FARMING SYSTEMS RESEARCH PROGRAM

RESEARCH REPORT NO. 2

SECTION 3

FARMING SYSTEMS IN SIX ALEPPO VILLAGES

This Internal Document is One of Seven Sections
Which together comprise Farming Systems
Research Report No. 2

THE INTERNATIONAL CENTER FOR AGRICULTURAL RESEARCH
IN THE DRY AREAS

Aleppo, September 1980

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FARMING SYSTEMS IN SIX ALEPPO VILLAGES

SUMMARY

1) The Farming Systems used on individual farms differ both between farms and also within farms over different seasons. A degree of aggregation of data is therefore essential in order to illustrate the main features of widely differing systems across agro-climatic zones. Sections 3.1 to 3.8 of this report therefore discuss systems at village level, based on the aggregated data from several farming families in each case. Section 3.9, and Annex 1 to Section 3, present data at individual farm level.

2) Six villages, spanning 200-600 mm mean annual rainfall were chosen to represent the major Farming Systems of Aleppo Province (see Section 2). Data is presented for two agricultural seasons, 1977/78 and 1978/79 for five villages, and for 1978/79 for one village. Comparison is made, where necessary, with two villages with irrigation in Hama Province.

3) In each village, a complete enumeration was made of all farming households, and the information (summarised in Appendix 3.2) was used to select a sub-sample of farm families for detailed recording. Selection was made on the basis of land resource endowment, defined by the land/person ratio for each holding.

4) The characteristics of the sample of recorded farmers can be compared with those of the village as a whole. Generally, the sample adequately represents the whole village, but where deviations occur, the data can be adjusted.

5) Recording was carried out on a monthly basis and included cropping, livestock, machinery and household activities. Data on household was collected for one season only, and in one village (1B/02) only cropping information was requested.

6) This section of the report discusses Farming Systems in terms of the three major components: cropping, livestock and household. The farm machinery enterprise is difficult to evaluate and is not an integral part of the biological system.

7) The allocation of land to crops reflects rotational requirements, compliance with State Planning directives, the need of farm households for foodstuffs and cash and the need to contribute to the animal feed supply. These resulted in crop mixes that were biased towards cash crops in the wetter areas (350-600 mm), for example wheat, chickpea, olive, lentil and summer crops, and in the drier areas to feed crops, mostly barley.

8) Rotational principles exist, but only that of wheat following a fallow or summer crop was rigidly adhered to. Even this rule was modified in the wettest and driest villages, where wheat sometimes followed legumes (mostly chickpea) or cereal respectively. Barley is relegated to second place compared to wheat with regard to fallowed land and soil quality. Cereals occasionally followed grain legumes in rotations where summer crops were not important, as in areas where chickpea occupied a large proportion of the area, or on shallow soils.

Where three and four course rotations including summer crops were used, it was very rare for wheat to follow a grain legume, and not common for barley to do so.

9) Crop allocations differed from those suggested in the Agricultural Plan, most significantly in zones two and four. In particular, the desire for wheat self-sufficiency supports its inclusion well beyond the point where barley shows a relative advantage. In zones two and three, more lentil was grown than was required by the plan, partly to break up what would otherwise have been cereal dominated rotations, and partly to improve the overall quality of the farm produced animal feed. In the wetter areas, less lentil was grown than required by the Plan.

10) Yields were highest in village 1B/05 (zone 1B), exceeding those in 1A/13, where rainfall was slightly higher. Otherwise they fell with declining rainfall. There is a considerable difference between yields presented in this section, which are averaged over all plots, soil types and farms, and those presented in Section 5, which are disaggregated. The yields here are more akin to "national yield statistics" and the variation within them suggests that comparisons with yield data relating to specific locations would be mis-leading.

11) Commodity input, output and utilization calculations indicate that systems in the wetter areas or with irrigation were surplus generating for wheat. Those in the mid-rainfall (275-350 mm) areas were self-sufficient, but the driest area was severely deficient. The greatest absolute surplus was 797 kg per farm family member in one irrigated village, and the greatest deficiency was -242 kg/person in the driest village.

On an individual farm basis, wheat deficits were associated with drier villages, and smaller land/person ratios, which tended to be the poorer families. A large proportion of the deficit in these cases was frequently made up with purchased flour of lower nutritional value.

Breadwheats predominated in the wetter villages, and were more important for sale than the durum wheats. Durums were grown more for household consumption. Breadwheats were not grown below 325 mm mean rainfall except with supplementary irrigation.

In terms of varietal preference, where wheat was grown as a cash crop, yielding ability was the dominant factor, whereas suitability for breadmaking or other household uses was of importance for home-grown wheat. Mexipak has been able to replace local durum types to a large degree in traditional village flour mixes.

12) Systems were deficient to a greater extent with respect to the provision of animal feed, both in terms of metabolisable energy and protein. The deficiency represents an imbalance between supply and demand, which was most serious in the drier villages. Apart from the absolute deficiency, the quality of farm-produced feed, especially in terms of protein concentration, was increasingly inadequate in the drier areas. The energy concentration was also poor in the middle rainfall villages.

13) Farm-produced feeds were supplemented by purchased feeds, mostly barley and industrial crop by-products. These contributed to the absolute amounts of feed available, allowing greater numbers of animals to be kept, but equally importantly, they helped increase the protein concentration in the overall diet.

14) Barley grain accounted for between 34 to 44 per cent of the feed energy consumed by livestock. Grain legume straw provided from 24 to 36 per cent in the wetter villages, being replaced by cereal straw in the drier areas.

15) All systems produced more cereal straw than could be incorporated into the feed ration. This is not to say that surpluses could not be sold, or otherwise disposed of, but in the dry areas particularly, it was both the energy and protein quality of farm-produced feed that needed improving, not the absolute quantity if these qualities are lacking.

It is important that straws are reasonably palatable, especially in varieties suited to rainfall areas of under 350 mm but the main justification for breeding longer-strawed varieties for these areas is to facilitate combine harvesting, not to increase the straw available for feeding.

16) Data for food legumes in the six villages is not extensive. Commodity budgets show that even with low yield levels, as were obtained by sample villages in 1977/78, systems incorporating grain legumes were surplus generating, and the crops were grown mainly for cash. The importance of grain legume straw in the animal diet has already been noted. Grain legume consumption (lentil and chickpea) on the farm was low, at between one and 13 kg per person per year.

17) Crop net outputs in the higher rainfall villages were highest for chickpea, followed by wheat and barley, and were generally lower for lentil and vetch. Summer crops gave low net outputs on account of low yields. Mature of olive/vine crops in the wettest village were highly profitable, but orchards in the process of establishment showed negative outputs. In the mid-rainfall villages, barley mostly gave higher net outputs than wheat, but in the driest villages, the opposite was the case. This presumably reflects the preference wheat had with regard to rotational sequence and fallow, and less efficient harvesting of barley.

18) Yield was the most significant factor in determining net output for durum wheat, breadwheat, barley and lentil. In a situation of equal yield, barley would have been more profitable than durum wheat, which would have surpassed breadwheat. In zone one, breadwheat would have had to outyield barley by 31 per cent to give a higher net output, and yield data indicated that Mexipak wheat in general achieved this. In zone two and below, breadwheats would have had to have yielded some 43 per cent above barley to have been more profitable, and this margin was not achieved.

19) Both the cost and output elements of crop net output increased with rainfall, but the rate of return, defined by net output as a proportion of cost, was higher in the wetter villages. Here it ranged between 144 and 253 per cent compared to -8 to 79 per cent in the drier villages. Investment in the drier area cropping was clearly less attractive.

The low rainfall villages appear trapped in a low input:low output cycle. Opportunities have yet to be demonstrated of increasing output by extra investment, and costs cannot be reduced further, as they represent the bare minimum needed to grow a crop.

20) Livestock densities were lowest in the wettest and driest villages, and highest in the mid-rainfall villages. They ranged between 0.6 to 1.4 heads of sheep and goats per whole farm hectare.

21) The cycles of grazing and supplementary feeding indicate that:

(i) The period of supplementary feeding was longer in the drier villages than the wetter villages; ranging from five to eight months;

(ii) Supplementary feeding was not required in spring, and animals were maintained on common land, light grazing of cereal crops, and yard-fed weeds hand-pulled from winter crops. The limiting factor in feed supply was clearly the systems' ability to provide conservable feed for the winter period, not spring grazing.

The grazing of cereal crops was said by farmers to be light enough not to affect grain yield. Most often it was reported to control excessive vegetative growth, and was therefore more common in wetter rather than drier areas.

Weed material formed a significant part of the animal diet in the spring months. We should determine the nutritive value before either aiming to eliminate weeds from cereal crops, or replacing them with purpose-planted spring forages.

22) Productive females predominated in the permanent village flocks: goats in the higher rainfall areas and sheep elsewhere. Most lambs, unless required as ewe-replacements, were sold before 12 months, and the proportion of yearlings in flocks was consequently low.

23) Average mortality rates were not excessive, ranging from 6 to 14 deaths per hundred in lambs and kids, and 0.4 to 11 per hundred in adult sheep and goats. Some flocks were worse affected than others. Milk production (surplus to the lambs' requirements) ranged from 44 to 98 kg/head/lactation, and was generally greater in the higher rainfall villages.

24) Dairy items generally accounted for the highest proportion of the value of home-consumed livestock production, although in some cases the value of meat, fat, skins and wool was almost as great.

25) Livestock net outputs were highest in the mid-rainfall villages, and lowest (negative) in the dry villages. The rate of return on investment followed the same pattern, and was highest at 45 per cent, and lowest at minus 10 per cent. These rates are lower than for cropping, but the nature of the investment is different. Apart from producing high-value foodstuffs for the house, and being maintained as a business enterprise in their own right, livestock are used as a "short-term investment account" in that they return a rate of interest, can be sold quickly to raise cash, and have a fairly low risk attached.

26) Livestock net outputs were most significantly explained by differences in costs rather than output. Of cost items, feedstuffs were by far the most important and there are indications that net output was highly negatively correlated with expenditures on supplementary feed. These expenditures were higher in the dry villages.

27) Rainfed cropping generated a cash surplus only in two villages. In other cases, much of the output was channeled through the household and livestock sectors for consumption within the system. Cropping became an increasingly large cash consumer in the drier villages. Livestock production showed the opposite trend with the exception of the two driest villages.

28) Expenditure on crops varied with location. Seed costs were high where chickpeas were grown, and in the driest village where seed stocks became depleted. Fertilizer was an important component in the three wetter villages. Labour costs were especially high in villages where much of the cereal area had to be hand-harvested. Mechanisation costs were highest in the wetter villages, where the system required more cultivations and where combine harvesting was more common.

29) Income from crops was dominated by chickpea and olive in the wettest village, and by breadwheat and summer crops in the next-to-wettest village. Barley and lentil were important in the middle-rainfall villages, and barley was the sole source in the driest village.

30) Livestock expenditure was dominated by purchases of stock, and feeds, especially concentrates. Feed costs accounted for between 60 and 87 per cent of expenditure other than purchase of stock.

31) Sales of homestock were important in all villages, but fattening and trade stock were more so in the drier villages. Of the non-stock items dairy products were most important.

32) Regarding cash flow, it would appear that livestock are to some extent complementary to cropping with regard to balancing inflow and outflow. Animals were purchased when cash from crop sales came in, and were sold when crop cash outlay was required. Sales of lambs and dairy products brought in cash during the spring period when crops were growing. The complementarity is more important in the drier areas, where both opportunities for crop investment, and returns through crop sales, are more discrete and inflexible.

33) This livestock-crop complementarity should not however be overestimated. Overall cash flow was negative for most months of the year in two villages examined in detail. However, the adverse flows were eased by a variety of credit arrangements. Debt was a much more significant feature in the drier villages, which through "hidden" interest changes suffered reduced profitability compared to the more largely self-financed systems of the wetter villages. More fortunate farmers paid cash, or obtained cheap credit from the Agricultural Bank. The less fortunate, who were mostly in the drier villages, had to obtain credit, and more of it, often at high cost.

34) In terms of total system productivity, livestock were of greatest importance in the mid-rainfall villages. The range of whole-system productivity (measured as crop and livestock net output) was tremendous across villages and seasons. In 1977/78 it varied between LS. 1042/ha and LS. 56/ha. Productivity per person was highest in the higher rainfall, and irrigated, villages. These values (corrected from sample data to better represent of the whole village) show net outputs of LS 1050 to LS. 1800 per person in the better villages, but only 80 to 700/person in the drier villages.

35) Low productivity per person in these drier areas, and for the worse-off families in the wetter areas, required supplementation, and the importance of non-farm income was much greater. The poor performance of farming systems in the two driest villages has apparently encouraged people, who previously relied on farming, to seek work elsewhere.

36) It remains to be seen whether agriculture in the drier villages can prove attractive enough to draw investment from non-farm income sources. All the indications of this report are that it cannot. However, in the most favoured areas, there is evidence that optimum investment levels have not yet been reached, as witnessed by an increase in the use of inputs such as HYVs, fertilizer and machinery over the period of the study.

37) Risk appears to be a significant feature of farming in all areas, but especially so in the drier zones. The performance of the individual farm systems i.e that mix of crops and livestock and management used on single holdings, varied tremendously between seasons in some cases. At village level, systems showed a degree of stability, in that the mix of crops and livestock compensated for seasonal effects, but on single farms the fluctuations were often worse.

3.1 PRESENTATION OF VILLAGE LEVEL DATA

3.1.1 Types of Analysis

The objectives of the work reported in this section were, broadly, to describe and understand example farming systems from within ICARDA's mandated agro-climatic zone of 200 to 600 mm annual rainfall. Such a zone includes a diversity of systems.

With a fixed level of research resources, the choice lay between concentrating effort on a limited number of systems, or components of systems, and by implication working with a large number of sample farms within those systems, or to attempt to describe all major systems in some depth. The consequence of this is that a much smaller sample of farms within each system has to be accepted. Further, the fact that we wished to understand something of system dynamics, and change over time, implied that a restricted farm household sample would be necessary.

It was felt that this latter approach was justified, particularly in view of the baseline nature of Project 2: Studies of Farming Systems in Syria.

These objectives have resulted in something of a compromise between the "case-study" approach, and the "sample survey" approach. The total number of farmers for which full recording and analysis has been completed is about 85, from eight villages,[1/] and so the within-village sample is on average small. However, the data obtained for each farm is in most cases very complete with regard to farm enterprise data.

1/ 52 farmers in 6 Aleppo villages; 33 farmers in 2 Hama villages.

On the other hand, farms were selected in such a way that they represented a range of holding types within each system, in order that a degree of extrapolation could be made. Of particular significance *in this study* has been the relationship between land resources and the farming population dependant on them, represented by land/person ratios.

The implications of such a sample distribution are that the data are more appropriate to a comparative analysis rather than an econometric "production function" analysis which attempts to illicit and quantify input-output relationships, but requires a relatively large amount of data on the variables of interest: it is more selective in its data requirements.

Production function analysis is also only valid within one system. The small farmer-sample given by the approach adopted for this study is generally inadequate for a diagnostic analysis of relationships within systems, for example the response in crop yield to fertilizer, or the relationship, if any, between output per hectare and farm size. Such comparisons cannot be made between farms in different systems, particularly where these differ as much in productivity as those between 200 and 600 mm rainfall do.

Information gathered at farming household level can be handled in several ways:

1) in aggregate form to depict what is happening at the village farming system level;

2) in a dis-aggregated form, to examine the differences between farm families within the framework of the village system;

3) by extraction of data across all households and villages, for example: seedrates, yields and wheat consumption.

Methods (1) and (2) involve quantifying the changes resulting from a farming system's physical and financial flows. These are illustrated in a generalised form in Figure 3.1.

Most farms in Syria and Aleppo Province are relatively small, and self-provisioning, and the capacity of existing systems to produce a surplus, are of great importance. In this report, therefore, the physical flows, or the processing of materials through the system, receive equal or greater emphasis than the corresponding monetary flows. This is not to say that the financial aspects are not important, for in a highly monetarised economy such as Syria's, cash flow in particular can potentially have a significant effect on the performace of a system.

In this report, sections 3.3 to 3.6 deal with physical production data for the aggregate farm sample in each village, and section 3.7 deals with financial flows. Physical and financial data are combined in section 3.8. In section 3.9, the aggregate sample is examined in terms of the individual farm families from which it is composed.[1/]

Analysis on the principle of Figure 3.1 allows us to link activities which produce output with those that consume it. We can examine, for example, how the crop mix at either household or village system level is directed towards providing food for the household, animal feeds, and a surplus for sale. At village level, we can link households that produce surpluses of certain commodities with those that are deficient in that respect, and evaluate the overall system performance.

Analysis in physical terms, i.e. in kilograms of wheat, is only possible and meaningful for commodities that have alternative uses; for example wheat, which can be utilized as seed, foodstuff or animal feed. Physical flow

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1/ For those wishing to examine data from individual farming households, refer to Annex 1: Summary data on sample farmers in the Farming Systems Program Village Level Studies.

analysis in this report has therefore been limited to wheat and animal feed commodities. For fruit trees and most summer crops, physical flows have little meaning, and measurement in monetary terms is usually more appropriate.

Commodities that can be dealt with in physical terms also have to be evaluated financially to obtain a measure of technical and economic performance.

3.1.2 Principles and Methods of Analysis

Physical and financial changes and flows can be handled in a simple budgetary way over a fixed time period, which is appropriately a single twelve month agricultural season. In village 4/04 this runs from 1st October to 30th September, and in all other villages from 1st November to 31st October.

These intervals naturally fit cropping systems but are also suitable for livestock -- as births, development and sales of most lambs fall into the same period.

Physical flows are calculated by:

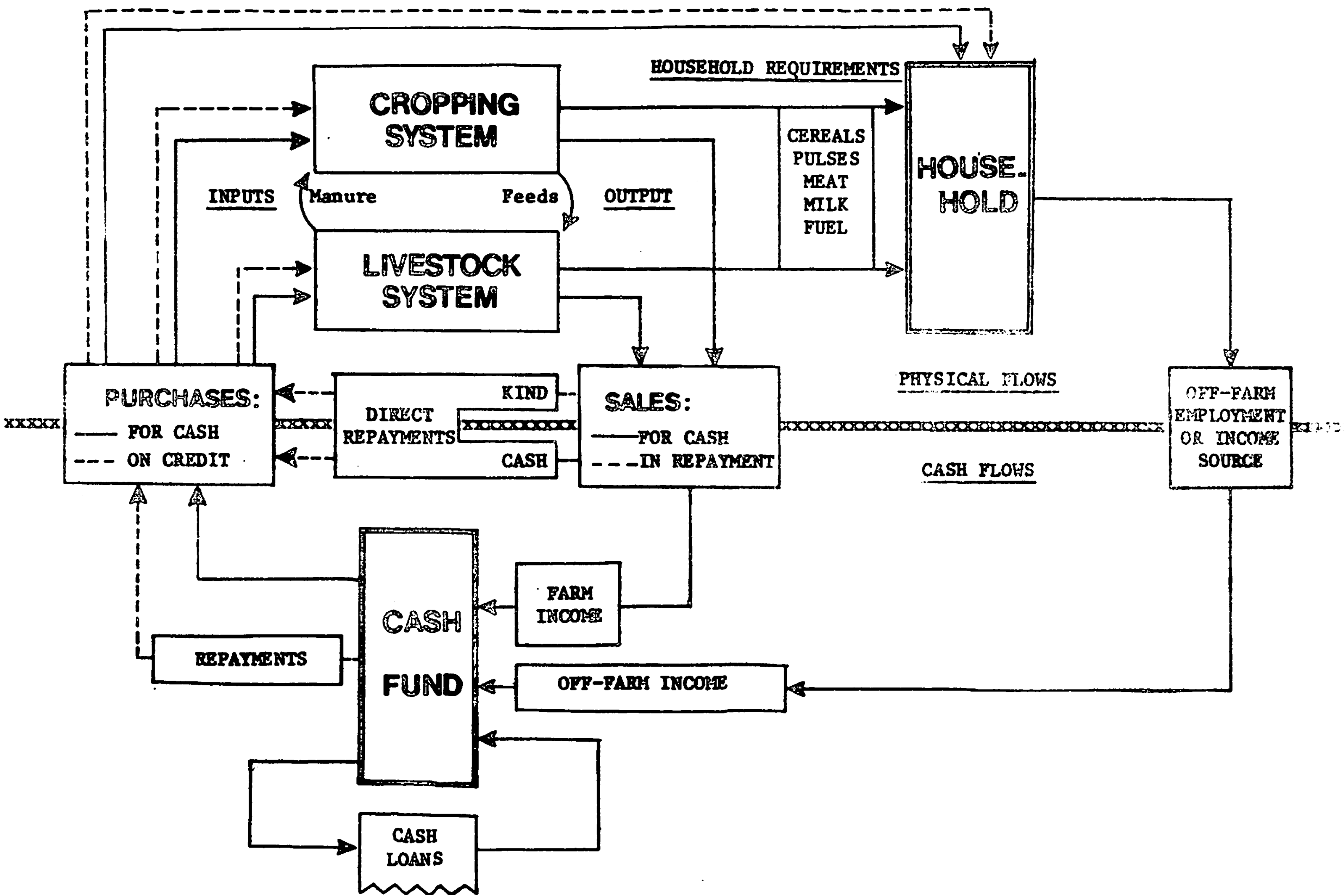
a) Crop commodity production:

START STOCK (seed)

+ Purchased seed
+ Other seed transferred in
- Seed consumed
+ Quantity harvested
- Quantities paid for harvest
- Quantities paid as rent
- Cleaning losses
- Transfers to household
- Transfers to animal feed
- Other disposals

= END STOCK

FIGURE 3.1 SOME PHYSICAL AND CASH FLOW INTERRELATIONSHIPS IN A FARMING SYSTEM



b) Crop commodity consumption:

START STOCK

+ Purchases
+ Transfers from own crops
− Consumption

= END STOCK

Production (a) and consumption (b) can be linked in this case by the internal transfers, into a combined flow at both household and village level.

