

# The Unit Farm Approach of Farm Planning in Ceylon: A Critique

NIHAL AMERASINGHE

## 1. Introduction

The unit farm approach or technique of farm planning has been adopted (consciously or unconsciously) to indicate the feasibility of various farm plans and other important aspects of land settlement to be undertaken under the Mahaveli diversion project in Ceylon. This approach of farm planning is inherently embodied in the "100 acre pilot project" initiated at the Maha Illupallama Dry Zone Research Station in 1970 in order to provide the necessary economic and technical information for planning future land settlement in Ceylon under the Mahaveli project. This technique of farm planning on which future farming in Ceylon is to be based is not a new tool in the kit of the agricultural economist and has been used intermittently since 1946. It has had a chequered history as a farm planning tool due to its many limitations and has been superseded by a host of more refined farm planning techniques. The object of this paper is to discuss the potentials and limitations of this technique in providing the necessary information for effective farm planning and settlement in Ceylon. An alternative approach will be suggested in the light of the limitations of the unit farm approach in providing the information necessary for effective farm planning in Ceylon.

## 2. The Unit Farm Approach

Agricultural science is essentially concerned with technical details of farming and not with the organisation of these techniques into an efficient farm business. The scientist cannot judge with any accuracy, nor for that matter is he greatly concerned with, how important a new technique may be to the operation of a farm or how its introduction will affect farm organisation in other respects. Wherever agriculture is technically less advanced the effect of any single innovation is likely to be correspondingly more fundamental. Therefore the need for subjecting it to economic tests within the farming system is even greater.<sup>1</sup> Farm surveys which were in vogue in the 1940's could offer only piecemeal information on farming as the sources of such information were scattered and it was not possible to integrate the information so as to evaluate more efficient farming systems. The absence of a suitable technique to evaluate economically viable farm plans was a major handicap for effective planning

---

1. G. P. Hirsch, "Peasant Experimental Farms as a Research Technique", *Farm Econ.* Vol. 8, No. 9, 1957, p. 51.

in the early 1940's. An attempt to overcome this void was made in 1946 when five experimental farms of different types were established by A. L. Jolly<sup>2</sup> at the Imperial College of Tropical Agriculture in Trinidad. The object of this experiment was to ascertain the possibility of developing a system of peasant farming that could provide full employment and a reasonable level of living. This was both an experiment in land settlement and in technical feasibility. This technique of establishing peasant experimental farms to investigate the potentials of farming was referred to as "the unit farm approach". It was held that this technique enabled the setting up of a hypothesis based upon a priori information and also testing the same.<sup>3</sup> In this method the investigator has complete control over the farm on which he is experimenting. Control is not only exercised in respect of agricultural techniques but also in the more fundamental features of labour organisation, capital investment, enterprise combination, intensity of application of resources and so on. Moreover, by proper accounting procedures the investigator can collect all the facts about the economic viability of given farm plans. Also, he could control and exercise any re-organisation he may think desirable in order to achieve an economically more efficient farm. This approach therefore enabled the economist to move ahead of existing farm organisations to more efficient organisations in terms of resource use. It was considered a boon to farm economists since they faced the problem of having <sup>no</sup> ~~an~~ laboratory to carry out experiments in farm organisation. Jolly<sup>4</sup> postulated that the classical tools of economic research were essentially meant to measure conditions as they exist and changes as they occur and that they offered no solutions to farm reorganisation and argued that the unit farm approach could therefore make a significant contribution to farm planning methodology.

At a glance the unwary researcher might be enamoured by the unit farm approach and may consider it a panacea to all farming problems whether they be technical or economic. However, it has many deficiencies which vitiates its practical usefulness. These limitations will be discussed in the context of the "100 acre pilot project" which has been initiated to shed light on the possible farm plans to be pursued under the Mahaveli project.

