early 1973, there was considerable resistance to the acceptance of these implications, although as events have transpired they have shown to be well founded and, as Table 4 shows, cotton production in the LSV had not subsequently attained the level of 1971/72 by 1976/77. Exploration of some of the causes of this resistance may still hold useful pointers for smallholder project design in the LSV and elsewhere; this examination is presented in the final section of the paper after a brief discussion of some of the factors which limited the effect of introducing cotton-spraying technology.

Factors Which Have Limited the Expansion of Sprayed Cotton Production

The basic fact is that sprayed cotton was not as well suited to the farming system of large numbers of LSV farmers as a straightforward comparison of the expected yields of improved-sprayed and unsprayed cotton must have suggested. Given that the improved practices were expected on average to double or triple yields and increase net returns per acre by a factor of over two, it is not difficult to understand why a substantial response to the technology might have been anticipated. However, because of the heterogeneity of local soil and water supply conditions, the extreme variability of yields of all crops, and the wide range of labour-to-land-to-consumption ratios of farming households, the attractiveness of sprayed cotton was not uniform for all households.

A critical factor about the insecticide-sprayed cotton technology is that it requires an increase in labour input almost in proportion to the increase in yield. Extra labour is required (1) for spraying, including the often arduous and disagreeable task of carrying water to the fields from water sources which may be over two miles away (Oblitas, 1973: p. 55); (2) for ridging the land as a qualifying condition for credit; and (3) the dominant item, which is for extra picking and grading of cotton. In consequence, the comparative increase in returns from sprayed cotton over other crops is much less per man-day than it is per acre. This is clearly borne out by the data in Table 5. These data - see remarks below about crop yields variance - reflect a substantial judgemental input about what average yields and input levels are; inevitably, estimates of these have changed over time, as have the relevant input prices, and new crops such as guar beans have arrived within the system. Nevertheless, the different estimates have certain key similarities: (1) In all three sets of estimates sprayed cotton ranks lower in terms of returns per man-day than in returns per acre. (2) The returns per man-day from unsprayed cotton are very little different from those of sprayed cotton, and certainly would not be statistically significantly different. The International Development Association's estimates even rank unsprayed above sprayed cotton on this criterion. (3) Only in Johnson's estimation (see Green, 1978), which leaves out of account both rice and guar beans, does sprayed cotton head the rankings of returns per acre, and in no case does it head the rankings in returns per man-day. In general, maize, even rainfed, yields a higher return to labour, as

Table 5. *Average Gross Margins Per Acre and Per Labour Day*[a]

Crop	Colman and Garbett (1974)				IDA (1976)				Johnson in Green(1978)			
	GM/acre		*GM/day*		*GM/acre*		*GM/day*		*GM/acre*		*GM/day*	
	K/ac	Rank	K/day	Rank	K/ac	Rank	K/day	Rank	K/ac	Rank	K/day	Rank
Maize (dimba)[b]	n.c.[c]	-	n.c.	-	31.08	3	0.89	1	33.89	2	0.97	1
Maize (dryland)	16.00	5	0.42	2	15.04	6	0.43	3	16.48	4	0.47	2
Cotton (tailboom sprayed)	47.57	2	0.35	3	35.42	2	0.31	5	34.95	1	0.37	3
Cotton (unsprayed)	20.54	4	0.30	4	18.94	5	0.32	4	22.16	3	0.36	4
Groundnuts (malimba)	26.00	3	0.29	5	9.04	9	0.16	9	9.81	6	0.16	7
Bullrush millet	n.c.	-	n.c.	-	10.10	7	0.30	6	8.34	7	0.22	6
Rice (rainfed)	66.00	1	0.47	1	30.77	4	0.29	8	n.c.	-	n.c.	-
Guar beans	n.c.	-	n.c.	-	42.00	1	0.60	2	n.c.	-	n.c.	-
Sorghum	n.c.	-	n.c.	-	10.10	8	0.30	7	12.72	5	0.33	5

Sources: Colman and Garbett (1974: Ch. 4 and Appendix II); International Development Association (1976: Annex 4, Appendix I, p. 10); Johnson in Green (1978: p. 17).