The system can then be balanced with regard to the outside world. Figure 3.2 illustrates the approach to this for any one commodity. The net flow (Δ flow) can be calculated from the difference between all in-flows (e.g. purchase of seed, or grain for household consumption) and all out-flows (sales, transfers to land-owners etc.). By also taking into account the change in stock (Δ stocks) of seed, household and animal feed stores, a system balance (Δ system) can be estimated. If the balance is positive, the farming system is surplus generating for that commodity; if negative it is deficient, which may be either by accident or design.

The amount by which a system is surplus generating or deficient suggests targets for production increases, which can come from increases in yield, or area allocated to that crop, or both. It also allows us to examine the consequences of change, particularly in crop area allocation.

Physical flow units

Different units may be appropriate to different flows within the system. For wheat and wheat products, mass units are appropriate, but for animal feeds, we need to be able to combine commodities such as grains, straw, forages, by-products and purchased concentrates. In this report the Metabolisable Energy (ME) system has been adopted, and commodities are rated in terms of their feed value to sheep.[1/]

1/ See "Energy allowances and feeding systems in ruminants". Tech. Bull. No. 33, Ministry of Agriculture, Fisheries and Food. HMSO London.

Financial flows

The financial flows in a system are classified in our analysis as:

EXPENDITURE INCURRED, and INCOME EARNED

These must conform to the criteria that (a) the transaction involves payment by cash, and (b) that a net transfer of goods or services takes place between the farming system and the outside world.

In Figure 3.2, some of the in- and out-flows may involve financial flows, and others, for example payments-in-kind, may not. However, to evaluate a system fully it is necessary to put a money value on all physical flows, both within the system and between it and the outside. For expenditure to be incurred, or income earned, whilst money transfer must ultimately be involved, cash transfer need not take place simultaneously. Payment may be delayed by incurring credits or debts. Thus the actual cash flow may differ from the financial flows technically generated by the system. The differences can have an important effect on management of a farming system; but the balance between expenditure incurred and income earned nevertheless measures a system's ability to generate real income.

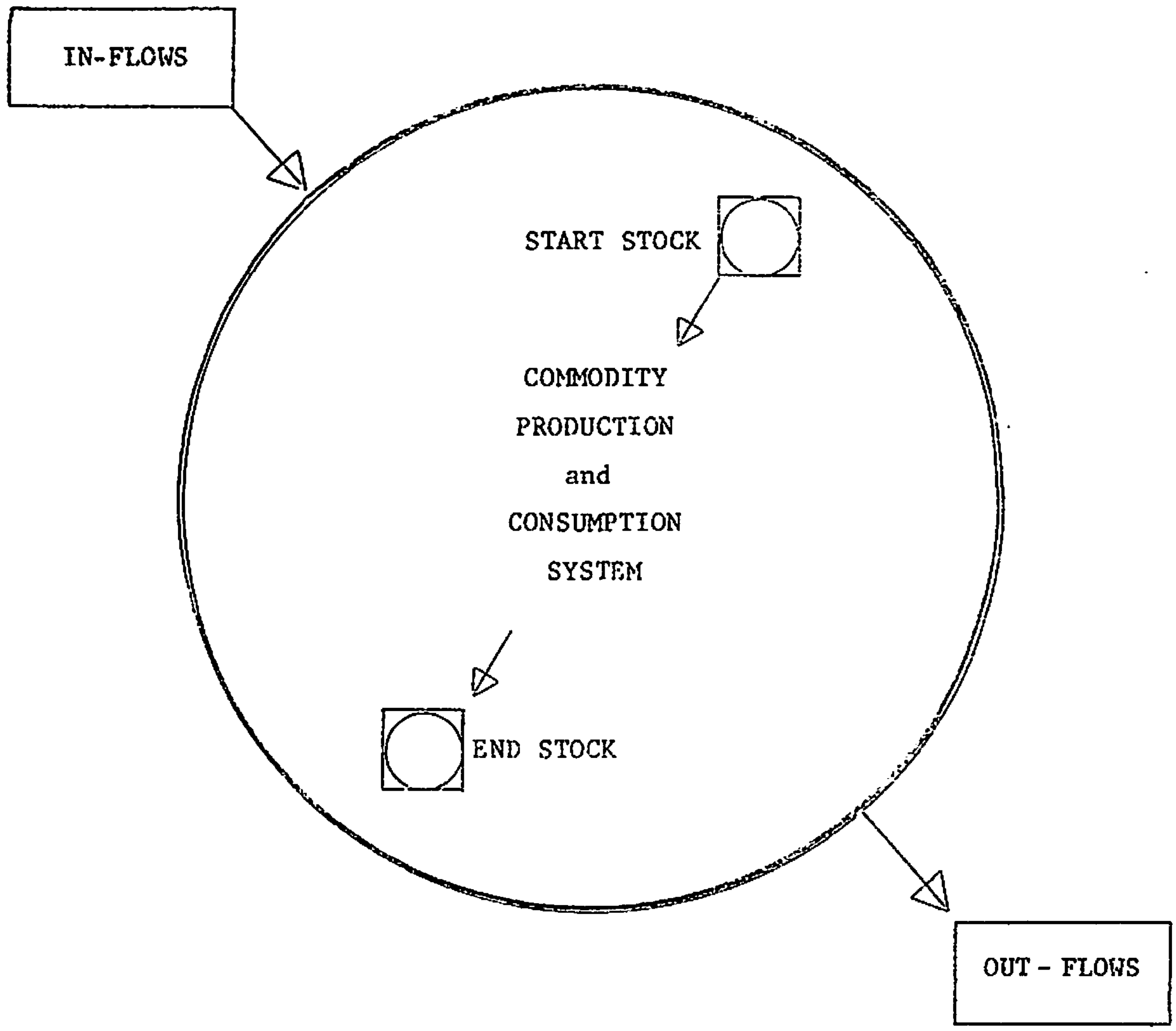
Productivity measures

The simplest measures of productivity are yields, for example kilograms per hectare, lambs per ewe, kilos of milk per lactation. However, these are output measures only and give no idea of the input:output ratio.

A better idea is given by the physical productivity of the system (Δ system of the previous section) which can be expressed as Δ system/hectare and Δ system/person. This at least tells us what the system can produce that is transferrable to the outside world, and is available for consumption by others.

FIGURE 3.2

COMMODITY SYSTEM CHANGE OVER AN AGRICULTURAL SEASON



△ FLOW = OUT FLOWS - IN FLOWS

△ STOCKS = END STOCK - START STOCK

△ SYSTEM = △ FLOW + △ STOCKS

However, true productivity can only be measured taking into account all inputs and outputs.

NET OUTPUT is a useful measure and is defined throughout this report as:

1) Net Output/ha by crop, which is:

OUTPUT	less	COSTS
- Sales,		- Purchased inputs,
- Transfers to seed, food & feed stocks,		- Hired labour,
- Disposals in kind to harvesting contractors, landowners etc.,		- Value of inputs from store,
- Residual grazing values.		- Machinery costs,
		- Value of payments in kind to harvesting contractors.

To enable comparison between farmers who own and those who rent land, all rent payments are excluded from costs. However, machinery costs are included, and are included in the costs of machinery owners as imputed values.

Net output can also be averaged over total rainfed or irrigated land area to show the productivity of a mix of crops. In this report, the cultivated area for this calculation includes fallow, as this is an essential component of some systems.

Net outputs corrected to exclude rents, but including machinery costs, are designated Net Output II.

2) Net Output (Crops) for the whole farm, which is the aggregate value of:

NET OUTPUT/ha x Farm Area

In this case, rent corrections are removed. This, therefore, represents the actual net output of a particular farm and more realistically indicates what a system provides a farming family with. Thus if two farmers have the same area, and the same Net output II/ha, but one owns his land and the other sharecrops, the farm net output of the latter will be lower, by the value of the sharecrop rent. This uncorrected figure is referred to as Net Output I.

In subsequent calculations, all crop net outputs expressed on a per hectare basis are Net Output II. Those expressed on a per person basis, to estimate personal income levels, are Net Output I.

3) Livestock Net Output takes into account:

OUTPUT	less	COSTS
- Closing valuation of stock and feeds,		- Purchases,
- Sales,		- Value of transfers of feedstuffs from crops,
- Transfers to household,		- Opening valuation of stock and feeds.
- Transfers to crops (FYM),		
- Other disposals.		

A word of caution is needed on livestock net output: the calculation is very much dependant on the opening and closing valuations, and whilst it is easy enough to value wheat, or lentil straw, problems arise with animals. This is partly owing to rapid market-price fluctuations and partly to the fact that without inspecting and weighing individual animals, it is difficult to estimate actual value. For this reason, overall average figures for different classes of livestock have been used.1/

1/ All valuations used for crops and livestock are recorded in Annex 2: Manual of Procedures.

Interpretation of Net Output

Net output is the most realistic measure of productivity, but a positive value does not necessarily imply a cash profit, nor a negative one a cash loss. For example, a cropping enterprise might have a positive net output, but, because most of the produce is transferred to the household, or the farm's own animals, show a cash loss. Livestock could show a positive cash income, but an unfavourable net output owing to valuation changes.

Further details on net output calculation are included in Annex 2, "A manual of procedures used in ICARDA's Village Level Studies" available with the Farming Systems Program.

3.1.3 Recording

Sample households have been visited monthly since the start of the survey in November 1977, and information has been taken on:

1) Cropping
2) Livestock
3) Machinery
4) Household

In village 1B/05, recording was limited to the cropping enterprise.

1) Cropping data

A record sheet has been kept for every crop on every plot on a farm, and all inputs, operations and yields have been detailed. From these records we can describe rotational patterns, and extract data on seed and fertilizer rates, operation timing, and yield, related to soil type, previous crop and other input levels. This information is discussed fully in Section 5 of this report.

In addition, records were kept of all transactions related to cropping, and inventories were made to determine stock changes over the season. Disposals of crops, either through sale or internal or external transfer, were monitored after harvest.

Specific observations have also been made, for example plant establishment and quadrat yield estimation, which give a fuller coverage not only of the study villages, but of the Province in general.

2) Livestock

Records have been kept of stock changes through births, deaths, sales, purchases, slaughtering and other disposals. Milk, eggs and other livestock products were recorded according to their use and disposal. All transactions relating to livestock were noted, as were internal transfers of feeds from the cropping enterprise, and farm-yard manure to the crops. Information on feed consumption and animal movements was taken.

3) Machinery

Transactions relating to farm equipment (tractors, pumps etc.) were recorded, but in most cases the information is incomplete, as owners were usually unwilling to disclose income. Machinery ownership has been treated as a separate farm enterprise and has therefore not been included in estimates of farm productivity.

4) Household

For the first year only, a full record was taken of purchases of food and other household items. Some of this information is included in this section of the report where it completes or complements analysis of the farm-household system. Most of this data is discussed in an internal Farm Systems Discussion Paper.

In the second and subsequent seasons, household recording was very much reduced. It has been limited to those commodities that could also have been produced within the farm system, i.e., wheat and wheat products, meat, pulses etc. This information is needed to evaluate how effectively farming systems are providing personal requirements.

3.2 DESCRIPTION OF THE STUDY VILLAGES

3.2.1 General Description

The locations of the six rainfed study villages with respect to mean annual rainfall and cropping system are shown in Maps 3.1 and 3.2.

1A/13 Kawkabeh

Cropping System: One (Trees/cereals/legumes/summer crops)

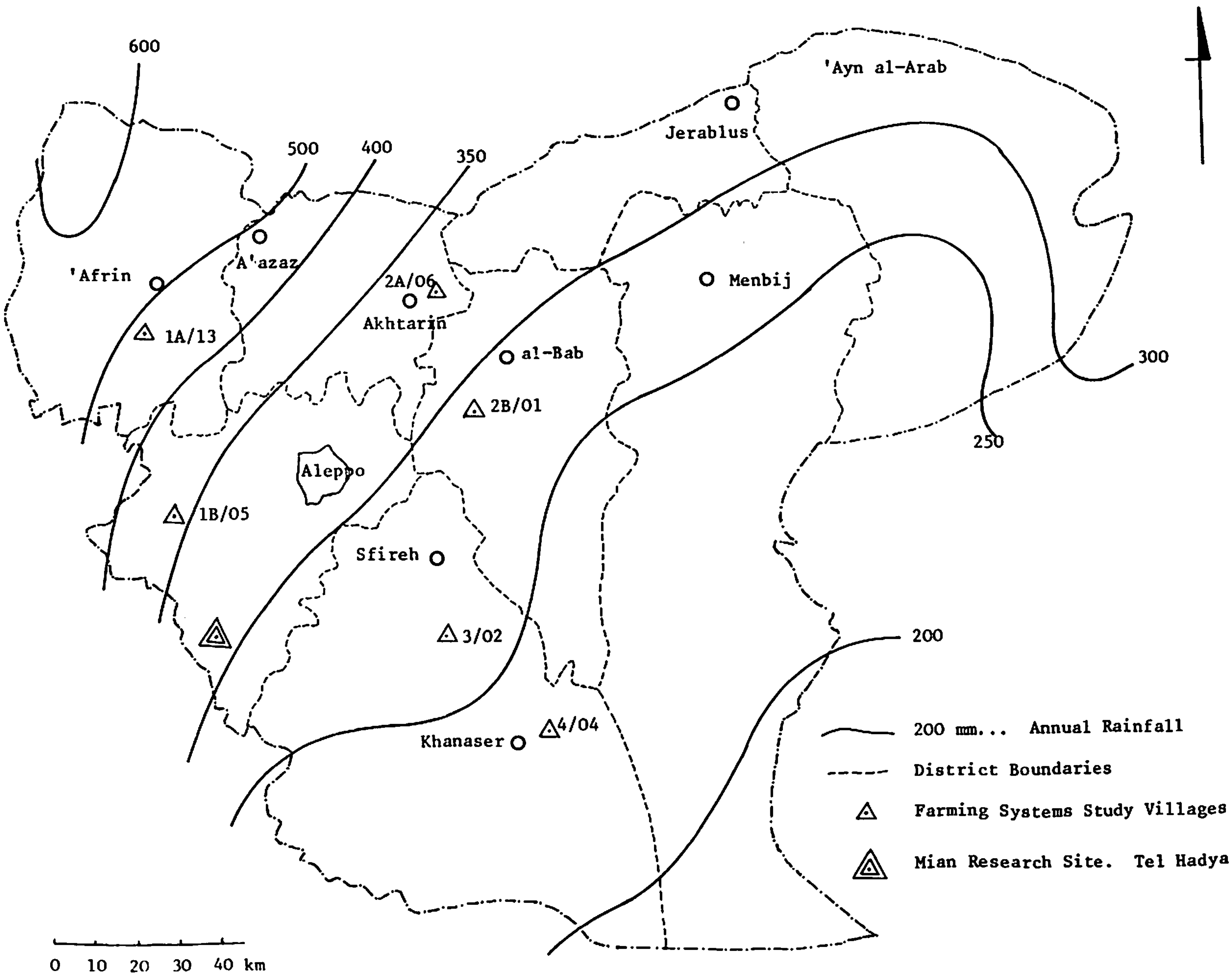
Agricultural Zone: One

Location & Access: One kilometer east of the 'Afrin-Jindiress road, about seven kilometers SW from 'Afrin. An all-weather road to the village was completed in the spring of 1979. Before this, access in the winter months was frequently difficult for cars or trucks.

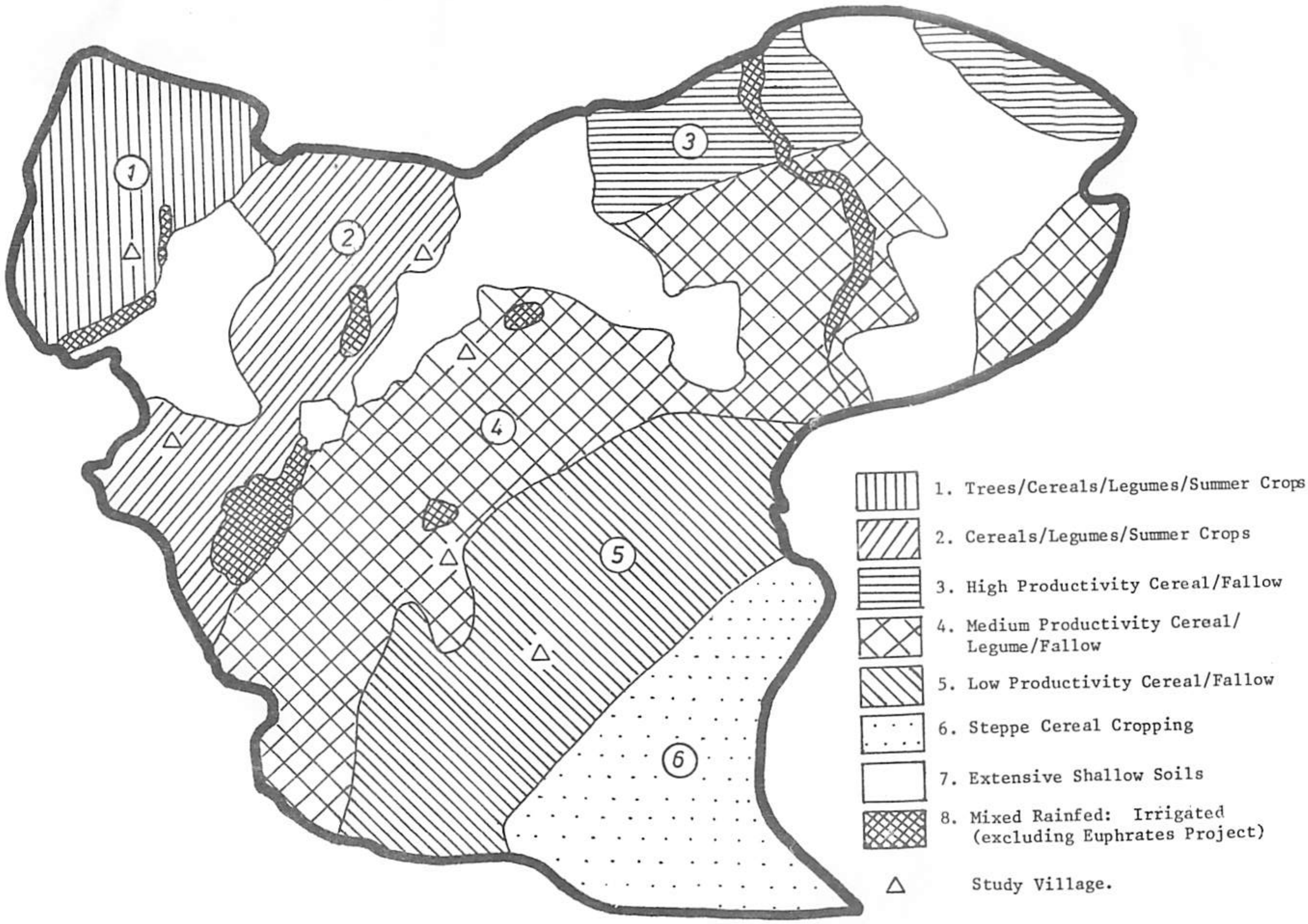
The village is situated in a shallow, gently sloping, south facing valley that runs down to the 'Afrin river. The higher ground is mostly planted to olives and vines, and the deeper soils in the valley bottom and lower slopes carry annual crops. Even some of the high productivity soils are now being planted to olive.