### 3. The "100 Acre Pilot Project"

The objectives of the project are multifarious and are expected to provide the necessary feedback information to undertake effective farm planning under the Mahaveli river diversion scheme which is expected to

2. A. L. Jolly, *Report on Peasant Experimental Farms*, Imperial College of Tropical Agriculture, Trinidad 1951.

3. E. S. Clayton, "Research Methodology and Peasant Agriculture", *Farm Econ.*, Vol. 8, No. 6, 1956.

4. A. L. Jolly, "The Unit Farm as a tool in Farm Management Research", *J. Farm Econ.* Aug. 1957.

increase the irrigable land area in Ceylon by 70 per cent. The following are some of the main aims of the project:

1. To obtain information in order to determine the optimum size of holdings to be allocated to colonists and the cropping patterns which are feasible within this holding.
2. To select cropping patterns which would assure an income of at least Rs. 6000 per annum to a colonist.
3. To indicate farm plans which could provide full employment for two persons.
4. To obtain information on the socio-economic problems associated with the settling of people as colonists.
5. To provide information on the possibilities of mechanisation, particularly the economics of two wheel tractors and its labour saving potential and
6. To evaluate various aspects of multiple cropping and the income potentials in different multiple cropping patterns.

It is therefore apparent that much is expected from this experiment and that the future development of the dry zone of Ceylon would be closely tied up with the success of this project. The period of experimentation has not been decided at present but it is envisaged that it would be continued for a period of about five years. Some individuals even contend that this project should be continued indefinitely to provide a laboratory for continuous experimentation.

During the Yala season in 1970 six farmers and subsequently a further twelve were selected for this project on the basis of farming background, size of family, age of farmer and spouse, landlessness, qualities of leadership and so on. These criteria of selection conform closely to the requirements for land alienation under colonization schemes specified by the Land Commissioner. However, in practice these criteria have been neglected.

Land preparation was completed before the colonists were settled. Each colonist was provided a cottage worth approximately Rs. 3000, but these were ready for occupation only later. The average size of holding is approximately five acres. Farm sizes have been intentionally made variable so as to gain an insight into the problems and potentials of having different sizes of holdings. The farmers do not enjoy any ownership rights to the land and merely operate as tenants who have been selected *ad hoc* for the experiment. The only incentive to production is the usufruct from the land. A peculiarity of the tenancy arrangement is the payment of wages to farmers and their dependents on a *per diem* basis at Government rates for their labour. This further reduces the status of the farmer to that of a wage labourer. In compliance with legislation a farmer and his wife are expected to work eight hours a day according to a strict time schedule. Another feature is that the farmer is 'free' for the weekend.

A basic requirement of those settled is to utilize each allotment fully. It was found that most of the farmers were unable to fully utilize their allotments and had to hire labour. Since hired labour was readily available through the board of management, this led to indiscriminate indulgence in the use of hired lands and consequent unprofitable cultivation.

The land utilization patterns prescribed for the two cultivation seasons are different. During the Maha season an average five acre holding has three acres under paddy cultivation and the rest is under subsidiary food crops. The homestead is located on half an acre of land and is cultivated with perennial crops such as bananas, passion fruit, grapes and so on. In the Yala season paddy is cultivated only in the ill-drained areas and the emphasis is more on subsidiary food crops. The choice of crops in both seasons is restricted to a few by the management in keeping with national food production policies, which curtails the freedom of the farmers to some extent. Moreover, once the crops have been selected it is incumbent on the farmers to adopt all the recommended practices in cultivating the crops and also to conform rigidly to a cultivation calendar which has been drawn up for them. Ample extension services to deal with technical problems are available. In this connection there is a full time project manager who visits each farmer periodically and also two field level extension workers.

Farmers are also provided with all the inputs they require, including an assured supply of water. There is also a machinery pool from which the farmers could obtain services readily. The cost of inputs and also land and water charges are recovered at harvest time when the crop is sold to the co-operative servicing the project. This is possible as the colonists are compelled to sell their produce to a centralized marketing agency (co-operative) servicing the project. Transport facilities, bags and other requirements for marketing the produce are available and the farmers experience no problems of marketing.

From this brief description of the "100 acre pilot project" it is apparent that this project is a repetition of Jolly's unit farm experiment. As in that experiment, this project also suffers from certain shortcomings and the object of the next section is to discuss these limitations in simulating realistic farming conditions and providing a foundation for feasible farm plans which would be readily acceptable to peasant farmers.