[a] These estimates have been made at different times - 1973, 1976, and 1977 - and the differences between them reflect (1) changes in prices, (2) changes in the judgement about average yield, and (3) possibly some revision in the assumed labour requirements.

[b] Land which becomes available for cultivation as the marshes recede, and which has a high water-table level, is known as *dimba* land.

[c] n.c. = Not calculated.

now it appears do guar beans, and as earlier did rainfed rice.

It is thus apparent that the new technology, *even in average conditions*, did not in general make sprayed cotton the most economically attractive of the alternative crops. This point is further reinforced by the data presented by the IDA (1976: Annex 4, p. 10) and by Johnson (in Green, 1978: p. 17) on crop gross margins per kwacha of capital invested. Since sprayed cotton and irrigated rice are the only two crops which typically involve the use of any significant farming capital, it is inevitable that their gross margins per kwacha invested should be substantially less than those for other crops. In fact, the gross-margin-to-capital ratio is estimated at less than three, which is significant since, as Kavinya (1979: p. 63) quotes, "From IDA's experience, unless the return on additional investment is at least three times the cost of extra input, the farmer has little incentive to take the risk involved in the innovations."

Another problematic aspect of the additional labour requirement, particularly that for harvesting, is that it comes at a time which conflicts with the labour demands for food crops. This is precisely the same problem as that recorded for sprayed cotton in Northern Nigeria by Norman *et al.* (1974). However, it is a particular problem in the LSV, since the area has a very substantial food deficit - in 1975/76 the IDA estimated the cereal deficit for the LSV as a whole to be 46 per cent of total demand - plus a somewhat inadequate system for marketing maize at the right times to the places where food demand is unfulfilled. Since, in addition to all the factors already listed, it is accepted that there is a labour shortage in several areas of the LSV at cotton-harvesting time, it is not perhaps surprising that the competition for labour and land between food crops and sprayed cotton has swung steadily in favour of the former.

In observing that there is an apparent labour supply shortage for certain agricultural tasks, it is important to observe that this is not entirely involuntary - that is, it is not due to an absolute shortage of potential labour supply. Rather, it must be adjudged to be a "voluntary" shortage caused by the diversion of labour to more remunerative or acceptable uses for available working time. It is true that there are some households with only old, sick, or single adults which may indeed have an absolute shortage of labour in relation to the potential absorbtive capacity of their land, and which may therefore be forced to choose labour-intensive cereal crops in preference to sprayed cotton. In other cases, however, the optimal family labour allocation may involve "exporting" labour abroad, to the urban areas, or simply to local employment off the family's holding. Even though this strategy may involve adopting a less labour-intensive farming system than might be possible, it may result in both higher and more stable family incomes. The allocation of available family labour to own-farming operations depends upon the opportunity-cost of labour, and in this connection the estimated

returns per man-day in Table 5 overstate the attractiveness of allocating labour to crop production. For the returns shown there make no allowance for the fact that there may be long periods in which little directly remunerative work can be performed. The labour profile of farming work in the dryland areas of the LSV has a very marked seasonal pattern with a long slack period. For most families the gain in income from exporting a family member to take up a job elsewhere, even at the minimum daily wage, will more than offset the value of the loss of output on the family holding which may result. In 1973 Colman and Garbett found surprisingly strong evidence of the lure of farm employment in a survey which indicated that in the LSV 25.6 per cent of adult males aged 15 to 49 could be classed as labour migrants (42.3 per cent of whom were outside Malawi), while another 13.7 per cent had local wage employment or were engaged in rural crafts. The recent paper by Kydd and Christiansen (1982) makes it clear that the exodus of adult males from smallholder agriculture has not diminished in the subsequent decade. It may be concluded that the returns from smallholder agriculture are inadequate to hold many of the most dynamic elements of the rural labour force.