The water table on the lower lands is high in winter, which can make late autumn cultivations difficult. The village has a functional cooperative which helps procure credit, fertilizer and other inputs, and runs a tractor. Eighty-five per cent of the farming households are members. The average holding size is pushed up by a number of medium sized private holdings. There are also two larger land-owners associated with the village.

MAP 3.1 LOCATION OF STUDY VILLAGES IN ALEPPO PROVINCE



MAP 3.2 CROPPING SYSTEMS IN ALEPPO PROVINCE



<u>1B/05 Atareb</u>

Cropping System: Two (Cereals/legumes/summer crops)

Agricultural Zone: One

Location & Access: The village is situated about 30 km WSW from Aleppo on the main road to Bab al-Hawa, which gives year round access.

Atareb is a large village, and a sub-district centre. It has resident agricultural and veterinary officers, and a small collecting depot for the Cereals Bureau.

The farm lands are flat or gently undulating, with a proportion of sloping stony soils which are mostly planted to olive, almond, fig and pistachio. In terms of soil and rainfall, Atareb appears to be situated in one of the best rainfed farming areas in the Province.

Many new houses are being built away from the main village on farm fields, especially where water for irrigation is available.

<u>1B/02 Sheikh 'Ali</u> (original choice)

Cropping System: Two (Cereals/legumes/summer crops)

Agricultural Zone: One

Location & Access: Situated about 25 km SW of Aleppo, to the east side of the old road from Aleppo to Idleb. The village is 8 km NW, and in sight of, Tel Hadya. Access to the village, which is two kilometers from the tar road, was usually possible on a newly graded all-weather road.

Sheikh 'Ali lies on the transitional area between the shallow soils SW of Aleppo and the deep soils of the fertile area in which Atareb is located, ten kilometers away.

It has a unified rotational pattern i.e. all plots in one locality follow the same crop sequence and carry the same crop. This organisation facilitates operations on the many small plots, and allows better control of grazing. Recording in this village had to stop in March 1978 for two main reasons:

1) The village was close to Tel Hadya, and many people thought that the survey was to prepare for the appropriation of their land.

2) These fears were exploited by two opposing factions, one of which cooperated with the survey, and one of which finally refused.

We therefore have a discontinuity in recording of zone 1B of one season, until the replacement village, 1B/05, could be selected.

<u>2A/06 Aqburhan</u>

Cropping System: Two (Cereals/legumes/summer crops)

Agricultural Zone: Two (higher productivity)

Location & Access: The village lies four kilometers east of Akhtarin, from which access is difficult in winter, but alternative routes exist from the al-Bab to ar-Ra'ai tar road about 10 km to the east of the village.

Aqburhan village lies on the edge of a wide shallow basin of deep soil, and is one of eight villages farming this land. Above the settlement are areas of sloping, shallow soil, mostly planted to trees. Beyond this, on the plateau above the village, the soil becomes deeper again.

Most farms are long established private holdings, but a few families received land in the Reform which was taken from two adjacent large holdings.

The village has a Cooperative, but its function has been impaired in the past by bad debt problems, mostly associated with some of the smaller farmers. About 40 per cent of families are in the cooperative. Another feature of the village is a split between the mukhtar's family and several other families. This is serious enough to prevent full functinning of the cooperative, but has little overt effect on other activities.

<u>2B/01 Deir Qaaq</u>

Cropping System:	Four (Medium productivity cereal/legume/fallow) with extensive areas under the shallow soil sub-system of cereal:fallow.
Agricultural Zone:	Two (lower productivity)
Location & Access:	The village lies on the Aleppo to al-Bab road, 10 km west of al-Bab. The road is surfaced and provides all-season access.

This village is representative of many of those found NE of Aleppo. Most of the land is shallow, stony and gently undulating. Some deep soil areas are found in the low central part of the village, but most of this land belongs to the large land-owner of the village. There are five wells, apart from the large landowner's, for irrigation on the deep land, but the water supply is unreliable, and re-charge of aquifer is said to be very localised.

Prior to Land Reform, the village was one of 17 owned by one family. Most of the land redistributed was of poor quality, and some of it was given to a number of "outsider" families, who now live in the village, causing further resentment which persists today. Some farmers are still sharecropping with the landowner, in addition to farming their own holdings.

The only tractor is owned by one of these "outsider" families. As most of the village are on bad terms with this family, they hire tractor services from outside the village.

3/03 Aqrabeh

Cropping System: Four (Medium productivity cereal/legume/fallow)

Agricultural Zone: Three

Location & Access: The village lies 15 kilometers SSE of Sfireh in a 5 km wide basin within al-Hass mountain, on the old trade route between Aleppo and Palmyra. Access is through Sfireh and has improved with the opening of an all-weather road in 1979.

Being set in a basin within Jebel al-Hass, the village is bordered by sloping, stony and increasingly shallow land on all sides but the east. These areas, which supported vineyards and orchards until the drought of 1958, are prone to soil erosion in heavy rain, and have partly gone out of production in recent years.

Between the slopes are areas of deep soils which are good enough to support summer crops in years of above average rainfall.

The village has expanded from seven to nearly 70 households in the last century and fragmentation of holdings is a particular problem. Previously, the land was State owned, and it was redistributed in 1970. Plots run up and down the slope to apportion land of all qualities fairly, but this, coupled with their narrowness, increases the erosion hazard. Narrow plots increase the occurence of dead-furrows from tractor ploughing, which result in gullying. Aqrabeh is the only village on the sample where soil erosion and bad water control are conspicuous problems.

Another unique characteristic of this village is the cooperative. *Eighty* per cent of the farming families are members, and the coop., with its single tractor, handles the farming operations of most of the village. The head of the coop. is undoubtedly a more influential character than the mukhtar. This results in a considerable uniformity of cropping practice; for example, all plots to be fallowed are grouped in one area of the village, and most people have exactly the same rotational sequence, and perform the same number and type of operations. However, with so many farmers relying on the coop., timeliness can be some problem for those at the end of the queue.

4/04 Hawaz

Cropping System: Five (Low productivity cereal/fallow)

Agricultural Zone: Four

Location & Access: The village lies in the centre of the wide plain linking Jaboul salt lake with the steppe, about five kilometers NE of Khanaser. It is within one kilometer of the all-weather road from Sfireh to Khanaser.

The area is flat or slightly undulating, and although three soil types are recognised they are less distinct than in other villages. Hawaz is without doubt the poorest village in the sample. The thirty families comprising the settlement received all their land in the Reform.

All families belong to the cooperative, which administers sheep loans, and is virtually inactive. Many farmers received loans to buy stock in 1976, but these were frequently mis-used.

Two factors have served to brighten the prospects of this village in recent years. Firstly the improvement of the road to Sfireh, and secondly the increasing opportunities for non-farm work presented by Government and military projects.

In many ways, this has been the most difficult village to work in. The villagers, on account of their poverty and insecurity, were originally reluctant to cooperate. Two main problems were involved, in which the findings of an agricultural survey could have adversely affected the village's relationship with the Ministry of Agriculture:

1) The Agricultural Plan prescribed a rotation of two years of fallow and one year of cropping; this was not possible for poor families who must plant a larger area every year, and the village was seriously deviating from the rule;

2) Survey data might result in a reclassification of the area into agricultural zone five, with a consequent ban on cultivation.

The consequences of action on either of these two counts were feared by the community. Three years later we feel we may have allayed these fears.

Technical descriptions of climatic parameters for all the villages are given in Section 5 of this report.[1/]

3.2.2 Village Comparison

Table 3.1 gives a summary of the basic characteristics of each village. Comparison can be made in terms of absolute area and number of households, but several indices give a better picture:

Land/person ratio

The number of donums of rainfed and irrigated land per farm family member ranges between 6.3 and 30.6, generally increasing in the lower rainfall villages. This trend corresponds with that in the whole Province (see 2.1.2).

The land/person ratio is an important index in this study; it has been used in the sampling procedure for study households, and it allows us to relate physical productivity, i.e. yield per hectare, to levels of personal income and welfare.

Sheep and goats/person ratio

The number of sheep and goats per farm family member generally increases up to village 2B/01, but falls again in the two drier villages. Thus we must qualify the statement that "livestock become more important in the drier areas". They do, especially in the true steppe areas, but there is evidence of a break in this trend associated with areas under cropping systems 4 to 6.[2/]

1/ An outline of agricultural stability zones and soil types is given in Appendix 3.1.

2/ Livestock/person ratio in villages 3/02 and 4/04 does not differ greatly from that of other villages in those areas. See 2.5.3.

Sheep and goats/hectare

The number of sheep and goats per hectare shows a similar pattern of increase followed by decline in the driest villages. The implications of these patterns will be discussed in the light of data presented in the following sections.

Per cent of land received under Land Reform

Village 1A/13 was owned by two major land-owners and 65 per cent of the land now under small-farmer control was taken from these.

Villages 1B/05 and 1B/02 are villages of longer established small private holdings, with some poorer families having received land in the Reform. 2A/06 is also a village of private holdings, and only small areas were redistributed from two adjacent large holdings.

Village 2B/01 had only small areas under private ownership before the Reform, and consequently much of the land now farmed in smaller holdings was redistributed.

Village 3/02 and 4/04 received all their title under the Reform. In the case of 3/02 this was State land, and in 4/04 it had belonged to tribal Sheikhs. Villages with higher proportions of land received under the Reform also had more farming families in the cooperatives. For example in 1B/02, only 12 per cent of households were coop. members, whilst in the three drier villages the figure was 80-100 per cent.

Holding size

Holding size generally increases as rainfall declines. Largest holdings are in 2B/01, but the land quality here is very poor.

TABLE 3.1 CHARACTERISTICS OF ALEPPO PROVINCE STUDY VILLAGES

VILLAGE:	1A/13	1B/05 1/	1B/02 2/	2A/06	2B/01	3/02	4/04
Crop system	1	2	2	2	4	4	5
Agricultural zone	1	1	1	2	2	3	4
Mean annual rainfall (mm)	500	370	345	331	303	289	222
Total households	64	1000	144	41	51	85	30
Farming households	39	400	98	39	46	64	30
Farming population	286	2800	898	283	391	571	193
Family size	7.3	7.0	9.0	7.2	9.0	8.9	6.4
Total rainfed area (ha)	399.0	1200.0	560.3	500.5	870.0	1058.0	590
Total irrigated area (ha)	0.0	150.0	9.2	0.0	10.8	0.0	0.0
Per cent of land received Under Land Reform (%)	65	n.a.	32	9	91	100	100
Rainfed land/household (ha)	10.2	3.0	6.3	12.9	23.6	18.2	19.7
Number of plots/household	3.9	n.a.	8.0	4.3	5.5	15.0	3.0
Land/person ratio (donums)	14.0	4.8	6.3	17.7	22.5	18.5	30.6
Heads of sheep	227	1000	594	606	976	1081	286
Heads of goats	210	200	167	111	71	128	44
Heads sheep and goats/person	1.53	0.43	0.85	2.5	2.7	2.1	1.7
Heads sheep and goats/hectare	1.1	0.89	1.3	1.4	1.2	1.1	0.6
Dairy cows	4	50	11	0	0	2	0
Poultry	436	n.a.	974	959	1291	647	197
Draught animals	14	n.a.	82	10	17	25	30
Tractors	5	10	10	10	1	1	1
Combines	1	1	1	1	0	0	0
Hectares/tractor	80	135	56	50	870	1058	590
Agricultural co-operative	Yes	Yes	Yes	Yes	Yes	Yes	No
Livestock co-operative	No	No	No	No	No	No	Yes
Primary school	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Permanent road	Yes	Yes	Yes	No	Yes	Yes	Yes
Electricity	No	Yes	Yes	No	No	(1981)	No

Notes: 1/ Village 1B/05 replaced 1B/02 in October 1978. Information taken from the Mukhtar.

2/ Village 1B/02 dropped in March 1978.

3/ Full data given in Appendix 3.2

Source: Questionnaire given to all farming households (Q/03) (except 1B/05).

TABLE 3.2

LAND QUALITY IN ALEPPO PROVINCE STUDY VILLAGES

VILLAGE:		1A/13	1B/02	2A/06	2B/01	3/02	4/04
SOIL TYPE:							
One	hectares	199.8	214.9	222.5	15.6	538.5	198.0
	per cent	50	39	44	2	52	53
Two	hectares	40.3	124.6	121.5	70.1	274.5	246.0
	per cent	10	23	24	8	26	42
Three	hectares	20.4	103.2	120.3	699.3	217.0	145.5
	per cent	5	18	24	83	21	25
Four	hectares	-	63.5	39.1	-	16.0	-
	per cent	-	11	8	-	1	-
Trees 1/	hectares	138.4	48.1	39.1	59.7	-	-
	per cent	35	9	-	7	-	-
Total 2/	hectares	398.9	554.3	503.4	844.7	1046.0	589.5
	per cent	100	100	100	100	100	100

Notes: 1/ Trees areas are almost all on soil types three and four.

2/ Totals differ slightly from Table 3.1; these figures are aggregated for individual holdings, and Table 3.1 totals are from official records.

Hectares/tractor

There is a marked difference between the three wetter villages and the rest, and not surprisingly, farmers report some difficulties in obtaining timely tractor services in villages 2B/01 and 4/04. More surprisingly, village 3/02 with a single cooperatively run tractor, reports few problems, at least with planting. However, a considerable spread of dates for spring fallow cultivations was observed.

Land quality

Land quality is shown in Table 3.2. Village 2B/01 is striking in having only two per cent of its land of first quality, and 83 per cent under low productivity type three. However, from observation this is typical of the area which this village represents.

Village 1A/13 has a considerable area (35 per cent) under trees, mostly olives and vines, but unlike other villages, these are not always on the poorer soils.

In all villages, less than 52 per cent of the land is of type one soil. This has implications for both present and future productivity. As Appendix 3.1 shows, yields on soil type one can be 50 per cent better than type two, and double that of type three.

3.2.3 Recorded Household Sub-Samples

A sub-sample of farming families, about 25 per cent, was selected in each village according to the land/person ratio within each holding. These ratios were ranked from smallest (large families on small holdings) to largest (small families on large holdings) and the sample was taken at regular points on the scale.[1/] The final sample for which full data analysis

1/ The procedure is fully described in Annex 2 (Manual of Procedures), and is discussed in Farming Systems Discussion Paper No. 4 "A Critique of ICARDA's Village Level Study Methodology".

was completed is usually smaller than the first selection, as not all information proved reliable enough to be included. It was not possible to continue with some families through to the end of the first season.

Table 3.3 compares specific land and livestock indices for the final sub-sample with those of the village as a whole. The greatest discrepancies occur in the land/person ratio, and there was a tendency for the sampling procedure to have resulted in increases of between 136 and 157 per cent. In 3/02 there was a decrease of 14 per cent and in 4/04 there was no effect. In village 1B/05, a sample having a higher land/person ratio was deliberately selected to be more representative of the area as a whole. There is generally closer agreement with regard to livestock measures.

Comparison of sample indices with those of the whole village allows us a wider interpretation of the data. For example, where the land/person ratio differs from either the village, or the locality, corrections can be applied to productivity estimates to give an improved picture.

Since soil quality has such a profound effect on productivity, we need to make comparisons here also. Table 3.4 shows the proportion of land falling into the different soil classes in the sample and the whole village. There is good agreement in most villages; in 2A/06 the sample has a slightly higher proportion of soil type one, and less of two and three, and in 3/02 the sample has slightly less of soil type one, and correspondingly more of type three.

TABLE 3.3

COMPARISON OF HOUSEHOLD SAMPLE WITH VILLAGE AVERAGES

	Number of Households	Land/Person Ratio (Donums)	Heads Total Sheep & Goats/ Person	Heads Total Sheep & Goats/ Hectare	Heads Milking Sheep & Goats/ Person
1A/13					
Sample 77/78	7	22.0	1.3	0.6	0.9
Sample 78/79	7	18.7	1.1	0.6	0.8
Village 77/78	39	14.0	1.53	1.1	-
1B/05					
Sample 78/79	7	7.0	0.16 1/	0.23	-
Village 78/79	400	4.8	0.43	0.89	-
2A/06					
Sample 77/78	8	22.7	2.6	1.1	2.0
Sample 78/79	8	24.1	2.9	1.3	2.4
Village 77/78	39	17.7	2.5	1.4	-
2B/01					
Sample 77/78	8	33.7	2.6	0.8	2.2
Sample 78/79	8	33.4	3.1	0.9	2.2
Village 77/78	46	22.5	2.7	1.2	-
3/02					
Sample 77/78	13	15.9	1.9	1.1	1.4
Sample 78/79	12	16.7	1.8	1.1	1.4
Village 77/78	64	18.5	2.1	1.1	-
4/04					
Sample 77/78	10	31.1	1.5	0.5	1.4
Sample 78/79	9	30.0	1.5	0.5	1.3
Village 77/78	30	30.6	1.7	0.6	-

Notes: 1/ Cattle more important as family milk source.

TABLE 3.4

COMPARISONS OF SAMPLE WITH WHOLE VILLAGE IN TERMS OF SOIL CLASSIFICATION

(Percentages)

SOIL TYPE	ONE	TWO	THREE	FOUR	TREES
1A/13					
Sample 77/78	47.2	13.5	15.9	-	23.4
Sample 78/79	51.8	12.5	14.5	-	21.2
Village 77/78	50.0	10.0	5.0	-	35.0
1B/05	Full data on Village not available				
2A/06					
Sample 77/78	51.3	19.4	20.9	-	8.4
Sample 78/79	51.8	18.3	19.2	-	10.7
Village 77/78	44.0	24.0	24.0	-	8.0
2B/01					
Sample 77/78	2.9	6.5	84.6	-	6.0
Sample 78/79	2.9	6.5	84.6	-	6.0
Village 77/78	2.0	8.0	83.0	-	7.0
3/02					
Sample 77/78	44.2	27.2	26.3	2.3	-
Sample 78/79	44.4	27.1	26.1	2.4	-
Village 77/78	52.0	26.0	21.0	1.0	-
4/04					
Sample 77/78	33.2	41.6	25.2	-	-
Sample 78/79	33.4	41.8	24.8	-	-
Village 77/78	33.0	42.0	25.0	-	-

3.3 BASIC CROPPING DATA

3.3.1 Crop Area Allocation

Allocation of crop areas in the study villages is a complex process, being affected by rotational principles, household and livestock requirements, and profitability issues. There is also a considerable degree of influence exercised through State Agricultural Planning, although this is primarily effective in the licenced areas, which are mostly in zone one or under irrigation.

Four particular groups of factors govern the allocation of land:

1) Rotational requirements which tend to place upper, and sometimes lower, limits on area proportions,

2) Compliance with State Planning requirements,

3) The need to satisfy the farm household's requirements for wheat, animal products, summer fruits and vegetables, food legumes, fuel and cash, and

4) The need to contribute to the overall animal feed supply.

This subject is also covered in Section 5 of this report.

Rotational requirements

A number of rotations are observed in the study villages and these are summarised in Table 3.5. Whilst the majority of plots exhibit a regular rotation, some follow either an irregular pattern or carry regular rotations with seasonal modification. For example, lentil may be dropped from a three-course rotation to give a two-course, such as wheat:summer crops, or it may be substituted for by barley, as in village 3/03, where wheat:lentil:fallow becomes wheat:barley:fallow.

There is considerable flexibility in the crop allocation that an individual farmer can make. However, a number of general rules prevail, for the main part, through all the systems:

a) Wheat almost invariably follows fallow or summer crop. In village 1B/05, all recorded wheat plots followed a summer crop, usually watermelon, and in 2A/06, 2B/01 and 3/02, between 71 and 98 per cent of the wheat area followed summer crop or fallow. The villages where this rule is broken are 1A/13 and 4/04. In 1A/13, considerably more wheat is grown than summer crops and consequently much of the wheat area has to follow other crops. The choice for the alternative preceding crop is usually chickpea.