#### **4. Limitations of the Unit Farm Approach**

Since the unit farm approach is the theoretical framework on which the 100 acre pilot project is based, the criticisms which would be directly levelled at the pilot project would be ostensibly a critique of the unit farm method. As discussed above, the objectives of the pilot project are many and it would be impossible to elicit all the information required

from this experiment. Various crop combinations within the restrictions imposed by the board of management are practiced by the farmers and information on inputs, costs and returns of individual crops and crop combinations are being collected. It is likely that the variability amongst the farmers would result in the information being statistically unacceptable. It is apparent that it would be potentially dangerous to recommend information based on such tenuous evidence to farmers. The information is bound to be piecemeal as various objectives would be satisfied under different conditions of farming. Moreover, this information would then have to be carefully examined and integrated into a coherent farm plan capable of satisfying all the requirements before it could be recommended. The problem is that this plan would remain untested and if it is to be recommended with any confidence it would have to be subjected to further experimentation. Also the fact that the information is based only on one year's experimentation makes the integrated farm plan an unsatisfactory foundation for any firm recommendations. Further experimentation would mean the wasteful use of scarce resources and loss of time, and this too would give information which will be valid under *ceteris paribus* conditions. Thus a change of prices, yields, technology and so on will require a new farm organization.

The 100 acre pilot project is both an investigation in technical feasibility and land settlement. However, it is apparent that the former objective has been given more weight. Technical feasibility is already known since the crops cultivated are not new introductions and there is already accumulated evidence on the potential of such crops. It would be therefore superfluous to incur such colossal expenditure to obtain information which is already available. The restriction of the choice of crops is also a highly undesirable feature. Farmers have their own preferences among crops and livestock based on socio-economic and cultural norms and it is unrealistic to expect them to accept an imposed system uninhibited. Risk and uncertainty and the likes and dislikes of farmers are important determinants of the farmers' ultimate choice of farm enterprises and it is too much to expect farmers to jettison their social and cultural values to satisfy national economic policies. Farmers' aspirations and attitudes would first have to be changed before they become primarily economic minded.

The basis of selecting farmers for this project also leaves much to be desired. The colonists chosen were mainly farm labourers from the experimental station with no genuine farming experience and with a different outlook altogether. This has already led to problems and five farmers have left the project for reasons such as alcoholism, work being too strenuous and so on. The 'human aspect' of settlement, which is imperative for successful land settlement, has been largely ignored. This shortcoming vitiates the credence which could be placed on this project as a feasible experiment in settlement. Moreover, if the idea was to develop workable

and profitable farm plans for peasant holdings it seems strange that the variations of the human factor have been neglected, there being complete control of management. The extension services available are completely out of proportion to what is observed under normal conditions. The supervision given by the project manager and two field assistants to eighteen farmers is nowhere near what actually is operative under field conditions where one field officer supervises about six hundred farmers on the average. The farmers have no problems in procuring their inputs in time although this is usually a problem for peasant farmers. Further, these farmers have no problems of marketing their produce, which again is often a limiting factor for peasant producers. It is therefore clear that the farmers in the pilot project farm under unusual and very exceptional circumstances. As stated earlier, the farmers have to adhere strictly to all the recommended practices and have no choice or any intimation of the costs involved. The principle of the unit farm is that the operator is only responsible for putting into practice the ideas of the economist and is no way concerned with the financial results of the experiment. This is an unacceptable situation under normal farming conditions where capital is a critical constraint in adopting innovations. It would therefore appear that this experiment has been only helpful in showing what the peasant farmer could do with unlimited capital and extension services.

The concept of family farming has also been neglected in this experiment. It is well known that farming and domestic work are closely linked. The allocation of labour between farm work and domestic work are intimately connected, and in farm planning the labour available for actual farming should be evaluated in this context. The requirement that the farmer should work eight hours a day and also keep to a time schedule borders on absurdity to anyone familiar with farming. Farmers have their own leisure-work preference schedules and to make simplifying assumptions about the labour time available for farm work without any appreciation of their values could only lead to impracticable farm plans. Further, the wages paid to farmers in this scheme are a bonanza, since they offer a security to farmers and an assured income throughout the year. Peasant farmers, it is well known, usually live from one harvest to another, depending entirely on their farm production as a source of income and sustenance, with little or no reserves to cushion the risks of farming.