A critical factor stimulating both the migration of labour from dryland farming in the LSV and the concentration of resources on cereal rather than cotton production is the exceptional variability in yields. This variability is manifest on a year-to-year basis, but, equally importantly, from plot to plot within the year. An aspect of the year-to-year variability is that declines in yields occur simultaneously for both cereals and cotton. Thus when cereal production for own-consumption declines, so too does the cash income from cotton, the discretionary part of which could be used to buy food. This leads to an extreme insecurity of food supplies - offset somewhat by repatriated incomes from "exported labour" - but it must inevitably lead the most vulnerable families, those with small holdings and little off-farm income, to concentrate resources on food production as a survival strategy. This tendency will also be accentuated by the high risk of low yields on many individual plots within a year. Average yields appear to have only limited significance, since the yield distributions for cotton and maize are remarkably flat (as are those for other crops), and there is a comparatively high risk of very low yields. At the extreme, in one village randomly surveyed by SOLV in 1973 no less than 19 out of 26 maize plots had a zero yield, and the average yield was a mere 52 pounds per acre. In these circumstances farmers are bound to take a very cautious view of expected returns, and even in years of high average maize and cotton yields a high proportion of producers must suffer very low yields and returns. Despite adequate sprayed cotton yields in the early years of the CCDP, many producers must have experienced much lower than average yields and have been discouraged.

Finally, mention must be made of the effect of population pressure on the land, which through reducing holding size has reinforced the other

pressures on marginal households to concentrate their efforts on food production. Estimates from SOLV suggested that between 1968/69 and 1972/73 alone the cultivable acreage per person declined by 17.8 per cent in Nsanje and 0.9 per cent in Chikwawa, with an average decline of 8.33 per cent for the LSV as a whole (Colman and Garbett, 1974: p. 128; IDA, 1976: Annex 1, p. 6). Data for the LSV for 1975/76 appear to confirm a continuation of this deterioration in the man-land ratio. It is inevitable that pressure of this type on the food-producing system will have resulted in a diminution of interest in non-food cash crops.

Implications for Smallholder Project Design and Implementation

As Norman (1978) has stated, "Because of the complexity of the farming system, often technology thought to be relevant has not been adopted, or, where it has been, it exhibits variations in degrees and levels of adoption. For example, much technological development has had a 'top-down' approach of modifying the technical element to fit the crop or animal, while the human element has been ignored." This seems to characterise fairly well the approach adopted to the introduction of cotton-spraying technology in the LSV. On the basis of cotton-growing trials in research conditions it was decided, with only limited testing in practical farming conditions, that introduction of the technology into the LSV would have a major impact. As a consequence, the CCDP project originally set up had a narrow, central purpose, which was to encourage and persuade farmers to spray cotton, and the organisation of the project's extension service reflected this narrow focus. In addition, the "top-down" orientation of the project was also limited by a syndrome noted by Kinsey (1975: p. 87) in his review of the Lilongwe Land Development Programme - namely, that there was an excessive tendency to concentrate on averages (the average farm size, the average yield, the average household composition) and to overlook the implications of the considerable variance in all of the relevant factors. Not only that, but there was an apparent failure initially to recognise the implications of the fact that the agricultural system of the LSV is an open one, in which, rather than being tied to working on their smallholdings, farmers and their families have options for deploying their labour elsewhere. The significance of all these factors of the LSV economic system, which contrived to reduce the anticipated attractions of the spraying technology, tended to be overlooked.

One thing which needs to be done to increase realism about the expectations of the impact of new technology on agricultural development strategies is to emphasise much more what is now being called the "bottom-up" approach. One aspect of this is the "farming systems approach" strongly advocated by Norman and others. While there is no simple blueprint for the execution of this approach, it includes, amongst other elements, the following four: (1) Research into farming systems to include socio-economic aspects such as the determinants of

the allocation of labour between farm and other work. That is, research should not simply be directed at technical agricultural systems; moreover, the technical research which is conducted should relate not to single crop or livestock trials, but to multi-product farming systems. (2) An attempt should be made to identify current farming practices employed on a limited scale which might have potential for wider application and development. Farmers have proved themselves in many cases to be highly successful innovators, and their "experiments" fully reflect the complexities of the farming system. (3) Technical research should, if possible, take place in conditions which closely resemble practical farming conditions, and ideally in farmers' own fields. The value of this approach is well exemplified in the International Rice Research Institute's experiments into constraints to rice yields (IRRI, 1979); this work, conducted in farmers' fields, gave powerful insights into why experiment station results were not being achieved in actual farming conditions. (This issue will be returned to below.) (4) An organisational system should be set up wherever possible which allows farmers' reactions to feed back into planning decisions and project implementation, and projects should have sufficient flexibility (autonomy) to be able to respond rapidly to ideas which surface from below.