   In village 4/04, all rotational principles, if they ever existed, appear to have broken down. There are probably several reasons for this. Firstly, it is possible that in the very dry areas, fallowing cannot effectively conserve moisture (see Section 5). Secondly, the poverty and adverse cash flow situation of this village may encourage speculative planting. This will be covered more fully in later sections. The whole question of the role of summer crop and fallow is further examined in ICARDA Discussion Paper No. 5.

   The implication of this is that, ideally, whatever area of wheat is planted an approximately equal area of summer crop or fallow is required. If wheat self sufficiency is the aim, the wheat area must be enough to produce an absolute surplus of about 240 kg/person[1/] in all but the worst years.

1/ This figure is derived from wheat consumption estimated in the villages. See 3.4.1.

b) Having allocated a minimum area of wheat, and its corresponding summer crop/fallow area, the remaining land can be allocated to the most required or profitable crop.

In the drier areas, barley is the most successful and reliable crop, and this takes first place. In the more humid areas, the possibility exists of including crops that bring about an immediate cash return: Wheat, lentil, chickpea and summer crops.

c) In areas where lentil grows well, its value in the rotation is appreciated but not as a predecessor to cereals. In some areas, for example 2A/06, on shallower soils, cereals do alternate with grain legumes (mostly lentil), but this is a minor rotation in circumstances where summer crops are not feasible.

d) As a general rule, different rotations are followed on different plots according to their soil characteristics. For example, in village 2A/06, the deep soils carry rotations which include 50 per cent of summer crop. As soil quality/depth declines, the proportion drops to 33 per cent and nil. Summer crops are replaced by legumes and fallow on shallower soils to give simple two course alternations.

In 2B/01 on the extensive shallow soils where a cereal:fallow rotation is used, the better areas carry wheat:fallow and the poorer areas barley:fallow.

The Agricultural Plan

The Agricultural Plan, which sets crop area targets, is shown in Figure 2.5 Section 2. The way that this plan functions to influence crop allocations is described in Research Report No. 1, Section 5.5; it is really only effective for areas which are licenced, and much of the land in the sample villages goes unaffected.

TABLE 3.5

EXAMPLES OF CROP ROTATIONS IN VLS VILLAGES

Village	General Rotation	Examples
1A/13	Cereal:Legume Cereal:Summer crops Cereal:Legume:Cereal:Summer crop	Wheat:Chickpea Wheat:Watermelon Wheat:Chickpea:Wheat:Sesame
1B/05	Cereal:Legume Cereal:Legume:Summer crops	Wheat:Vetch Wheat:Lentil:Summer crops
2A/06	Cereal:Fallow Cereal:Legume Cereal:Summer crops Cereal:Legume:Summer crop Cereal:Summer crops:Legumes:Summer crops	Barley:Fallow Wheat:Vetch Wheat:Watermelon Wheat:Lentil:Watermelon Wheat:Watermelon:Lentil:Watermelon
2B/01	Cereal:Fallow	Wheat:Fallow Barley:Fallow
3/03	Cereal:Fallow Cereal:Cereal:Fallow Cereal:Legume:Fallow	Barley:Fallow Wheat:Barley:Fallow Wheat:Vetch:Fallow
4/04	No regular rotation	Wheat:Barley:Barley Fallow:Wheat:Barley etc.

Table 3.6 shows the comparison of crop allocation in 1978/79 with the figures required in the Agricultural Plan. Village 1A/13 has more wheat and chickpea, and less lentil and summer crop than prescribed. 1B/05 corresponds reasonably, having more breadwheat and less durum wheat, more barley and less lentil, than required.

Not surprisingly, the zone two villages show considerable disagreement with the Plan, which does not appear flexible enough to accommodate farmers' actual needs. The situation is complicated by the fact that in villages 2A/06 and 2B/01 there is insufficient deep soil to accommodate all the wheat area and some must be planted on poorer ground.

In zone three, the agreement is good with regard to the crop area: fallow balance, but again the Plan is not flexible enough with regard to wheat and legumes.

There is a major disagreement with the Plan in village 4/04. Whilst an allocation implying two years fallow and one year of barley might have some theoretical backing, it clearly does not satisfy farmers' requirements.

Two particular points arise from this comparison:

i) Farmers are clearly intent on providing at least some proportion of their wheat, no matter how unfavourable the environment for that crop, and

ii) It is possible to devise theoretical plans, which, even at village level, clearly do not satisfy the needs of the farm-household system.

TABLE 3.6 COMPARISON OF CROP ALLOCATION IN 1978/9 WITH AGRICULTURAL PLAN

	1/ 1A/13	1B/05	ZONE 1 Plan	2A/06	ZONE 2 Deep soil Plan	2B/01	ZONE 2 Poor soil Plan	3/03	ZONE 3 Plan	4/04	ZONE 4 Plan
Wheat 1	9.2	7.9	15.0	9.8	50.0	31.9	-	20.4	10.0	16.6	-
Wheat 2	30.0	20.8	15.0	7.7	-	-	-	-	-	-	-
Barley	1.9	13.2	4.0	36.1	-	11.5	50.0	22.1	40.0	68.3	33.0
Lentil	4.5	15.0	18.0	11.0	4.0	1.3	-	6.7	-	0.2	-
Chickpea	33.6	0.2	5.0	-	-	-	-	-	-	-	-
Forage	-	7.1	8.0	3.1	1.0	1.3	-	-	-	-	-
Summer crops	19.1	35.8	35.0	30.2	10.0	2.0	-	-	-	-	-
Fallow	1.7	-	-	2.1	35.0	52.0	50.0	50.8	50.0	15.0	67.0
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Notes: 1/ All percentages on the basis of annually cropped area, therefore excluding tree crop areas in 1A/13, 1B/05, 2A/06 and 2B/01.

The Farm household's requirements

There are no hard-and-fast rules to apply at farm level and the way that every household uses its land is different. For example, the area planted to wheat per person can vary considerably within one village. However, some general rules can be suggested now that explain, at least at village level, the allocation of land.

i) Provision of wheat. The security aspect of self-sufficiency in wheat appears important. It also makes economic sense to grow the household's needs on the farm, or at least within the village, if the value of production exceeds the cost. Home-provisioning avoids insecurity and the problems of purchasing requirements from more distant sources.

In areas well adapted to wheat, those above 350 mm, self-sufficiency is not the major factor, as wheat is a profitable cash-earning crop in its own right. This was the situation in villages 1A/13 and 1B/05. As rainfall diminishes, wheat productivity decreases compared to barley and its inclusion over and above that needed for self-sufficiency is undesirable. This situation arose in village 2A/06. With similar costs and market value, barley, with its increased reliability and higher yield, made increasingly better use of the land.

The desire to be self-sufficient in wheat supports its inclusion in the cropping pattern well beyond the point where barley starts to show a comparative advantage. Wheat remained an important crop in villages 2B/01 and 3/02 in spite of producing generally lower yields and requiring a preceding fallow. Only in the driest village, 4/04, was there any indication of the wheat area being limited in favour of barley, and of the system consequently failing to achieve self-sufficiency levels.

The wheat component of the whole system is dealt with more comprehensively in section 3.4.1.

ii) Animal products. Livestock can make an important contribution to income (see 3.7.4) and household food supply (see 3.8.5), and crop allocation must take account of their feeding. The area that has to be planted specifically for animals depends on the livestock density per hectare, the amount and quality of the rangeland grazing available, what by-products are generated by crops grown for other purposes, and how important livestock are as an income generating enterprise over and above subsistence.

In the higher rainfall villages, where natural pasture is more productive, more by-products (legume straw, olive prunings) are available, and livestock densities are generally low, the area of crops planted for feed is restricted. This was the case in village 1A/13. An exception to this is where cattle are kept for milk production, for example village 1B/05, and crops such as barley, vetch and alfalfa are included.

With decreasing rainfall, a decline in crop productivity and the reduced option to grow wheat, legumes or summer crops for cash, livestock assume greater economic importance.

Table 3.7 examines two aspects of crop area allocation, (a) the area of wheat planted per person and (b) the area of fodder and forage crops planted per head of small ruminants.

In village 1A/13, the bias in crop allocation was very much away from livestock and towards wheat. There was an increasing provision for livestock in 1B/05 and 2A/06, and consequently a lower emphasis on wheat production. Village 2B/01 went against this trend; the very poor soil quality and the aim of self-provisioning resulted in large areas of wheat per person but only small, and equally unproductive, areas of forage/fodder per head.

TABLE 3.7

AREAS OF WHEAT PLANTED PER PERSON, AND FODDER/FORAGE CROPS[1/] PLANTED PER HEAD SHEEP & GOATS

(Donums)

Village	Season	Wheat/Person	Fodder/Forage/Head
1A/13	1	6.07	0.92
	2	5.01	0.83
1B/05	2	1.89	2.43
2A/06	1	5.45	3.85
	2	3.83	3.92
2B/01	1	10.26	1.91
	2	9.85	1.45
3/03	1	4.52	2.99
	2	3.39	2.67
4/04	1	5.52	13.52
	2	4.92	13.56

Notes: 1/ FODDER AND FORAGE includes barley, *Vicia* and *Lathyrus* spp., and lentil. The latter is included on account of the large contribution made to animal feed by its straw.

Only in 4/04, again with very low productivity land, was the bias strongly in favour of livestock.

The final outcome of these factors is shown in Table 3.8. This table is based on the aggregate areas for those farmers for which full data analysis was performed. The relatively consistant inclusion of wheat, the increase in the importance of barley, and the decline in the importance of legumes and summer crops can all be seen as rainfall declines. Orchard crops are of major importance in 1A/13 (olives, grapes), of minor importance in 1B/05, 2A/06 and 2B/01, and almost non-existant in 3/03. There are no trees in 4/04.

Tree plantings are on the increase, however, particularly olives in 1A/13, and other species in the drier areas. Government is executing tree-planting projects which are currently affecting villages 2B/01 and 3/02.

A fuller breakdown of crop area allocation, by village, season and soil type, is given in Section 5 of this report - (Table 5.7).

Area allocation and population

Table 3.9 shows the areas planted to each crop per person. The reason for showing this is that it forms the basis for relating system productivity to the number of people making a living from it. These areas are used in subsequent productivity estimates in this report.

3.3.2 Crop Productivity

Figure 3.3 and Table 3.10 show the overall average crop yields attained over two seasons. These figures only relate the total quantity of crop harvested to the area planted. As with other data reviewed in this section, they are based on farmers' estimates, and are averaged over all farms, plots and soil types. They also relate to the quantity obtained after any harvest and preliminary cleaning losses.1/

1/ These losses are usually small. See ICARDA Discussion Paper No. 4.

TABLE 3.8

CROP AREA ALLOCATION FOR SAMPLE FARMERS OVER TWO SEASONS

(SEASON 1 = 1977/78; SEASON 2 = 1978/79)

- (Percentages) -

VILLAGE:	1A/13		1B/05	2A/06		2B/01		3/03		4/04	
Season:	1	2	2	1	2	1	2	1	2	1	2
Wheat 1 (Durum)	7.5	6.3	7.5	23.7	8.9	29.1	26.8	28.4	20.4	17.8	16.6
Wheat 2 (Bread)	20.1	20.6	19.7	-	7.0	1.4 7/	2.8 7/	-	-	-	-
Barley	0.5	1.3	12.5	22.6	32.8	14.9	10.6	22.5	22.1	65.6	68.3
Lentil	2.2	0.4	14.3	15.6	10.0	0.4	1.2	12.9	6.7	-	0.2
Chickpea	18.9 1/	21.3 4/	0.2	-	-	-	-	-	-	-	-
Forage	-	-	6.7	5.1	2.8	-	1.2	0.3	-	-	-
Summr crops	8.1 2/	8.1 5/	34.0 6/	24.1	27.5	3.7 7/	1.9 7/	0.2	-	-	-
Fallow	1.1	1.2	-	-	1.9	43.6	48.3	35.7	50.8	16.6	15.0
Trees	41.6	40.8	5.1	8.9	9.1	6.9	7.2	-	-	-	-
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Winter crops 3/	51.2	51.6	60.9	67.0	63.5	45.8	42.6	64.1	49.2	83.4	85.0
Summer crops	15.1	13.1	34.0	24.1	27.5	3.7	1.9	0.2	0.0	0.0	0.0

Notes: 1/ An additional two per cent of the total area is chickpea intercropped with young trees.

2/ An additional seven per cent of the total area is summer crop intercropped as above.

3/ Winter and summer crop areas include intercropped area.

4/ & 5/ Plus two and five per cent of intercrops respectively.

6/ Includes 7.6 per cent of irrigated summer crops.

7/ With supplementary irrigation.

FIGURE 3.3 OVERALL CROP YIELDS (GRAIN)

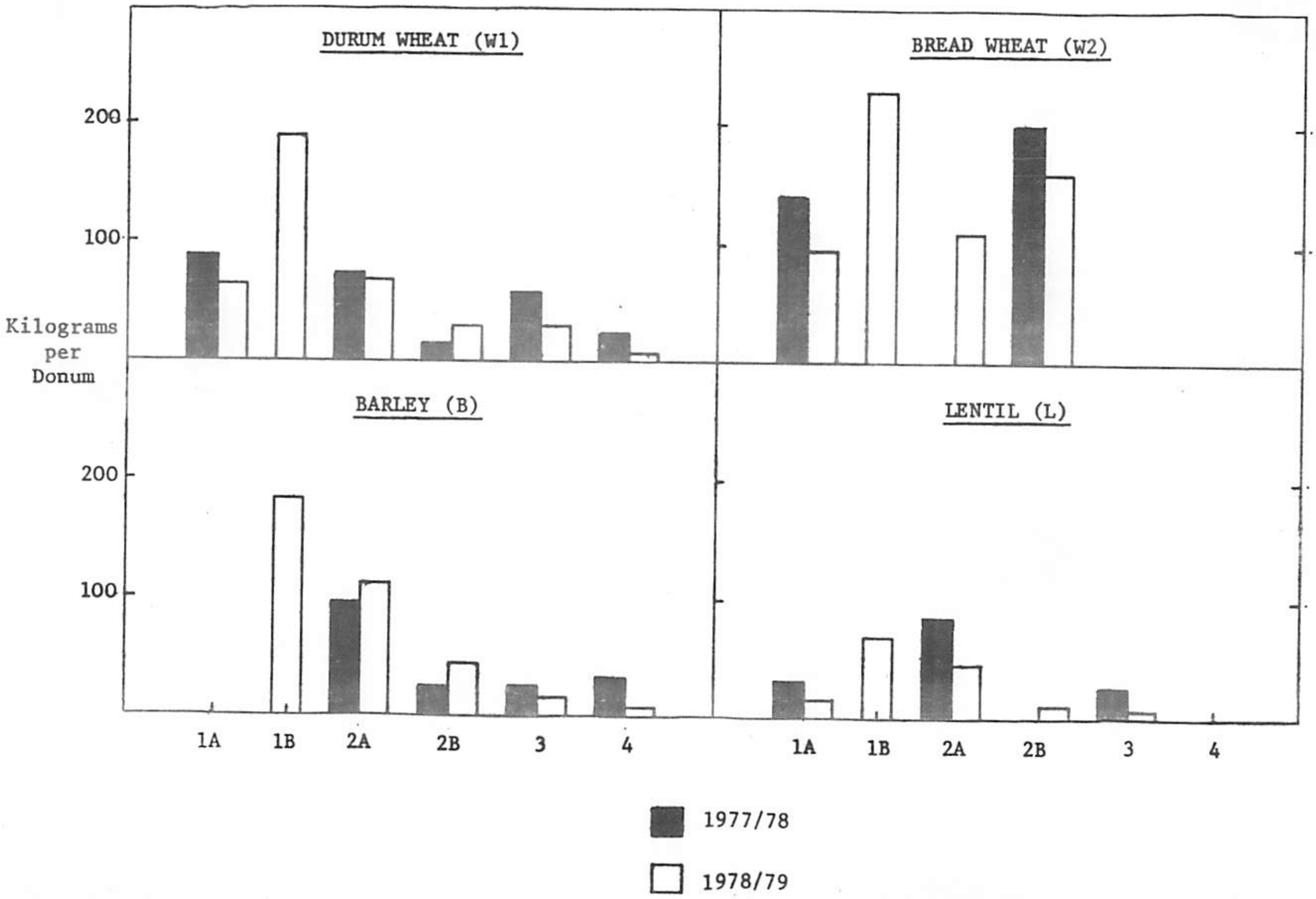


TABLE 3.9 CROPS AREAS PLANTED PER PERSON FOR SAMPLE FARMERS OVER TWO SEASONS.

(Donums/person)

VILLAGE:	1A/13		1B/05	2A/06		2B/01		3/02		4/04	
Season	1	2	2	1	2	1	2	1	2	1	2
Wheat 1	1.65	1.17	0.52	5.45	2.14	10.26	9.85	4.52	3.39	5.52	4.92
Wheat 2	4.42	3.84	1.37	-	1.69	-	-	-	-	-	-
Total wheat	6.07	5.01	1.89	5.45	3.83	10.26	9.85	4.52	3.39	5.52	4.92
Barley	0.10	0.24	0.87	5.22	7.90	5.01	3.54	3.58	3.69	20.39	20.40
Lentil	0.82	0.58	0.99	3.63	2.41	0.13	0.40	2.05	1.12	-	0.05
Chickpea	4.57	4.30	0.02	-	-	-	-	-	-	-	-
Forage	-	-	0.47	1.14	0.67	-	0.40	0.05	-	-	-
Summer crops	3.34	2.45	2.36	5.22	6.64	1.26	0.67	0.04	-	-	-
Fallow	0.24	0.22	-	-	0.46	14.69	16.14	5.69	8.47	5.15	4.49
Trees	9.16	7.64	0.35	2.04	2.19	2.35	2.40	-	-	-	-
TOTAL	22.0 1/	18.66 1/	6.95	22.70	224.10	33.70	33.40	15.93	16.67	31.06	29.86

Note: 1/ 2, 3 and 1.8 donums respectively carry two crops (Orchard, and chickpeas, lentil or summer crop).

A detailed treatment of crop yield from both farmers' estimates and physical sampling, according to rainfall zone and soil type, is given in Section 5 of this report.

Highest crop productivity is found in village 1B/05. Yields of all crops in 1978/9 were considerably higher here than in either the wetter village 1A/13 or the drier 2A/06. Several factors may serve to depress wheat yield in 1A/13: (i) only 40 per cent of the wheat area followed summer crops as compared to 100 per cent in 1B/05, and (ii) a severe weed problem has developed there, particularly wild oat.

Yields otherwise decrease with rainfall. Of interest is the higher productivity of cereals in villages 2A/06 and 2B/01 in 1978/9 compared to 1977/78. Farmers attributed this to a better distribution of spring rainfall, despite lower totals. This is supported by the rainfall data, which shows twice as much spring rainfall in those two villages.

Villages 3/02 and 4/Q4 experienced very poor seasons in 1978/79. In 4/04, very little of the area planted was actually harvested, and the remainder was grazed-off at maturity.

The yield of animal feed energy (expressed in units of metabolisable energy for sheep) is a compound value. It includes all crop commodities that are collected and retained as animal feed, but does not include the value of any crop material grazed *in situ*.

The reasons for restricting this estimate are (i) it is difficult to estimate the feed value of a crop for which no yield information is available (ii) we have no estimate at present of the feed value of range material and (iii) it is thought at this stage that the limiting factor in animal feeding is the availability of conserved, stored feed at critical times of the year when other feed sources have dried up (see Section 6 of this report). It is not the ability of a crop system to support grazing that is critical, rather its ability to provide conservable, storable material (see 3.6.2.).

Animal feed energy yield varies considerably across the villages. This in part reflects the general variation in crop productivity, and in part the degree to which the system is set up to provide feed.

In village 1A/13, low productivity is due to the fact that animal feed is produced entirely as a by-product. In the other villages, with greater areas allocated to feed crops, the variation reflects mainly biological productivity. A full breakdown of animal feed supply and demand is given in 3.4.2.

Productivity and population

The area data presented in Table 3.9 and the yield data of Table 3.10 allow us to start measuring the productive capacity of the different systems. Table 3.11 shows the amount of wheat harvested per person, and animal feed harvested per head of small ruminants.

Wheat production per person declines with rainfall. These figures might be compared with the 240 kg/person wheat requirement discussed in 3.3.1, and it would appear that four villages achieved or exceeded self-sufficiency, whilst two, 4/04 and 3/02 in 1978/9, did not.