Another unrealistic feature is the type of tenurial arrangement in operation. The farmers have no claim on the land and are merely entitled to the usufruct. It is well known that the Ceylonese peasant has an innate desire to be a cultivator-owner rather than a paid labourer and this type of tenurial arrangement is a violation of peasant values. Ownership of land or a secured tenancy is a basic pre-requisite for enhanced productivity. It is therefore likely that in this experiment farmers have neither made any efforts to increase production nor sought to maintain the fertility of

the land. This tendency would be further strengthened by the fact that the farmers are entitled to an assured income.

It would be clear from the discussion above that the conditions under which the 100 acre pilot project operates are at variance with normal peasant farming conditions. In this experiment it seems axiomatic that if peasant production is to be increased, labour must be balanced by larger inputs of capital. The socio-economic and cultural complex in which the farmer operates has been ignored and it has been assumed that the farmer is only economically motivated. Under these circumstances this experiment would only provide some insight into the technical aspects of production. But this too is limited since it has been carried out under one set of conditions. From the point of view of land settlement it does not help us to draw any worthwhile conclusions since the basic premises on which settlement would normally be based, such as cultivator ownership, family farming with restricted capital, inadequate technical know how and so on, have not been observed in this scheme.

### 5. An Alternative Approach

The factual implication of the unit farm approach is that peasant producers are not aware of economic incentives or that they do not act in response to them. This notion of peasant irrationality has been refuted under different situations.<sup>5</sup> It would not be incorrect to suggest that peasant farmers in Ceylon are aware of economic opportunities and are sensitive to them. We may then inquire as to why agricultural production has not shown significant progress in the light of scientific progress. The failure of science in the last few decades to push agricultural production to satisfactory levels may be less attributable to scientific misinformation than to the fact that much of the information sought and found was irrelevant.<sup>6</sup> Past failures to relate agronomic research to effective farm economic analysis has rendered much agricultural research abortive. Even when research is able to relieve existing constraints and push out the production possibility frontier, there are other economic reasons why farmers might objectively decline to adapt innovations. We might distinguish four such reasons:

1. that they increase gross returns by less than the increase in costs,
2. that they increase long run average net returns only at the risk of short run calamity,

5. D. Hopper, "Allocative Efficiency in Traditional Indian Agriculture", *J. Farm Econ.*, Vol. 47, 1965, p. 611-624 and T. Jogaratnam, "Farm Planning in Ceylon: An Application of the Linear Programming Technique", *J. Nat. Agric. Soc.*, Vol. 5, 1968, p. 30.

6. L. Joy, "Diagnosis, Prediction and Policy Formulation", in *Subsistence Agriculture and Economic Development* by C. R. Wharton, ed., Frank Cass & Co., Ltd., Lond., 1970.

3. that the prospective yield increases have unattractively low present net worth in the light of the farmers high rates of time preference and
4. that social and institutional constraints could prevent peasant farmers from accepting innovations.

As observed earlier, the unit farm approach ignores all these considerations and has merely concentrated on the financial aspects. Considerations of risk and uncertainty and the time preference of farmers have been assumed to be inoperative in this experiment. This is a serious drawback if we are to simulate acceptable peasant farm plans as farmers are generally averse to risk and consciously hedge against such situations due to their vulnerable financial position. It is suggested in this paper that peasant farmers should be studied in their own farming environment and on their own farms. And that a detailed and prolonged comparative study of the economic behaviour of peasants on their own farms would give more feasible information than the *ad hoc* creation and investigation of unit farms.

Let us now consider how all the objectives of the unit farm experiment may be more realistically achieved. From the unit farm experiment, or for that matter from farm surveys alone, it would be impossible to evolve a farm plan which could satisfy simultaneously all the objectives noted above. We would only have fragmentary evidence from different unit farms from which to derive the farm plan satisfying all our requirements. However, this too will be only an approximation. To overcome this problem as well as make a more realistic study of peasant farming possibilities it is felt that linear programming is more eminently suitable.