This heavy emphasis on detailed research in the systems approach just outlined carries with it inevitable implications in terms of cost. However, it should be noted that there has been a strong commitment to technical agricultural research in the LSV, but that it is possible to criticise its effectiveness. It was recognised early that the conditions at Makanga Research Station did not adequately reflect average conditions in the LSV, and it was also decided in 1972 that Kasinthula should cease being a pilot farm and should take on a more significant research role. However, management problems reduced Kasinthula's effectiveness, and the research orientation appears to have continued to be towards crop trials rather than a farming systems approach. It may therefore be possible to change the orientation of agricultural research in the LSV without necessarily incurring additional cost.

The importance of socio-economic research must be emphasised. It is of considerable significance that from 1968/69 to 1971/72 the management signals received by the CCDP, in the form of statistical performance indicators, were seriously misleading, as has been argued earlier in this paper. It was not until some time after the formation of the Evaluation Unit in 1971 and the SOLV survey in 1972/73 that revised indicators of performance became available, and that some analysis emerged about the determinants of responses to the technology promoted by the CCDP. However, as already noted, there was strong initial resistance to accepting the revised indicators and their implications. Part of this can be attributed to the fact that, as Kinsey (1975: pp. 87-8) noted in relation to the LLDP, the organisational position of the Evaluation Unit within the project was a weak one; not only was there no well-defined link between evaluation output and management input,

but the staff of the unit were given subordinate rank, and although they were exceptionally energetic they lacked the necessary training and professional experience in statistical analysis. Part of the problem was also due to the fact that the Evaluation Unit only got into its stride some years after the start of the project, by which time attitudes and management practices already established were hard to change. The experience with cotton in the LSV serves to illustrate clearly the fundamental role of monitoring and evaluation in project implementation and planning, which depends for its success upon its capacity to respond to new information about changing problems and opportunities. To be successful the monitoring and evaluation service should have a fairly high-level input into the on-going planning process, and some independence in identifying research projects. As a final specific recommendation about monitoring and evaluation work it seems worth suggesting that a panel of farms should be surveyed on a continuous basis. Where a permanent sample is maintained (with, say, only 10 per cent dropout and replacement per year), accurate monitoring of all aspects of change in farming and household activities can be undertaken with a fair degree of economy in terms of sample size and resources employed.

A problem allied to that discussed about evaluation was that the CCDP project, and perhaps also its second-phase successor, were somewhat too inflexible, and that the narrow focus on cotton yields and production became counterproductive. In the first place, again as Kinsey (1975) noted with respect to maize yields at the LLDP, cotton yields and output came to be almost the sole yardsticks of success, and other indicators of progress and change were rather neglected. Further, this emphasis led to a project organisation and staffing appropriately attuned to promoting cotton but with less capacity to adjust to changing circumstances. As became apparent with the Central Lakeshore Project at Salima (where the introduction of the Mani Pintar groundnut, which ADMARC was prepared to buy unshelled, caused a perfectly rational switch of acreage from sprayed cotton to groundnuts and jeopardised the cotton production targets), it is not possible, or wise to attempt, to restrain farmers from pursuing strategies which maximise their returns. If economic circumstances change in the form of new crops or changed relative prices, or because new information becomes available about the behaviour of the production system, it must be possible to adjust specific lower-level management objectives in order to achieve the larger goal of maximising rural output and welfare. While undoubtedly strategy for the LSV has been adjusted in the light of additional knowledge, the rather inflexible attachment to cotton output objectives in the early 1970s undoubtedly slowed the speed and efficiency of this adjustment. Furthermore, the slowness to adjust may have had adverse effects on the morale of both farmers and project staff in the LSV.