The animal feed situation showed much more variation, with only villages 1B/05 and 2A/06 producing relatively high amounts compared to the livestock population they had to support. The case of 4/04 is interesting; in 1977/78, owing to the large area of feed crops planted per head, the harvest contributed significantly to feed supply. It is only unfortunate that much of this production had to be sold to raise cash and repay debts rather than go straight to the home feed store.

The presentation so far gives us only a partial insight into the functioning of the systems in the six villages. To go further, we must apply the procedures outlined in 3.1.2 and examine the farming system in terms of the commodity systems it comprises of.

TABLE 3.10

CROP PRODUCTIVITY AND RAINFALL

VILLAGE:	1A/13		1B/05	2A/06		2B/01		3/02		4/04	
Season	1	2	2	1	2	1	2	1	2	1	2
GRAIN YIELDS 1/ (kg / ha)											
Wheat 1	883	656	1903	720	683	157	333	581	293	235	72
Wheat 2	1389	965	2289	-	1105	2003 4/	1607 4/	-	-	-	-
Barley	-	-	1822	824	1103	224	413	246	134	307	34
Lentil	312	130	667	838	422	-	152	231	67	-	-
Chickpea	779	482	-	-	-	-	-	-	-	-	-
ANIMAL FEED ENERGY (Megajoules ME/ha) 2/	4550	3550	23880	9550	11260	6670	11450	6600	4870	4520	800
RAINFALL											
Whole season (mm)	430	322	258	317	227	274.8	219.5	258.5	142.5	241	153
After week 9 (mm) 3/	58.5	62	48.5	28.5	67	21	52	34	37.5	32	25

Notes:
1/ These yields are the overall means, per hectare planted for crops on all soil types.
2/ Feed energy yields are calculated per hectare of barley, forage and lentil.
3/ Week 9 coincides approximately with the 1st of March.
4/ Wheat 2 in village 2B/01 received supplementary irrigation.

TABLE 3.11

WHEAT AND ANIMAL FEED HARVESTED PER PERSON AND PER HEAD

Village and Season		Wheat Harvested kg/person	Animal Feed Harvested MJME/Head
1A/13	1	759	2174
	2	448	1824
1B/05	2	414	7188 1/
2A/06	1	400	3678
	2	333	4424
2B/01	1	219	1272
	2	450	1660
3/02	1	225	1971
	2	99	1218
4/04	1	130	6113 2/
	2	35	1085

Notes: 1/ Figures for 1B/05 of limited accuracy as livestock include dairy coes and followers.

2/ For reasons that are explained later, less than half of the animal feed harvested per head was transferred directly to the animal feed flocks.

3.4 COMMODITY SYSTEM ANALYSIS

3.4.1 Wheat

Wheat flows, which have been calculated for all villages over two seasons, represent the production process of the aggregated sample of households in each village. They take into account the production component (crops sector) and the two consumption components (household and livestock sectors).

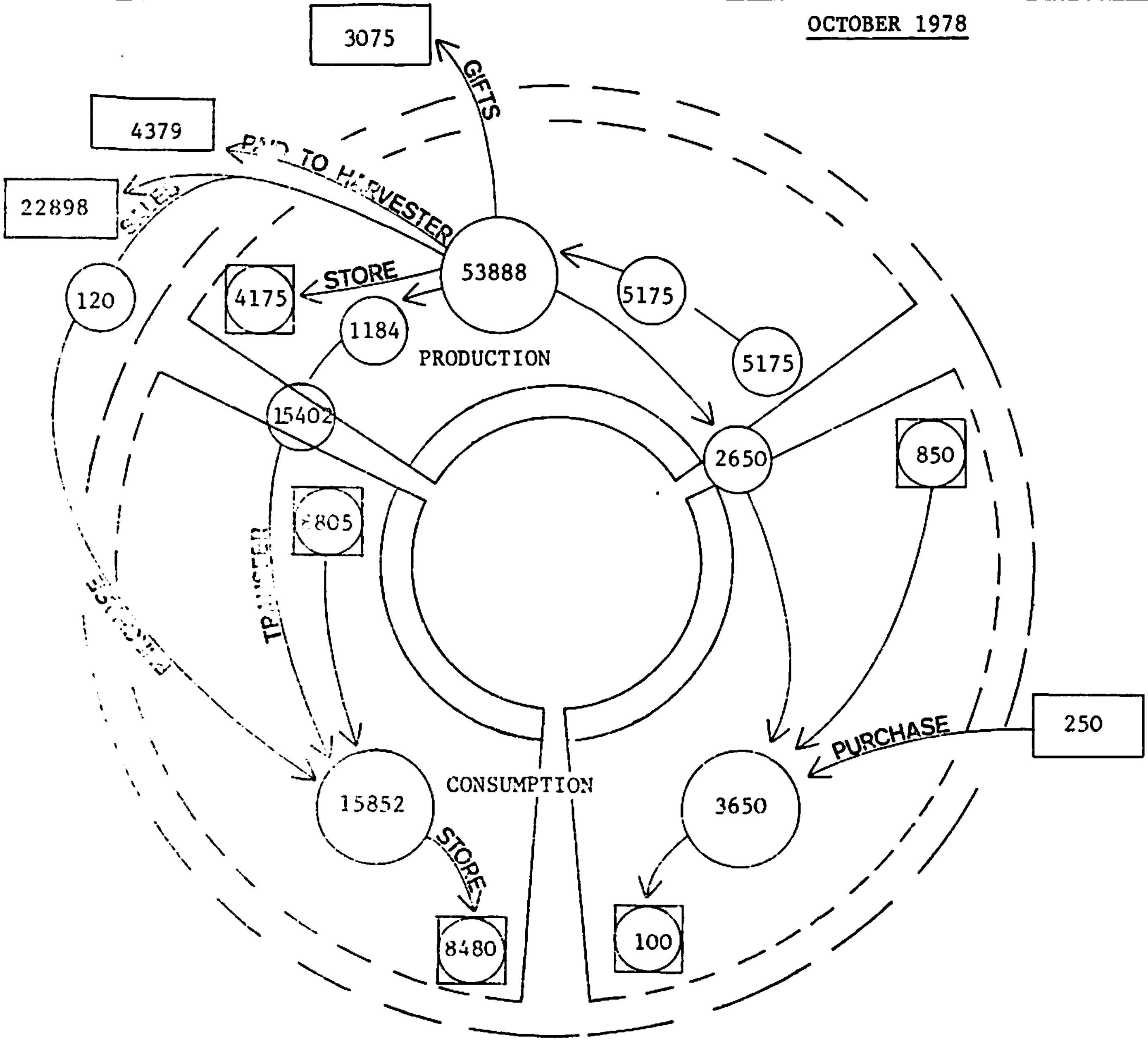
Figures 3.4 to 3.6 illustrate flows in three villages in 1977/78. In the crops sector, wheat from store plus purchased seed are consumed in the process, and the harvest is disposed of by:

- payments in kind to combine harvester operators,
- sales within the village,
- sales outside the village,
- gifts to charity (here assumed to go outside of the system because receipts from charity are not recorded for any sample farmers),
- transfers to the household,
- transfers to animal feed (usually second grade or dirty wheat),
- losses in cleaning,
- seed kept in store for the following year's planting.

In Figures 3.4 to 3.6 any transfer across the farming system boundary is marked by a rectangular box and transfers within the system are marked by circles. These diagrams explain the calculation of net flow (Δ flow) and the system change (Δ system). Full flow budgets are given in Appendix 3.3.

FIGURE 3.4

VILLAGE 1A/13: WHEAT FLOWS (kg) NOVEMBER 1977 - OCTOBER 1978



INFLOW	OUTFLOW
	3075
	4379
250	22898
250	30352

△ FLOW	+ 30102
△ STOCKS	- 2075

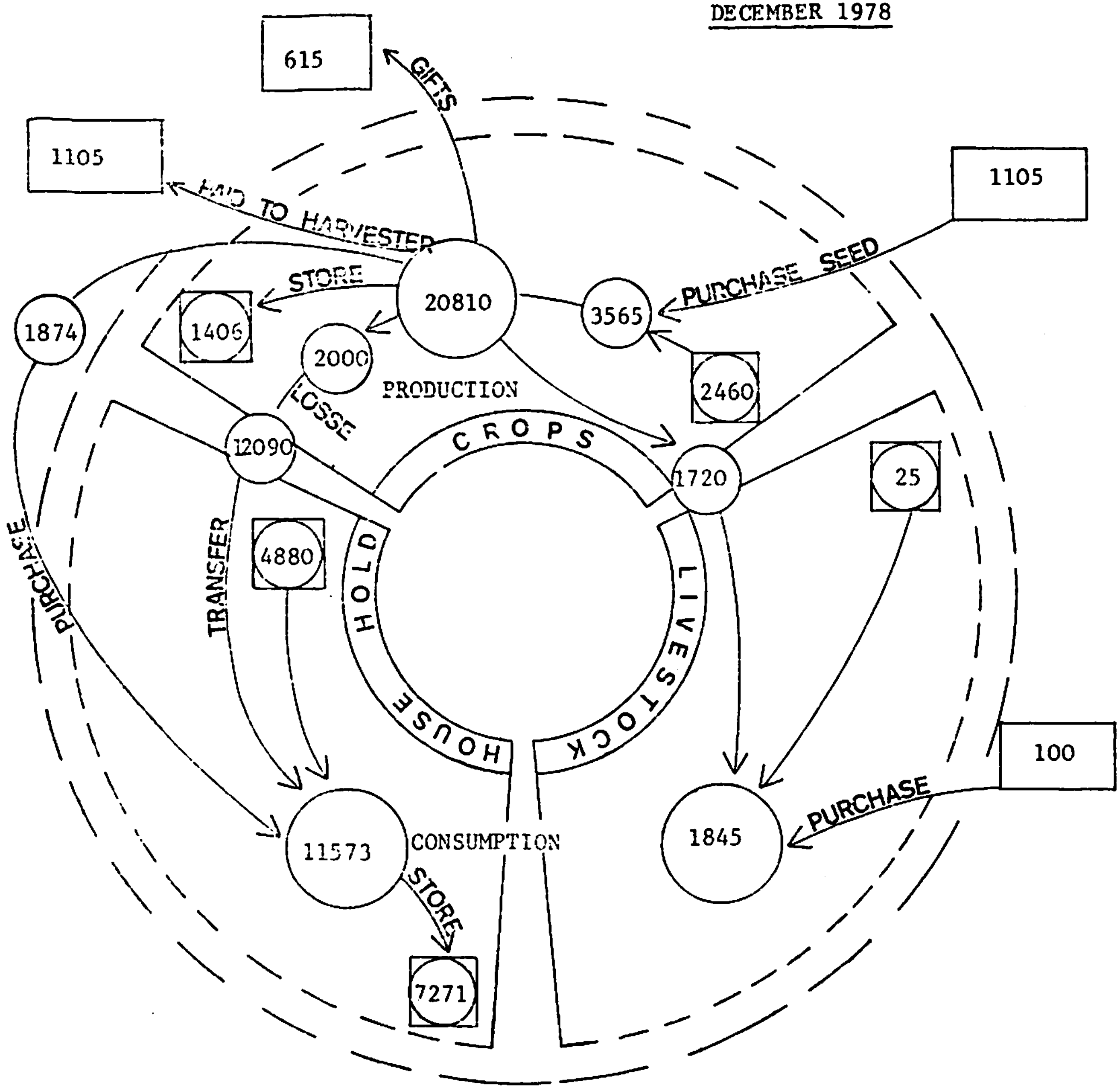
△ SYSTEM CHANGE + 28027

100 per cent of wheat input to Household generated within the system.

STORE

FIGURE 3.5

VILLAGE 2A/06: WHEAT FLOWS (kg) NOVEMBER 1977 - DECEMBER 1978



INFLOW	OUTFLOW
1105	1105
100	615
1205	1705

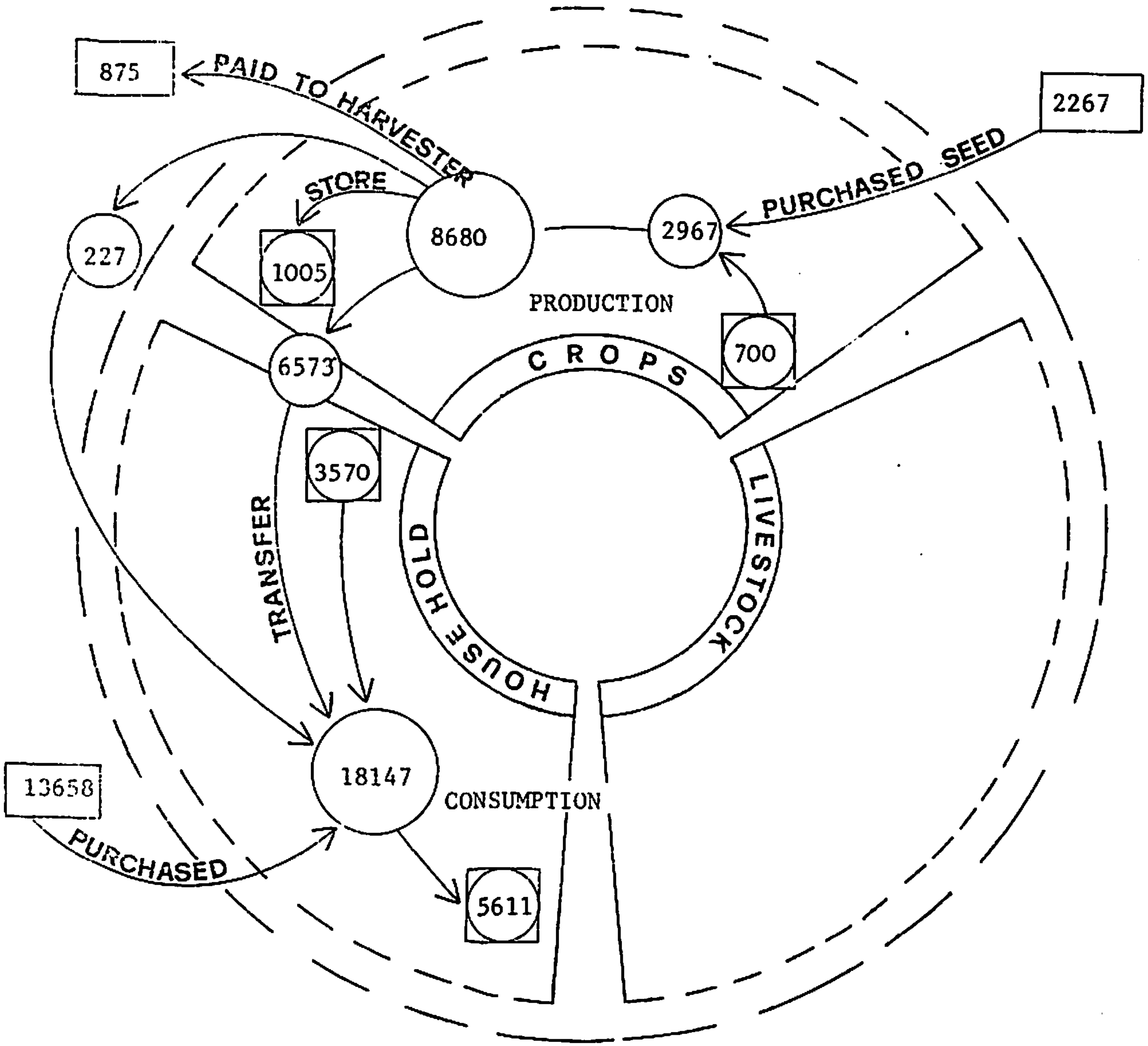
△ FLOW	+ 515
△ STOCKS	+ 1312

△ SYSTEM CHANGE	+ 1827

100 per cent of wheat input to Household generated within the system.

◯ STORE

FIGURE 3.6 VILLAGE 4/04: WHEAT FLOWS (kg) OCTOBER 1977-SEPTEMBER 1978



INFLOW	OUTFLOW
2267	875
13658	
15925	875

△ FLOW	- 15050
△ STOCKS	+ 1755

△ SYSTEM CHANGE	- 13295

33 per cent of wheat input to Household generated within the system.

If Δ system is zero, or reasonably small in comparison to the figure for household consumption, then that group of farms as a whole can be considered to have been just self-sufficient. If Δ system was large, the system was surplus producing; if negative, the system was deficient.

Some farmers in that group may have produced a surplus, others may have been self-sufficient, and others may not have produced enough to satisfy their requirements. These differences are discussed in Section 3.9.

Table 3.12 shows the system change (Δ system) per hectare and per person for the six villages over two seasons. Two villages with irrigation, IRR/01 and IRR/09, are included for comparison.[1/]

On a per hectare basis, comparing figures for 1978/79, the irrigated villages and 1B/05 were clearly ahead of the rest. Villages 2A/06 and 2B/01 were slightly better than self-sufficient over both seasons, and 3/02 and 4/04 showed increasing degrees of insufficiency.

Per person, the situation is slightly different. The advantage of the irrigated villages is somewhat diminished owing to smaller land/person ratios. The deficiency of village 4/04, at -136 and -242 kg/person in 1977/78 and 1978/79 respectively, represents a considerable proportion of the expected annual consumption per person.

These figures can be used in two ways. Firstly, we can estimate what yield increases, on average, would be required in a deficient village to achieve self-sufficiency. Secondly, for villages currently achieving self-sufficiency, or little more, but where wheat is not the best suited crop, we can estimate what area might be freed for other crops should yield increases be demonstrated.

1/ Full data in Section 4 of this Report.

TABLE 3.12

WHEAT: SYSTEM SURPLUS OR DEFICIT (Δ SYSTEM) - (kg)

Season	Δ System/hectare		Δ System/person	
	1	2	1	2
Villages:				
IRR/09 1/	-	1841	-	797
IRR/01	-	820	-	264
1A/13	659	345	412	173
1B/05	-	1282	-	243
2A/06	63	99	35	37
2B/01	25	231	25	231
3/02	- 64	-377	- 28	-136
4/04	-343	-491	-190	-242

Notes: 1/ Two irrigated Hama villages included for comparison. (See Section 4).

For example to have achieved self-sufficiency in 3/02 and 4/04, the following average yields would have been required.[1/]

	------ 3/02 ------		------ 4/04 ------	
	Required	Actual	Required	Actual
1977/78	645[2/]	581	578	235
1978/79	670	293	563	72

Note: 2/ Small differences reflect the slightly different allocation of wheat area per person in each season.

In the first season, the increases required represent 11 and 146 per cent of achieved yields in 3/02 and 4/04 respectively. But if real stability is the objective, we should have needed increases of 129 and 682 per cent in the driest years.

Table 3.13 compares Δ system and average yield for all the villages. These measures, particularly Δ system expressed as a proportion of yield, give an idea of the relative surplus orientation of the systems. There is a clear difference between the zone one and irrigated villages, which are clearly set up as surplus generators, and villages in zone two, three and four, which are not. The proportions indicated in Table 3.13 may also help us anticipate how much surplus can be expected given certain yields.

Table 3.14 shows some further characteristics of wheat production and consumption. The proportion of the harvested grain that is sold, i.e. that which generates ready cash, is obviously higher in the surplus villages. But for the villages achieving sufficiency or less, this figure gives an idea of how much grain is redistributed within the system, from surplus farmer to deficit farmers. The figure was particularly high in 2B/01 for 1977/8, where some 45 per cent of the total harvest was produced by one farmer having access to supplementary irrigation.

1/ This is calculated from: (Required yield = Actual yield − Δ system).

TABLE 3.13 SYSTEM SURPLUS OR DEFICIT (Δ SYSTEM) AND YIELD 1/

	IRR/09	IRR/01	1A/13		1B/05	2A/06		2B/01		3/02		4/04	
	2	2	1	2	2	1	2	1	2	1	2	1	2
Δ System/hectare	1841	820	659	345	1282	63	99	25	231	- 64	- 377	- 343	- 491
Yield	2518	1756	1215	894	2183	720	869	213	455	581	293	235	72
Δ System/yield %	73	47	52	39	59	9	11	12	51	- 13	- 129	- 146	- 691

Notes: 1/ Δ System and yield are overall averages for rainfed and irrigated wheat, both durum and breadwheat varities.