During the past decade, linear programming (LP) has been increasingly used to investigate problems of peasant agriculture and has established itself as a valuable technique. In the peasant context the basic profit maximizing model has to be modified to approximate the realities of peasant production.<sup>7</sup> The problem is to find an analog of the peasant's decision making environment, a matrix or matrices into which we could feed the data about soil, climate, technology, yield and price fluctuations, social structures and values which will give us a fair approximation of the relevant choice situation and the feasibility of adopting innovations. As a first step it is necessary to obtain information on the socio-economic factors influencing peasant decision making. In this context subsistence production should be carefully analysed since the peasant would be averse to any change which could affect his consumer requirements. Risk of famine is not the only reason why farmers would objectively prefer to

7. N. Amerasinghe, "An Appraisal of Linear Programming in Studying the Peasant Decision Making Environment", *J. Nat. Agric. Soc.*, Vol. 7, 1970.



produce their own food requirements, but also the question of price differentials between the price he receives as a producer and consumer. Further, the availability of markets for his produce and problems of marketing should be carefully examined as a faulty marketing system could be an impediment to greater productivity. The labour time actually available for farming should also be carefully evaluated. It is incorrect to assume that a farmer could work a fixed number of hours per day without a proper understanding of the demands made by non-farm work on the farmer's time. Labour migration patterns, social factors influencing labour supply, reciprocal labour practices and other factors influencing the actual labour available should all be carefully investigated. Further, soil fertility and its influence on production and the influence of climatic variation should be carefully explored. Experimental station conditions are seldom representative of what obtains in the field and it is imperative to understand the climatic and edaphic conditions under which proposed farm plans are to be tested. The more important social considerations involve kinship ties, caste, social status, land tenure, traditionalism, and religion which should be carefully studied and incorporated into the production model as far as possible.<sup>8</sup>

The basic data required for the formulation of a LP model are the technical relationships between inputs and outputs, input restrictions and resource supplies, prices, production alternatives, soil and climatic factors, and sociological and institutional restrictions on production. It is obvious that the above variables preclude the specification of a single model to study peasant farming in Ceylon. However, it is possible to indicate a general model which could be modified to accommodate the relevant variables under different situations.

The objective function to be maximized could be written as,

$$\text{Maximize } \sum_{j=1}^n C_j X_j \quad \dots\dots\dots(1)$$

Where  $C_j$  = Net revenue per unit of activity  $j$

$X_j$  = Number of units of activity  $j$

The condition that no resource constraint is exceeded as,

$$A_{ij} X_j \leq b_i \quad \dots\dots\dots(2)$$

Where the matrix  $A_{ij}$  contains elements  $a_{ij}$  which represents the number of units of resource  $i$  that are used per unit of activity  $j$ .

8. For further discussion on the methodology of incorporating social and economic factors in a LP model, refer Amerasinghe, *op. cit.*

Minimum requirements to be fulfilled by the model can be written as,

$$S_{ij} X_j \geq r_i \quad \dots\dots\dots(3)$$

Where the matrix  $S_{ij}$  contains elements  $s_{ij}$  which represent the number of units of requirement that are contributed by the unit of activity  $j$  and  $r_i$  is the minimum requirement of  $i$ .

The condition that no activity enters the solution at a negative level can be represented as,

$$X_j \geq 0 \text{ for all } j \quad \dots\dots\dots(4)$$

Any rotational husbandry constraints could be written into the model if required. Any acreage restrictions on crops could also be accommodated in the model and written as maximum permissible constraints. Subsistence requirements could be written as minimum constraints in the model which will have to be satisfied. The LP model is amenable to modification to accommodate any economic or social consideration relevant for decision making. It could also handle risk and uncertainty within its framework to some extent. It would be therefore clear that a production model of the LP type is more flexible and would be more useful as a farm planning technique than the unit farm approach. The problems explored under the 100 acre pilot project could all be handled by a LP model more realistically.