It may well be that the lack of a bottom-up, systems-orientated research programme, combined with the rigid focus on cotton in the early 1970s, is largely responsible for the comparatively slow progress

with irrigation in the smallholder sector. The immediate attractions of irrigation are obvious: (1) It is the unreliability and variability of soil moisture availability which is responsible for the inter- and intra-seasonal variability of crop yields which makes rainfed farming such a high-risk business in the LSV. (2) The systems for exploiting *dimba* lands in the dry season and for exploiting subsoil moisture by growing maize in deep pits in sandy soil all attest to the skilled traditional ways in which water resources are exploited, and the value placed upon them. (3) Given the progressively declining size of holdings, irrigation is one of the only ways it is possible to imagine raising output intensity to a level where smallholdings become viable economic units. (4) It is difficult to see a major expansion of cash-cropping until a system with a secure food supply base is developed, and it is difficult to see how stability and yields of staple food crops can be substantially improved without irrigation. (5) There appears to be ample surface water readily available in the Shire River and in the Elephant and Ndinde Marshes for quite extensive irrigation.

That water resource management is the key to LSV agricultural development is apparent, and there have been many major studies for irrigation schemes in the area. As a consequence of these, there have been significant irrigated developments for sugar at SUCOMA, for rice at Muona, in the water conservation schemes on the rivers on the East Bank area, in the Smallholder Sugar Scheme, and in the plan to sink a number of tubewells for irrigation purposes. Despite these, it does seem that progress towards expanding irrigation in the smallholder sector has been hampered by inadequacies in the research programme and by the very strong commitment to a rainfed production strategy based on cotton. Of course it may be that the small-scale irrigation option may not be justified on economic grounds. As Carruthers and Clark (1982) convey in their book, there is a marked tendency for the irrigation option to be invoked in the face of problems with dryland farming, without adequate attention to the problems of irrigation or to the social rates of return. Nevertheless, it is difficult to envisage raising the intensity of agricultural production and substantially improving the living standards of smallholders in the LSV without irrigation.

BIBLIOGRAPHY

Carruthers, I. and Clark, C. (1982), *The Economics of Irrigation* (Liverpool: Liverpool University Press).

Colman, D.R. and Garbett, G.K. (1974), *Economic and Sociological Issues in the Development of the Lower Shire Valley* (Report 1, Socio-Economic Survey of the Lower Shire Valley, University of Manchester).

_____ and _____ (1976), *The Labour Economy of a Peasant Community in Malawi* (Report 2, Socio-Economic Survey of the Lower Shire Valley, University of Manchester).

Green, D.A.G. (1978), *Factors Affecting Cotton Production* (interim report of Bunda College Production Project, Lilongwe).

International Development Association (1976), *Shire Valley Agricultural Development Project, Phase II: A Review of Agricultural Activities and Proposals for Future Development* (Nairobi: International Development Association).

International Rice Research Institute (1979), *Farm-Level Constraints to High Rice Yields in Asia: 1974-77* (Los Banos, Philippines: International Rice Research Institute).

Kavinya, R.F. (1979), "An Appraisal of Crop Production Constraints in the Shire Valley Agricultural Development Project" (University College of Wales, Aberystwyth, unpublished dissertation submitted in part fulfillment of M.Sc. degree).

Kinsey, B.H. (1975), *Broadening the Evaluation of Rural Development Projects: Final Report of the Lilongwe Land Development Program Follow-up Study* (RPO-293)(Washington, D.C.: The World Bank, Eastern African Department).

Kydd, J.G. and Christiansen, R.E. (1982), "Structural Change in Malawi since Independence: Consequences of a Development Strategy Based on Large Scale Agriculture", *World Development*, Vol. 10, No. 5, pp. 355-75.

Malawi Government (1972), *Lower Shire Valley Agricultural Development Project: Phase II* (Zomba: Government Printer).

Norman, D.W. (1978), "Farming Systems Research to Improve the Livelihood of Small Farmers", *American Journal of Agricultural Economics*, Vol. 60, pp. 813-20.

_____, Hayward, J.A., and Hallam, H.R. (1974), "An Assessment of Cotton Growing Recommendations as Applied by Nigerian Farmers", *Cotton Growing Review*, Vol. 51, pp. 266-80.

Oblitas, K.R.A. (1973), *Farm Survey 1971/72* (report of Evaluation Unit, Chikwawa Cotton Development Project).