TABLE 3.14 CHARACTERISTICS OF WHEAT PRODUCION AND CONSUMPTION

VILLAGE:	1A/13		1B/05	2A/06		2B/01		3/02		4/04	
Season	1	2	2	1	2	1	2	1	2	1	2
Proportion of harvested grain sold (per cent)	42.9	16.8	53.7	9.0	17.3	38.7	6.8	16.7	0.0	0.0	0.0
Proportion of consumed grain 1/ (per cent)											
1) Home produced	99.2	100.0	N.A.	86.6	67.6	80.9	97.4	79.3	50.3	32.5	12.6
2) Purchased	0.8	0.0	N.A.	13.4	32.4	19.1	2.6	20.7	49.7	67.5	87.4
Wheat consumption 2/ kg/person/day	0.67	0.65	N.A.	0.61	0.58	0.40	0.40	0.60	0.62	0.77	0.76

Notes: 1/ Consumed grain is corrected for inventory changes and thus becomes the total of "Purchased" plus "Transferred from Crops".

2/ This figure includes wheat, flour, burghul and frikeh converted to wheat equivalents, but excludes purchased bread and cakes.

Looking at the consumption side, the proportion of consumed grain that is home produced ranged from 100 per cent in the higher rainfall villages to below 33 per cent in village 4/04.[1/]

The flow analysis allows us to calculate average consumption figures, in terms of kilograms of whole wheat per person per day. Within villages, these figures were remarkably consistent, but between villages, they range from 0.40 to 0.77 kg/person/day. The lower figure occurs in village 2B/01 which is on the main road from Aleppo to al-Bab. Most families have members commuting to work in either of these towns, and consumption of town-purchased bread is high. The higher figure is given by village 4/04, which is relatively remote, and until recently had few commuting workers. This is also the poorest village where one would expect bread to be a more important food item.

These figures compare with the Syrian national average consumption of 0.34 kg/person/day (see Research Report No. 1 Section 4.3). There are no comparable figures for the rural Syrian population, but the village estimates come within the range quoted by FAO (1970) for rural populations in countries heavily dependant on wheat.

Wheat type

The crop allocation shown in Table 3.8 indicate the relative importance of durum wheats (W1) and breadwheat (W2). In villages 1A/13 and 1B/05, the greater proportion of wheat area was under breadwheat cv. Mexipak. The remainder was under local varieties, mostly Bayadi. In 2A/06, Mexipak was first grown in 1977/78, and by several of the sample farmers in 1978/79. It was also grown in 2B/01 under supplementary irrigation. In all other situations, the local durum varieties, Bayadi and Hamari were grown. Jezireh 17, Senator Cappelli, Florence Aurore, Jori and Siete Cerros were not planted by the Aleppo sample farmers, but many of these were grown in the two Hama irrigated villages (see Section 4).

1/ Consumed grain is calculated as a residual in the physical flow budget. It includes wheat, flour, burghul and frikeh converted to wheat equivalents, but excludes purchased bread and cakes.

Several factors influenced choice of variety and land allocation to them:

1) no adapted alternative varieties were available for rainfed production in areas under 300 mm annual rainfall.

2) Mexipak has outyielded local varieties in the higher rainfall areas.

3) Breadmaking habits have proven flexible enough to accommodate the flour of some new varieties, notably Mexipak.

Wheat uses

These three factors can be considered against the background of the uses to which farmers put their wheat. These were: for sale, and for home consumption as burghul, frikeh and flour. The preferences of sample farmers for each of these were for:

Use	Requirements
Sale	The highest yielding variety of any type. In the case of Mexipak, the increase in yield over local varieties more than offset the 12 per cent lower price received from Government. 1/
Burghul	Hamari, Bayadi, Italian (Senator Cappelli), in decreasing order. 2/
Frikeh	Italian, Hamari, Bayadi, in decreasing order.
Bread	The preference is complicated by adaptability of farm families in terms of taste, and changing preferences in colour.

1/ Mexipak outyielded local varieties in 1A/13, 1B/05 and 2A/06 by 20 to 62 per cent on average.

2/ Farmers rank varieties in decreasing order of hardness: Hamari, Bayadi, Mexipak, French (Florence Aurore). Italian is about the same as Bayadi.

Bread types and flour requirements

Traditional village bread has a darkish colour, and the wholemeal flours of Hamari and Bayadi wheats are used. This type of bread was the most popular in villages 2A/06, 2B/01 and 3/03. It was also the choice of a number of families in the higher rainfall villages.

An adapted version of this, giving a lighter coloured bread, was found in the "local variety" villages (2A/06, 2B/01, 3/02 and 4/04) and consists of two parts of Hamari/Bayadi wholemeal flour, and one part of refined breadwheat flour, known as "zero" flour.1/ Thus the cheap "Government" flour can make up for shortfalls in home production.

A more extreme version of this is found in households very deficient in home-produced wheat: one part of durum wholemeal flour to two parts of "zero" flour.

Where Mexipak is grown, i.e. village 1A/13, 1B/05 and 2A/06 (in the second season), it makes an acceptable substitute for local varieties in the mixture of two parts Mexipak wholemeal to one part of "zero" flour. A better version of this is two parts of Mexipak wholemeal to one part of French (Florence) wholemeal.

Whilst taste and texture might previously have been most important, there was a trend in some households to a preference for lighter coloured breads:

Colour	Mixture
Lightest	Mexipak wholemeal plus "zero"
	Mexipak wholemeal plus French wholemeal
to	Local durum wholemeal plus "zero"
	Local durum wholehome plus French wholemeal
Darkest	Local durum wholemeal.

1/ "Zero" is refined softwheat flour; if milled locally it is usually from French (Florence Aurore) wheat, or Mexipak.

TABLE 3.15

BREAKDWON OF WHEAT HARVEST, SALES AND TRANSFER TO HOUSEHOLD STOCKS, BY TYPE

VILLAGE:	1A/13		1B/05	2A/06		2B/01 1/	
Season	1	2	2	1	2	1	2
WHEAT HARVESTED							
Durum %	19.8	17.2	24.1	100.0	44.1	54.5	
Bread %	80.2	82.8	75.9	0.0	55.9	45.5	33.8
WHEAT SOLD							
Durum %	9.2	11.5	20.4	100.0	24.9	26.7	100.0 2/
Bread %	90.8	88.5	79.6	0.0	75.1	73.3	0.0
WHEAT KEPT FOR HOUSEHOLD USE							
Durum %	36.1	25.7	21.6	100.0	51.0	77.6	97.8
Bread %	63.9	74.3	78.4	0.0	49.0	22.4	2.2

Notes: 1/ All wheat in villages 3/02 and 4/04 is durum wheat.

2/ Much of the breadwheat in village 2B/01 is sharecropped and ultimately is sold. These figures do not include sharecrop transfers.

Nutritional aspects

Our information is not sufficient to examine nutritional factors in depth. However one factor stands out regarding self-sufficiency. Villages, and families, that are fully self-sufficient in wheat can make their bread from wholemeal flour -- unless they choose to "whiten" it with "zero" flour. But villages and families not self-sufficient must make up the shortfall from purchases, the cheapest form being "zero" flour at Government controlled price. There is a strong tendency to use "zero", as the families with the greatest shortfalls are usually also the poorest.

In village 4/04, 68 and 87 per cent of consumed wheat was purchased in 1977/78 and 1978/79 respectively. Much of this purchase was in the form of "zero" flour. If we consider also the high consumption figures of about 0.77 kg/person/day, we can see that the nutritional quality of the overall diet could well have been inferior to better placed villages.

Table 3.15 shows the actual proportions of durum and breadwheat, harvested, sold and retained for household consumption. The figures for villages growing breadwheat indicate that it was used more for sale than for home consumption. The opposite is true for durum (local) wheats. For villages that were fully self-sufficient, the balance of durum:breadwheat retained for household consumption was between 1:2 and 1:4.

A further discussion on wheat variety preference in the irrigated villages will be found in Section 4 of this report. Irrigation widens the range of possible varieties to include both high yielding durum and breadwheats.

3.4.2 Animal Feeds

We have already indicated the orientation of systems towards livestock in the six villages. Table 3.16 summarises the livestock density on the whole-farm area, the density on the area planted to forage, fodder and by-product feed crops, and the ratio between the two. This ratio represents the proportion of the whole farm area planted to feed productiong crops.1/

Table 3.16 shows how this ratio was considerably higher in 2A/06, 3/02 and 4/04 than the other villages. The low value of 13 per cent in 2B/01 reflects the non-availability of plantable land after the wheat allocation has been made, and increased planting of feed crops (mainly barley) would encroach into the fallow portion. In any case, the large fallow areas in this village provide some grazing until they are cultivated in spring. Also of note in Table 3.16 is the low overall livestock density in village 4/04 on both the whole farm and fodder and forage (i.e. barley) areas.

The livestock numbers used in these calculations include the average number of adult sheep and goats held during the season. They do not include the sometimes considerable numbers of trade and fattening animals that pass through or are held in the village for periods of one to four months. Fattening is a particularly important activity in village 3/02 and to a lesser extent in 2A/06 and 4/04, and the figures tend to underestimate the true feed demand situation in these villages.

Feed flow budgets

As with wheat, we need to consider both production and consumption sectors of the system to understand the whole picture. Feed flow budgets have been calculated for each village in two seasons, and examples are shown in Figures 3.7 and 3.8.

1/ $\dfrac{\text{Livestock No.}}{\text{Whole Farm Area}} - \dfrac{\text{Livestock No.}}{\text{Fodder and Forage Area}} = \dfrac{\text{Fodder and Forage}}{\text{Whole Farm}}$

TABLE 3.16

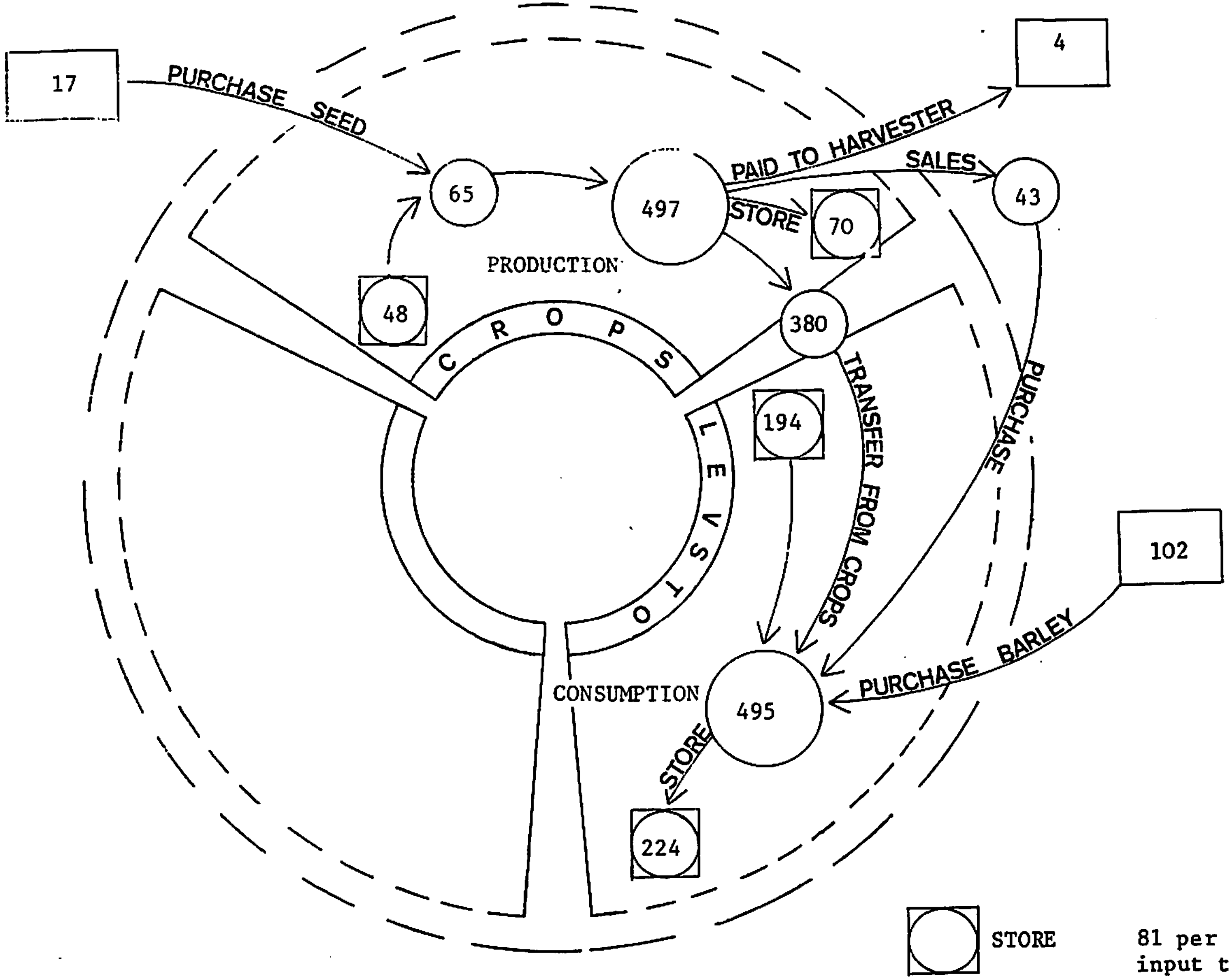
LIVESTOCK DENSITY (AVERAGE HEAD OF SHEEP & GOATS), 1978/1979

VILLAGE	(1) Head/ha Whole farm Area	(2) Head/ha Fodder & Forage crops	Ratio (1):(2) per cent
1A/13	0.6	12.5	4
1B/05	0.2 1/	4.2	5
2A/06	1.3	2.6	46
2B/01	0.9	6.7 2/	13
3/02	1.1	3.7	30
4/04	0.5	0.7	71

Notes: 1/ 1B/05 includes cattle

2/ 2B/01 has extensive fallow areas which supplement grazing.

FIGURE 3.7 VILLAGE 2A/06. ANIMAL FEED FLOWS (GIGAJOULES OF METABOLIZABLE ENERGY) NOVEMBER 1977 - OCTOBER 1978



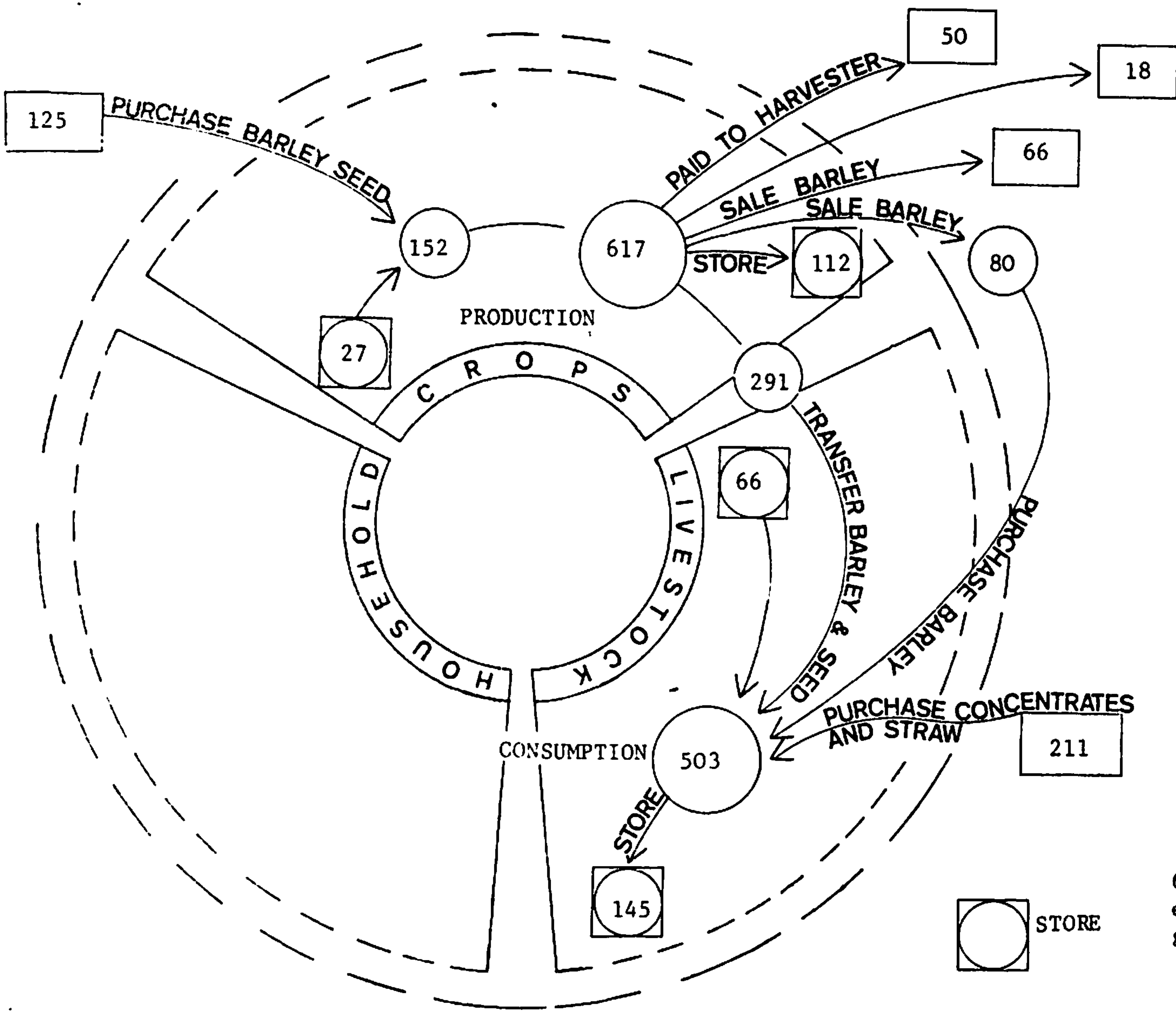
INFLOW	OUTFLOW
17	4
102	
119	4

△ FLOW	- 115
△ STORES	+ 52

△ SYSTEM CHANGE	- 63

81 per cent of metabolizable energy input to Livestock generated within the system.

FIGURE 3.8 VILLAGE 4/04: ANIMAL FEED FLOWS (GIGAJOULES OF METABOLIZABLE ENERGY SHEEP), OCTOBER 1977 - SEPTEMBER 1978



INFLOW	OUTFLOW
125	134
211	
336	134

△ FLOW	- 202
△ STORE	+ 164

△ SYSTEM CHANGE	- 38

64 per cent of metabolisable energy input to Livestock generated within the system.

A number of principles have been used in these calculations:

1) As explained previously, the budgets refer to feed material that is collected, stored and subsequently fed. The estimates do no include the value of direct grazing, either of crops, range or steppe.

2) To enable combination of different materials, standardised values for Metabolisable Energy (ME) and digestible crude protein (DCP) have been used. These are given in Appendix 3.4. However, results have to be interpreted with some caution:

(a) ME values for Syrian feeds have been determined by calculation rather than by direct <u>in vivo</u> measurement.

(b) Digestibility values for crude protein are based on temperate country standards. Syrian sheep may not utilize protein with the same efficiency (if anything it is probably greater).

(c) The ME system is realistic only within certain limits. For example an ME requirements (for lactation, growth, or pregnancy) can be met by many mixes of different feedstuffs. However, some of these may be inappropriate in other ways, or the average ME content may be so low that actual intake is limited. This would be the case with animal rations containing a large proportion of ME from cereal straw.

(d) The calculations include feed produced in the farming system, and kept either on individual farms, or transferred within the system between farms. They also include purchased feeds from outside the system, which in most cases consist of industrial by-products, but can also include agricultural products, i.e. barley, straw.

(e) In calculating the system-produced component, allowance has been made for the input of feed value as seed into the crop sector budget. For example barley for seed could have been fed, as an alternative use, and is included as an input. The same applies to other crops which are wholly consumed as feed, i.e. vetches.

In the case of crops grown primarily for other purposes, for example wheat, lentil or chickpea, a proportion of their seed is included as an input. The exact proportion varies in each case, but is calculated according to the principle:

$$\text{ME INPUT} = \text{ME TOTAL} \times \text{HFR}$$

where:

ME input is the ME value to be charged to the feed budget;
ME total is the ME value of all seed used;
HFR is the harvest feed ratio, given by:

$$\frac{\text{ME value of the harvested material fed}}{\text{ME value of total harvest}}$$

For example, in the case of lentil, the harvest feed ratio (HFR) would be:

$$\frac{\text{ME value of straw}}{\text{ME value of total straw plus grain}}$$

The justification for valuing all crop components in feed terms lies in the fact that they all have possible uses as feed. For example, if some lentil grain was fed as well as straw, the HFR would be given by:

$$\frac{\text{ME value of straw and grain fed}}{\text{ME value of total straw and grain}}$$

By this method we take into account crops that may often be thought of as single-purpose, but need evaluation as dual-purpose.