The optimum size of holding could be determined, depending on the definition of an optimum size. If it were a target income, this could be written as a minimum requirement in the model and an optimum economic solution satisfying this and other requirements could be obtained. The requirement of full employment of labour could be written as an 'equality' constraint or 'greater than' constraint which would ensure at least the utilization of family labour. The feasibility of multiple cropping within the given resource endowment situation is automatically solved since LP provides an optimum combination of farm enterprises under a given set of conditions. The full utilization of land could be written as an equality constraint in the model. To study the labour saving potential of machinery it would be necessary to relax the constraint of full employment of labour and feed in the relevant technical input-output information. Besides providing optimal economic solutions, LP provides valuable by-product information, particularly on the constraining and abundant resources available via information regarding the marginal value products (MVP). It could therefore serve both as a prescriptive as well as a diagnostic tool and would be invaluable in indicating what could be done as well as what should be done to promote agricultural development.

## 6. Summary and Conclusions

The unit farm approach has been adopted to indicate the technical and economic feasibility of various farm plans to be undertaken under the Mahaveli diversion scheme. This technique was observed to be deficient in many ways and particularly in the light of the "100 acre pilot project" being carried out at Maha Illupallama, it was evident that farming conditions were highly artificial. The concept of family farming, management or 'human aspect', conditions of tenure and choice of farms had all been ignored. Moreover, the availability of inputs and extension services were far in excess of average conditions. In this project it is axiomatic that if production is to be increased labour must be balanced by larger inputs of capital, while the influence of the human factor as an important variable has been totally neglected. The objectives of the pilot project cannot be achieved within the framework of the unit farm planning approach. The only useful purpose, perhaps, of the project may be to indicate the technical problems involved but this too is very restricted since it is an experiment carried out only under one set of conditions. From the point of view of land settlement no worthwhile conclusions could be derived since the basic premises on which settlement is normally based have been overlooked. This experimentation cannot be therefore expected to be very worthwhile. At most it would be useful in indicating what a peasant farmer with unlimited capital and extension services could do.

The unit farm approach has ignored considerations of risk and uncertainty in farming, the time preference of farmers and the social and institutional factors affecting production. It is an unrealistic approach if one's intention is to simulate acceptable peasant farm plans. Farmers would not accept revolutionary changes. However, they have been found to be rational in accepting innovations. It could hardly be maintained that the unit farm approach of farm planning justifies the colossal expenditure involved in obtaining technical information which is more or less already known. It is suggested in this paper that peasants should be studied on their own farms and in their own environment and that a detailed and prolonged comparative study of the economic behaviour of peasants on their own farms would give more feasible information than the *ad hoc* creation and investigation of unit farms. LP has been suggested as an alternative approach where the peasants decision making environment could be accommodated within the framework of a production model. It would serve to indicate optimal economic plans under the relevant socio-economic and cultural matrix being investigated. Moreover, in addition to being a prescriptive tool it could also be an useful diagnostic tool and would help to indicate those factors that restrict agricultural development.

## References

1. Amerasinghe, N.; "An Appraisal of Linear Programming in Studying the Peasant Decision making Environment", *J. Nat. Agric. Soc.*, Vol. 7, 1970.
2. Clayton, E. S.; "Research Methodology and Peasant Agriculture", *Farm Econ.*, Vol. 8, No. 6, 1956.
3. Hirsch, G. P.; "Peasant Experimental Farms as a Research Technique", *Farm Econ.* Vol. 8, No. 9, 1957.
4. Hopper, D.; "Allocative Efficiency in Traditional Indian Agriculture", *J. Farm. Econ.* Vol. 47, 1965.
5. Jolly, A. L.; *Report on Peasant Experimental Farms*, Imperial College of Tropical Agriculture, Trinidad, 1951.
6. Jolly, A. L.; "The Unit Farm as a tool in Farm Management Research", *J. Farm Econ.*, Aug. 1957.
7. Jogaratnam, T.; "Farm Planning in Ceylon an Application of the Linear Programming Technique", *J. Nat. Agric. Soc.*, Vol. 5, 1968.
8. Joy, L.; "Diagnosis, Prediction and Policy Formulation", in *Subsistence Agriculture and Economic Development*, C. R. Wharton (ed.), Frank Cass & Co., London. 1970.