Full feed-flow budgets are given in Appendix 3.5. The absolute values of the system-change, Δ system, cover in enormous range, and generally are negative, indicating the deficiency of most systems. Only in one case, village 2A/06 in 1978/79, did the system generate a surplus.

In order to compare systems, we need to examine them in terms of the area involved and the number of livestock to be fed. Table 3.17 compares the two indices Δ system/ha and Δ system/head.

On an area basis, villages 1A/13 and 2A/06 were closest to a zero or positive balance over two seasons. Also, village 4/04, in the 1977/78 season, was very close to a balance, suggesting that livestock numbers were kept down to a level that could be supported in an average year. The shortfall in this village in 1978/79 was a result of the almost complete crop failure.

The remaining villages 2B/01 and 3/02 showed considerable deficits in both seasons. Both villages were investing in — and dependant on -- livestock over and above the ability of the crop system to support them. In these villages, the system deficit appears to have improved in 1978/79 over 1977/78. In 2B/01, this was mainly due to slightly higher barley yields, and some decrease in livestock numbers. In 3/03 it is entirely due to the latter effect. In particular, fewer farmers engaged in fattening in the second season.

In terms of the system change per head, we can get a better idea of to what extent livestock numbers are "in balance" with the cropping system that helps support them. The greatest deficit, some 5234 MJME/head in village 4/04, should give us warning of what can happen in the drier areas in a poor year. Whilst in all other villages, the situation was modified in 1978/79 either by slightly higher productivity, or lower livestock numbers, in 4/04 the feed situation worsened by a factor of 13.

TABLE 3.17

SYSTEM CHANGE (Δ SYSTEM) IN ANIMAL FEED ENERGY
(MJME)

	Δ system/hectare		Δ system/head	
SEASONS:	1	2	1	2
1A/13	- 920	- 150	1065	-
1B/05 1/	-	-	-	-
2A/06	- 570	+ 1210	- 475	+ 862
2B/01	- 2580	- 1850	- 3138	- 1844
3/02	- 5190	- 4560	- 4595	- 4316
4/04	- 180	- 2530	- 388	- 5234

Notes: 1/ Flow budgets cannot be calculated for 1B/05 as livestock enterprises were not included in the survey.

Feed transfer within the system

Material harvested for animal feed can be disposed of by direct transfer to the feed store, by sale to other farms within the village system, and by sale or other transfer completely outside the system.

Table 3.18 examines these components. There is some variation between systems and seasons in the proportion of the harvested feed energy that is utilized within the system. This includes the proportion of the yield transferred to the feed store either directly or indirectly.

The lowest utilization of 58 per cent was in village 2A/06 in 1978/79; this, associated with a positive Δ system value, is explained by sales of surplus barley following a good harvest.

Figures of 80 to 85 per cent utilization, occuring with negative Δ system values, indicate some imbalance in the quality of feed provision. The system was capable of producing more low value feed (straw) than could be used, and surpluses were sold off. The straw was of course utilized elsewhere, but it was a low value product in comparison with the trouble and cost of collecting it.

In village 4/04, the low utilization of home produced feed (71 per cent) was due to the fact that barley had also to be grown as a cash crop to cover immediate expenses. A large proportion of the yield had to be sold-off after harvest at low prices to cover debts incurred over the season. A part was repurchased for higher prices several months later. In years of good production, barley must be produced in surplus quantities compared to the relatively low numbers of stock held (0.5 sheep and goats/ha).

TABLE 3.18

ANIMAL FEED PRODUCTIVITY PER HECTARE UNDER ANNUAL CROPS INCLUDING FALLOW (MEGAJOULES M.E.)

VILLAGE:	1A/13		1B/05	2A/06		2B/01		3/02		4/04	
Season	1	2	2	1	2	1	2	1	2	1	2
Yield per hectare	1550	1420	8780	4470	5830	1090	1610	2350	1410	2960	550
Direct Transfer to Aniaml Feed store 1/	1420	1390	7390	3420	3310	840	1250	1660	1130	1420	440
Total Transfer to Animal Feed store 2/	1420	1390	N.A.	3800	3400	937	1360	1960	1278	2100	440
Proportion of yield usable within the system (per cent) 3/	92	98	84	85	58	86	85	83	91	71	80

Notes: 1/ This figure is the value of feed transferred directly to livestock within farms.

2/ This figure includes feed sold but purchased within the village level system.

3/ Total transfer as proportion of yield.

Straw collection

On the question of straw, we can compare the quantities collected under different systems and seasons. This is shown in Table 3.19.

Quantities of cereal straw collected generally increased in the drier villages and in drier seasons. The exceptions are 1B/05, where large amounts were kept for feeding dairy cattle, and 4/04, where yields were so low that most of the area was grazed directly.

In general, straw yields were mostly above 500 kg/ha in villages wetter than 4/04. In the higher rainfall villages (excluding 1B/05) only a small proportion of straw was kept, and the remainder was either grazed *in situ* by either village on transhumant sheep, or burnt or ploughed in. In the drier villages, the uncollected part, which formed a much smaller proportion of the total, was grazed off.

The larger amounts of legume straw more nearly reflect the total yield, as in the process of collection, threshing and cleaning, the straw is mostly retained.[1/]

One interesting point is that over half (54 per cent) of the cereal straw came from wheat. This does not reflect a nutritional preference: farmers consider barley straw of better quality. However, in dry years, a greater proportion of the barley area is grazed directly, whilst nearly all wheat is harvested -- by hand if necessary -- so producing more straw.

Straw of the wheat variety Bayadi (W1) was considered the best for animal feed, and that of Senator Cappelli (W1), the worst. The latter gives high yields of straw, and Mexipak (W2) and Florence Aurore give low yields.

1/ For a discussion of post-harvest processes and stubble treatment, see ICARDA Discussion Paper No. 4.

TABLE 3.19

QUANTITIES OF STRAW COLLECTED

Village	Season	Cereal Straw	Legume Straw
1A/13	1	50	350
	2	0	240
1B/05	2	1020	1320
2A/06	1	102	720
	2	159	710
2B/01	1	161	400
	2	240	390
3/02	1	251	240
	2	298	145
4/04	1	111	0
	2	50	0

Production and consumption

The system budgets presented so far give us a good idea of how performance varies accross villages, and Table 3.20 compares specifically production and consumption of metabolisable energy per head of total livestock and per head of milking stock.

Consumption per total head, excluding high rainfall 1A/13, ranged from 2890 to 6316 MJME per year. Actual consumption is probably nearer the lower end of this range, as the higher figures should be spread over an unknown number of fattening stock.[1/] A further reason for higher values in the drier areas is that animals are more dependant on supplementary feed, which is recorded, rather than grazing, which is not. In 1A/13, the higher consumption in 1977/78 was due to a concentration of trade animals on one farm.

The self-sufficiency ratio, i.e. the proportion of feed ME supplied from within the system, was clearly higher in the wetter villages -- and in village 4/04 in better seasons. Over both seasons in villages 2B/01 and 3/03, the system failed to produce even half of the necessary feed.

Feed composition

Feed quality depends not only on the value of individual constituents, but on the proportions these constituents occupy.

(a) Metabolisable energy

Table 3.21 gives a breakdown of consumed feedstuffs in terms of sources of metabolisable energy. Generally, the proportion derived from barley grain ranged between 34 and 44 per cent. Village 3/02, with higher values, used barley for short-term fattening and therefore needed a more concentrated feed.

1/ Farmers in village 2B/01 estimated the requirements of an ewe and lamb over a five month winter feeding period at 2750 MJME. The average concentration of this ratio was 9.6 MJ/kg and 5.0 per cent digestible crude protein.

TABLE 3.20

PRODUCTION AND CONSUMPTION OF ANIMAL FEED ENERGY (MEGAJOULES M.E.)

VILLAGE:	1A/13		1B/05	2A/06		2B/01		3/02		4/04	
Season	1	2	2	1	2	1	2	1	2	1	2
PRODUCTION											
1) Per head of total sheep and goats	1649	1660	N.A.	3177	2416	1139	1357	1736	1216	4458	909
2) Per milking head sheep and goats	2370	2234		4143	3073	1329	1939	2296	1491	4600	879
CONSUMPTION											
1) Per head of total sheep and goats	2675	1550		7724	2890	4355 1/	3304	6316 1/	5357	5129 1/	4859
2) Per milking head sheep and goats	3842	2085		4856	3676	5082	4720	8354	6608	5292	4699
Proportion of feed M.E. supplied from within the system (per cent)	62	107		85	84	26	41	27	23	87	19

Notes: 1/ Some feed energy is consumed by fattening animals which are not included in total head numbers. The consumption figures are consequently higher.

TABLE 3.21 COMPOSITION OF CONSUMED METABOLISABLE ENERGY, BY SOURCE

SOURCE	1A/13		1B/05	2A/06		2B/01		3/02		4/04	
	1	2	2	1	2	1	2	1	2	1	2
Barley grain	38.4	33.8	N.A.	41.2	44.4	35.6	37.3	64.6	62.7	39.5	36.8
Wheat grain	19.9	10.0		4.3	2.3	0.9	5.0	1.2	0.4	0.0	-
Lentil grain	-	1.0		-	-	-	0.3	0.2	0.0	0.0	-
Vetch grain	-	1.1		6.5	2.9	-	0.8	-	-	-	-
Cereal straw	2.7	3.7		13.6	12.8	18.8	27.9	21.8	23.7	38.2	40.1
Legume straw	28.3	35.8		23.7	33.8	7.7	2.9	4.3	1.8	0.0	0.0
Cotton seed cake	3.3	9.6		2.4	3.0	14.2	10.0	1.2	1.6	7.3	11.1
Cotton seed hulls	0.2	1.1		2.3	0.8	11.6	5.9	0.9	-	11.6	7.7
Wheat bran	0.5	1.3		1.0	0.0	7.5	2.6	5.8	9.2	3.4	4.3
Other	6.7	2.6		5.0	0.0	3.7	7.3	0.0	0.6	0.0	0.0
TOTAL	100.0	100.0	N.A.	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Proportion from industrial by-products	10.7	14.6		10.7	3.8	37.0	25.8	7.9	11.4	22.3	23.1

The proportion derived from cereal straw increased in the drier areas, and the opposite trend is shown for legume straw. Straw of lentil, vetch and chickpea accounted for some 24 to 36 per cent of the ME consumed in the wetter villages. In village 1A/13, most of the straw was from chickpea. Wheat grain was important only in village 1A/13; it was produced in surplus in that village and competed on cost with purchased barley. Dirty or second rate wheat was also disposed of through animals.

The proportion of feed energy supplied from industrial by-products (cotton seed cake, cotton seed hulls, wheat bran etc.) varied between four and 37 per cent, being especially high in villages 2A/01 and 4/04.

We can compare with this the composition of feed generated within the system. This is shown in Table 3.22. Village 1A/13, with little allocation of land to forage crops, produced much of its feed harvest from legume straw, and in 1B/05 and 2A/06, legume straw (mostly from lentil) remained important. Feed produced in the drier villages was heavily dominated by cereal straw to the point that, unless supplemented with more concentrated material, it may not have been suitably balanced. In particular, we need to look at the protein content of rations and the average levels of both ME and DCP.

(b) Digestible crude protein

The feed values in Appendix 3.4 show that some materials, notably straws and cotton seed hulls, contain relatively little protein whilst still having a moderate level of ME.

Table 3.23 shows the composition by source of the consumed digestible crude protein. Barley grain was overall the most important source, but in some cases, high levels were provided by the industrial by-products. This latter group invariably contributed higher proportions of DCP than ME to the system, suggesting that the farm-based ration was generally in need of protein supplementation.

TABLE 3.22 COMPOSITION OF SYSTEM GENERATED METABOLISABLE ENERGY 1/

SOURCE	1A/13		1B/05	2A/06		2B/01		3/02		4/04	
	1	2	2	1	2	1	2	1	2	1	2
Barley grain	-	-	28.5	44.1	56.5	31.4	18.7	28.1	17.0	66.6	29.5
Wheat grain	23.4	49.1	-	4.7	-	-	6.7	0.6	1.5	-	-
Lentil grain	-	1.0	-	-	-	-	-	0.9	-	-	-
Vetch grain	-	-	6.4	5.4	0.9	-	1.8	-	-	-	-
Cereal straw	10.9	-	37.8	9.7	17.8	67.3	65.5	57.3	63.0	33.3	70.5
Legume straw	65.7	49.9	27.3	36.1	24.8	1.3	7.3	13.1	7.4	-	-
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Proportion from grain	23.4	50.1	34.9	54.2	57.4	31.4	27.2	29.6	18.5	66.6	29.5

Notes: 1/ Includes feed energy transferred directly within farms and that sold between farms within the village system.

TABLE 3.23 COMPOSITION OF CONSUMED DIGESTIBLE CRUDE PROTEIN BY SOURCE

VILLAGE:	1A/13		1B/05	2A/06		2B/01		3/02		4/04	
Season	1	2	2	1	2	1	2	1	2	1	2
SOURCE											
Barley grain	36.8	31.1	N.A.	42.5	50.5	35.0	37.9	72.7	69.5	50.7	41.9
Wheat grain	29.3	14.2		6.8	4.0	1.3	7.8	2.1	0.6	-	-
Lentil grain	-	2.5		-	-	-	0.8	0.7	-	-	-
Vetch grain	-	2.4		15.5	7.6	-	2.0	-	-	-	-
Cereal straw	0.9	1.2		4.9	5.0	6.4	9.9	8.5	9.1	17.1	16.2
Legume straw	16.4	19.9		14.7	23.3	4.6	1.8	2.9	1.2	-	-
Idustrial by-products	16.6	28.7		15.6	9.6	52.7	39.8	13.1	19.6	32.2	41.9
TOTAL	100.0	100.0	N.A.	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table 3.24 examines the protein composition of system generated feed. Grains, especially barley, were the most important contributors. Protein may help explain the inclusion of crops such as vetch, harvested for grain.

In villages 1B/05 and 2A/06, whilst vetches occupied from only three to seven per cent of the farm area, they contributed from 14 to 20 per cent of the DCP (excluding 1978/79 when the grain vetch crop almost failed in 2A/06).

Legume straw is also an important contributor of DCP in the wetter villages.

Table 3.25 shows the absolute levels of production and consumption of DCP per head of livestock. As in Table 3.19, high consumption levels in 2B/01 and 3/02 were due to fattener feed being averaged out over only permanent livestock.

The proportion of DCP that was provided from within the system was invariably lower (except 1A/13, season 2) than the proportion of ME provided. It was particularly low in villages 2B/01, 3/02 and the poor season of village 4/04. Thus again we have the indication that system produced material is deficient in protein.

The implications of this are important. Not only will inadequate protein levels affect absolute production, but low protein content, as in the various straws, can affect voluntary intake of feeds. It is often the *limiting* factor affecting intake for poor roughages (Owen, 1976 p. 211).

The absolute values for ME and DCP consumption per head are best interpreted comparatively, but given further investigation, may allow us to estimate what proportion of feed requirements come from conserved feed, and how much comes from grazing.

TABLE 3.24 COMPOSITION OF SYSTEM GENERATED DIGESTIBLE CRUDE PROTEIN BY SOURCE

VILLAGE:	1A/13		1B/05	2A/06		2B/01		3/02		4/04	
Season	1	2	2	1	2	1	2	1	2	1	2
SOURCE											
Barley grain	-	-	39.0	49.5	70.7	56.6	34.8	47.7	34.3	85.2	55.6
Wheat grain	47.5	69.8	-	8.1	-	-	19.2	1.5	4.7	-	-
Lentil grain	-	2.3	-	-	-	-	-	3.8	-	-	-
Vetch grain	-	-	20.3	14.1	2.7	-	7.6	-	-	-	-
Cereal straw	4.6	-	18.7	3.7	7.7	42.0	30.2	33.8	52.0	14.8	44.4
Lentil straw	47.9	27.9	22.0	24.6	18.9	1.4	8.2	13.2	9.0	-	-
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

TABLE 3.25 : PRODUCTION AND CONSUMPTION OF DIGESTIBLE CRUDE PROTEIN

(Kilograms)

	1A/13		2A/06		2B/01		3/02		4/04	
	1	2	1	2	1	2	1	2	1	2
PRODUCTION										
1) Per head of total sheep and goats	8.3	11.0	17.3	11.7	3.9	5.6	6.2	3.7	18.1	2.9
2) Per milking head of sheep and goats	12.0	14.8	22.5	14.9	4.5	8.0	8.3	4.6	18.7	2.8
CONSUMPTION										
1) Per head of total sheep and goats	17.0	10.3	22.0	15.5	26.8	19.8	34.2	29.4	24.3	25.9
2) Per milking head of sheep and goats	24.5	13.8	28.7	19.7	31.5	28.3	45.2	36.3	25.1	25.1
Proportion of DCP produced within the system (per cent)	49	107	78	76	14	28	18	12	75	11

Finally, we can look at the overall quality of the consumed diet and system generated component in terms of average ME and DCP values.

Table 3.26 shows a considerable overall consistency in ME concentration for consumed feed across villages at between 9.0 and 9.6 MJME/kg. The ME concentration of the system produced feed was consistently lower than the consumed feed in villages 2B/01 and 3/02, and was lower in season 1 in 1A/13 and season 2 in 4/04.

The implication is that, especially in 2B/01 and 3/02, concentrated energy feeds had to be purchased not only to increase absolute feed availability, but to raise the energy concentration of the system generated component.

There is slightly more variation with regard to protein. Levels in the consumed feed tended to be lower in the drier villages (with the exception of the low value of 4.8 per cent DCP for 2A/06 in season 2 caused by a high consumption of lentil straw, DCP content 2.8 per cent.

As with ME levels, the DCP content of the system-produced material is lower than the diet, particularly in the drier villages. Thus in villages 2B/01, 3/02 and the poor season of 4/04, the voluntary intake of material would almost certainly have been limited without protein supplementation. This may be the case in all villages, but further work is required for confirmation.

In summary, we have shown that in absolute terms, cropping systems have proven inadequate in maintaining the livestock based on them. The quality of the material produced was also below that of the material fed, after supplementation.

In the wetter villages, a deficiency in animal feed can be offset by revenue generated from sales of other commodities. In the drier villages, notably 2B/01 and 3/02 it is the low productivity of cropping that gives the incentive for increased investment in livestock. The system becomes unbalanced, and heavily dependant on imported feeds. It is encouraged to develop in this way by the availability of cheap feeds from Government.[1/]

1/ Many farmers did not purchase feeds directly from the General Organisation for Feedstuffs, but the controlled prices also help regulate the free market.

TABLE 3.26 COMPARISON OF MEAN ME AND DCP VALUES OF FEED CONSUMED AND FEEDS PRODUCED BY THE SYSTEM

	1A/13		1B/05	2A/06		2B/01		3/02		4/04	
	1	2	2	1	2	1	2	1	2	1	2
Metabolisable Energy Value MJ/kg											
1) Consumed	9.6	9.3	N.A.	9.3	9.0	9.4	9.3	9.6	9.6	9.0	9.1
2) Produced by system	8.2	9.1	8.1	9.1	9.1	8.0	8.2	8.0	7.6	9.3	8.2
Digestible Crude Protein Value (per cent)											
1) Consumed	6.1	6.1	N.A.	6.5	4.8	5.8	5.6	5.2	5.3	4.3	4.9
2) Produced by system	4.1	6.1	3.6	5.0	4.4	2.7	3.3	2.9	2.3	4.4	2.6

Given that farmers in villages like 2B/01 and 3/02 and 4/04 need their existing levels of livestock investment in order to make a living, we can see that making the system more self-sufficient, by increasing production of home-grown feeds, is no easy task.

In village 3/02 for example, system deficiencies (Δ system) of −5190 and −4560 MJME/ha would need yield increases in barley of about 200 to 600 per cent in seasons like the two under consideration.1/ This is no small task given the poor soils on which barley is grown, the lack of rotational priority regarding fallow, and the low rainfall.

The situation will be discussed more fully in Section 7 of this report.

1/ Calculations are similar to those produced earlier for wheat:

Yield required = yield achieved − Δ system.

In this case, the calculation is made on barley grain only, as we assume that we also wish to improve the quality of the feed.

3.4.3 Food Legumes

The information presented in this section is very brief, for the main reason that food legume production is covered in some depth in other Farming Systems reports.[1/] The value of the data from the six Aleppo villages is also limited, as production levels were lower than in many other similar villages.

Food legumes occupy significant areas of land in the higher rainfall villages, and include chickpea and lentil in 1A/13 and 1B/05, and lentil in 2A/06. Their indirect contribution to animal feed upplies has already been discussed, but their more important role is in providing direct income to the farming household.[2/] Physical flow budgets have been prepared as for other commodities and these are given in Appendix 3.7.

Despite generally low recorded yields, especially for lentil in 1A/13, 2A/01 and 3/02, systems have mostly produced a surplus, as shown by positive Δ system values.

The flow budgets also allow us to examine disposal of the crop after harvest. Table 3.27 shows the proportions sold or transferred to the household, and the quantities consumed as a foodstuff. These figures must be interpreted against the low yields generally achieved, for where these were higher, as in 2A/06 season 1 for lentil, a smaller proportion was kept for the house and a larger proportion was sold.

1/ See Research Reports No. 6 and 9 and Farming Systems Discussion Paper No. 5

2/ However, in dry years, the value of lentil straw can exceed that of the grain.

TABLE 3.27

GRAIN LEGUME UTILIZATION

VILLAGE:	LENTIL							CHICKPEA	
	1A/13		1B/05	2A/06		3/02		1A/13	
Season	1	2	2	1	2	1	2	1	2
Proportion of harvest sold (per cent)	42	49	51	86	69	64	0	85	73
Proportion of harvest transferred to house stock (per cent)	51	31	20	2	5	12	12	2	1
Trans. to house per person (kg) 1/	8	2	13	6	5	6	1	6	2
Δ System/yield (per cent)	6.4	-5.4	54.7	84.8	64.2	39.8	- 108.9	83.1	75.9

Sotes: 1/ Recording of grain legumes in the household was not very accurate. The transfer of own-crop to the household can, however, be taken as a guide to the order ot magnitude of the annual consumption.

Actual consumption figures vary, but generally they were low at between one and 13 kg per person per year. This compares to a national average of only 0.77 kg for lentil and 3.7 kg for chickpea (see Farming Systems Research Report No. 1 section 4.3). As with wheat, no figures are currently available for rural consumption of food legumes.

Thus while food legumes are a more important food item in these villages than the country as a whole, they still contribute to the overall diet in only a minor way.

The ratio of Δ system/yield gives some measure of the surplus generating capacity of systems. Where yield levels are higher, for example 2A/06 in season 1, the ratio was high at 85 per cent. For chickpea also - despite moderate yields - the ratio was high indicating the commercial standing of the crop.

3.4.4 Other Crops

Physical budgets have not been calculated for orchard and summer crops.

The poor seasons of 1977/78 and 1978/79 resulted in low summer crop yields. For example, in village 2A/06, the watermelon and melon crop were severely attacked by aphids in season 1, and failed through lack of moisture in season 2.

The summer crop information from six Aleppo villages is rather limited and the subject is covered more fully in ICARDA Discussion Paper No. 5.

Orchard crops in the higher rainfall villages are important for cash, and also provide fruits and oil for household use. In the middle and lower rainfall areas, trees are planted almost entirely for household use.

The simplest measure of productivity for these crops is output, and this will be covered in the next section.

3.5 CROP NET OUTPUT

3.5.1 Individual Crops

The principle of net output calculations has been discussed in section 3.1.2. In summary, it is the total value of the output, less all costs. It can be used as a compound measure of technical productivity.

Table 3.28 presents net output figures for the major crops. These are based on the output and costs of the aggregate sample in each village, and conceal the variation within the sample. This variation can be considerable, but to present estimates of this is not very meaningful for a small sample.

The net outputs in Table 3.28 include in the costs machinery charges, either as contract hiring fees, or as imputed values in the case of machinery owners, but exclude any rent payments, either as cash or sharecrop transfers. 1/

Labour is an input that in many farm management studies would be included in adjustments of this type. Imputed values, based on "opportunity cost" for family labour would be added to the cost, or alternatively, all labour costs could be excluded. There are several difficulties with regard to the VLS data in this respect.

1) Monthly visiting is generally too infrequent to gather accurate labour utilization data.

1/ These are designated net output II.

2) Many jobs involving family labour occupy a few hours *per day* over an extended period, for example weeding of winter crops, and tending of summer crops.

3) The opportunity cost of labour varies tremendously according to the job in question, sex, age, season and locality. For example, for weeding, which occurs in a slack period, it could not be said there is any real opportunity cost except that of leisure. At lentil harvest -- depending on the season and location -- an opportunity cost for female labour does exist, but is difficult to assess because of large variations in wage rates.

4) Many operations are mechanised, but still require the presence of family members. Most farmers are present on their land for planting and harvesting, even if any labour required is hired-in. Family members may be in the field at the time of harvest, handling bags or gleaning behind the combine harvester, but such labour inputs are very difficult to assess.

In the calculations in this report, labour is included as a cost when hired, and the net output therefore represents the return to farm families' investment and labour. Where labour issues are of particular importance, for example, in harvesting of lentil, cotton and other irrigated crops, they are discussed elsewhere.

Table 3.28 shows that breadwheat usually had higher net outputs than durum wheat. Barley was more profitable in the higher rainfall areas, but surprisingly, did not do so well in the low rainfall villages.

TABLE 3.28

NET OUTPUT PER HECTARE FOR MAJOR RAINFED CROPS

VILLAGE	Season	Durum Wheat	Bread Wheat	Barley	Lentil	Chickpea	Forage Grains	Summer Crops
IRR/09 1/	2	531	873	-	-	4357	-	-163
IRR/01	2	1132	817	1177	353	-	1179	-227
1A/13	1	371	665	-	187	2043	-	- 10
	2	368	511	-	- 5	1069	-	+187
1B/05	2	1750	1637	1985	815	-	191	- 66
2A/06	1	360	-	369	532	-	294	75
	2	423	694	750	428	-	150	-117
2B/01	1	99	-	83	140	-	-	-
	2	304	-	440	-98	-	-	-
3/02	1	322	-	120	- 7	-	-	-
	2	149	-	80	48	-	-	-
4/04	1	116	-	68	-	-	-	-
	2	- 7	-73	5	-	-	-	-

Note: 1/ Two irrigated villages included for comparison.

Lentil was generally less profitable than the cereals, but the very low yields obtained in the study villages may not present an adequate picture. 1/ Chickpea, on the other hand, is clearly more profitable than any other crop. How long it remains so will depend on the price stability. In the past, the free market price has fluctuated in a cyclical pattern (see Farming Systems Project Report No. 1, section 3.2), but it is currently guaranteed by Government.

Forage -- mostly vetches grown to maturity -- generally performed poorly, largely on account of low yields.

Summer crops were a failure in all villages in both seasons; even the positive outputs in 1A/13 season 2 and 2A/06 season 1 are extremely poor. These crops, with their relatively heavy investment in cultivations and fertilizers, are subject to greater potential losses should low yields result. 2/

A number of crops are not included in Table 3.28. Among these, olive was the most important in 1A/13, but net output is difficult to calculate. Orchards varied in age from fully mature, which produced very high outputs, to newly established where net output was negative. Additionally, olive yields fluctuate on a two-year cycle, and most productive trees in 1A/13 were in an up-year in 1978. Thus, in 1978, net output for olives in 1A/13 ranged from LS 2932 per hectare for mature trees to minus 128 for newly established trees. They therefore have great potential provided farmers are able to support the investment.

1/ Fuller information on aspects of grain legume productivity and profitability are given in Farm Systems Research Report No. 9 "Lentil and Chickpea Production in Syria".

2/ See ICARDA Discussion Paper No. 5

Other crops of minor importance in the Aleppo villages included rainfed cotton (1A/13, season 1, LS 439/ha) and small areas of irrigated crops in 1B/05 and 2B/01. Net outputs for these are shown below:

	LS / hectare		
VILLAGE	1B/05	2B/01	
Season	2	1	2
Breadwheat	-	1469	904
Cotton	546	1754	1120
Maize	-	2040	-
Vegetables	-	-	5108
Sugar beet	470	-	-1240
Tomatoes	-	-	4300

These outputs are generally higher than those for rainfed crops, but as only small areas were involved, this made little difference to the system productivity.1/

Factors affecting net output

Differences in net output between crops are a complex matter of yields, prices and differential input levels. However, for any one crop we might expect yield to be the principal determining factor, and this can be shown for durum wheat, breadwheat, barley and lentil:

1/ See section 4 of this report for a comparison of irrigated and rainfed crop output in two villages with about half their land under irrigation.

Crop	Function	r	r^2	p =
W1	NO = 0.867 y - 139.2	0.93	0.86	0.01
W2	NO = 0.795 y - 243.9	0.97	0.94	0.01
B	NO = 0.978 y - 138.7	0.95	0.90	0.01
L	NO = 0.874 y - 38.7	0.84	0.71	0.01

These relationships for durum wheat, breadwheat and barley are shown in Figure 3.9. They indicate that for equal yield levels, barley appeared most profitable followed by durum wheat and bread wheat.

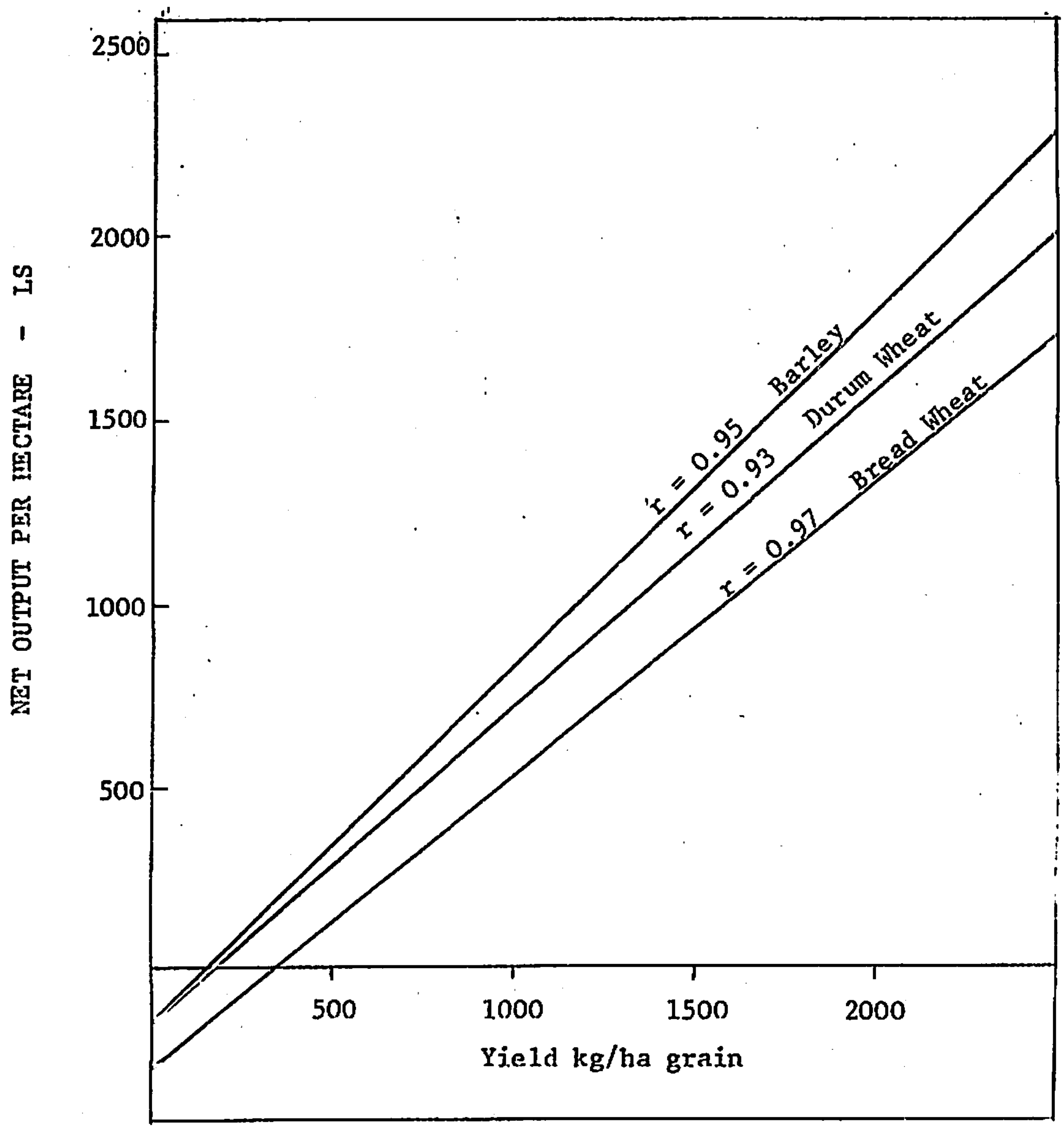
Progressing from the 600 mm isohyet to the 200 mm level, the relative yield levels of the three crops change. Thus higher yields of breadwheat in the higher rainfall areas would ensure that it gives higher net outputs despite a lower inherent profitability.

We can use the data of Figure 3.9 to indicate what relative yield levels are required for the same net output. For example:

Net output (LS/ha)	Yield Required (kg/ha)		
	W1	W2	B
500	737	936	653
1000	1314	1565	1164
1500	1891	2194	1676

Thus at zone one level (LS 1500/ha), breadwheat must outyield durum wheat by 16 per cent, and barley by 31 per cent over all soil types to be more profitable. Yield data from farmers' fields in 1978 indicates Mexipak outyielded barley by this level, and so would have been more profitable. However at lower potentials (zones 2 and 3), breadwheat would have to outyield durum wheat and barley by 34 and 43 per cent respectively. Farmers field sampling and the results of the ICARDA Cereals

FIGURE 3.9 RELATIONSHIP BETWEEN YIELD AND NET OUTPUT BASED ON TWO SEASONS' DATA 1978-1979



Program Field Verification Trials indicate the opposite trend, showing clear favour to barley. In 1979, the ratio of barley to wheat prices increased, resulting in a general shift to barley in all zones, including zone one.

Grain legumes have not been included in this discussion as the data from the VLS is not so extensive or reliable. In village 1A/13, chickpea gave a net output of LS 1069/ha when wheat gave only half of this, and it is clear why the chickpea area has grown to exceed wheat in the three seasons up to 1980.

The more imperfect relationship between yield and net output for lentil (r^2 = 71 per cent) reflects the more variable costs involved; from farmers harvesting with family labour to those hiring workers at some expense.

3.5.2 Whole Farm Crop Net Output

The net outputs shown above, coupled with the areas planted to each crop, give us an estimate of the average productivity of the whole farm area under the system in question. Calculation of this aggregate output figure is shown in Appendix 3.8.[1/]

The overall figures per hectare are shown in Figure 3.10 and summarised in Table 3.29. These values may not seem high, even for the higher rainfed villages, but they are averaged over all soil types, fallows, and productive and unproductive orchards. In season 1, 1A/13

1/ Note that in Appendix 3.8 the net output figure includes rents in the costs, and therefore, estimate Net Output I. The discussion in this section continues to relate to Net Output II i.e. adjusted for rent.

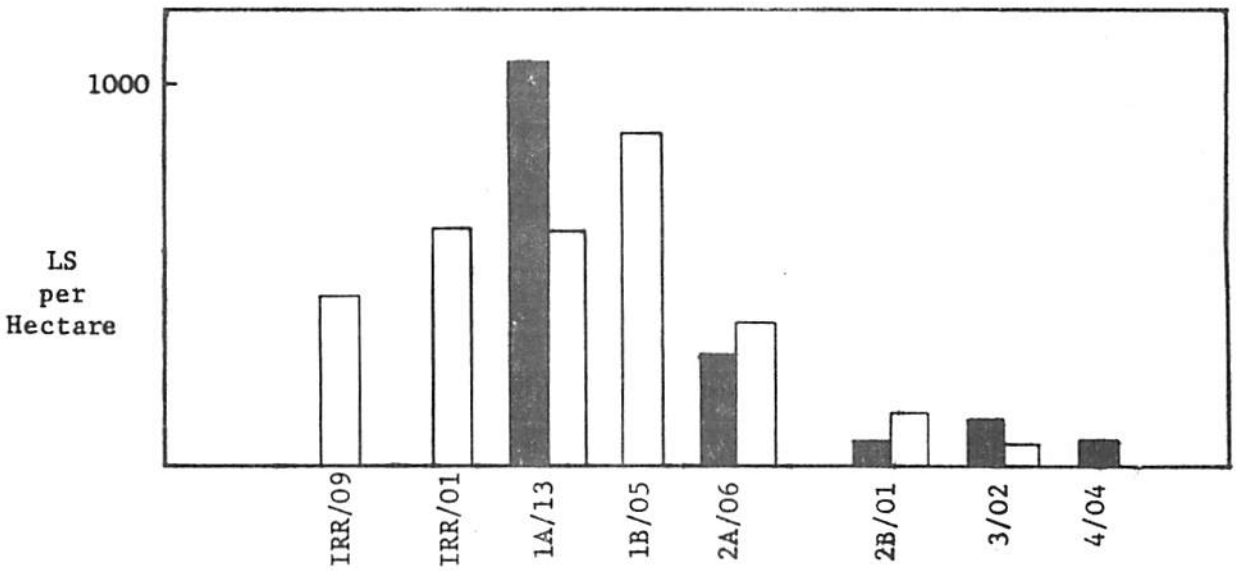
TABLE 3.29

COMPARATIVE INDICES RELATING TO CROP NET OUTPUT

(Rainfed crop area)

VILLAGE	Season	TOTAL COSTS PER HA	TOTAL OUTPUT PER HA	NET OUTPUT PER HA	% RATE OF RETURN PER CENT	L.S. INVESTMENT PER PERSON
		L.S.				
1A/13	1	393	1388	995	253	864
	2	425	1037	612	144	793
1B/05	2	558	1371	813	146	388
2A/06	1	217	503	286	132	508
	2	261	625	364	139	629
2B/01	1	82	138	56	68	306
	2	118	263	145	124	443
3/02	1	146	263	117	79	241
	2	131	184	53	40	219
4/04	1	153	220	67	44	458
	2	127	117	-10	-8	379

FIGURE 3.10 NET OUTPUT PER HECTARE FOR THE TOTAL RAINFED CROP AREA, 1977/78 AND 1978/79



with its highly productive olive and chickpea, was in a favoured position but the advantage was lost in season 2 to village 1B/05. Rainfed land productivity in the two villages with irrigation (IRR/09 and IRR/01) is not outstanding. Most serious is the extremely poor position of the drier villages; in the second season, village 4/04 produced effectively no net output. However, it should be remembered that all such net output figures underestimate productivity to some extent. The most important factor is the difficulty of estimating the value of crop material grazed, which might include fallows, stubbles, tree prunings etc.

Of these, stubbles are probably the most important. If a whole crop is grazed off, an appropriate commercial value can be applied, and this would appear in the output part of the calculation as a transfer to animal feeds. However, in the drier villages 2B/01, 3/03 and 4/04, harvesting may be incomplete, in which case a low yield is reported, but information is lacking to allow a value on grazing to be included. In village 4/04, and in other marginal areas, combine harvesters sometimes recover less than 75 per cent of the grain. The remainder is not wasted, it will be gleaned by sheep, but this will go unrecorded.

Tree crops in villages 1B/05, 2A/06 and 3/02 are used for household consumption, but recording of these items is inadequate, and almost certainly underestimates the true value.

3.5.3 Components of Net Output

Appendix 3.8 allows us to examine some of the components of net output, and a number of indices are shown in Table 3.29.

Output and costs

Both output and costs are greater in the higher rainfall villages, and these reflect the larger investment in fertilizer, seed and cultivations.[1/] Figure 3.11 shows the relationship between output and costs across all the study villages, including the rainfed area of the two irrigated villages.

Two points are of note, (i) the grouping of points into two main clusters, one of low input-low output villages, and one of high input-high output, with village 2A/06 somewhere in between and (ii) the change in slope of the relationship over the two seasons, indicating lower returns per unit of cost in the second season.

However, Figure 3.11 should not be taken to imply that higher costs result in higher return as each point involves a separate production function. What we can conclude is that in the higher rainfall villages, greater absolute levels of outputs might in turn finance higher input levels. The drier villages appear to be caught in a trap of low input-low output which in itself hinders further investment in cropping.

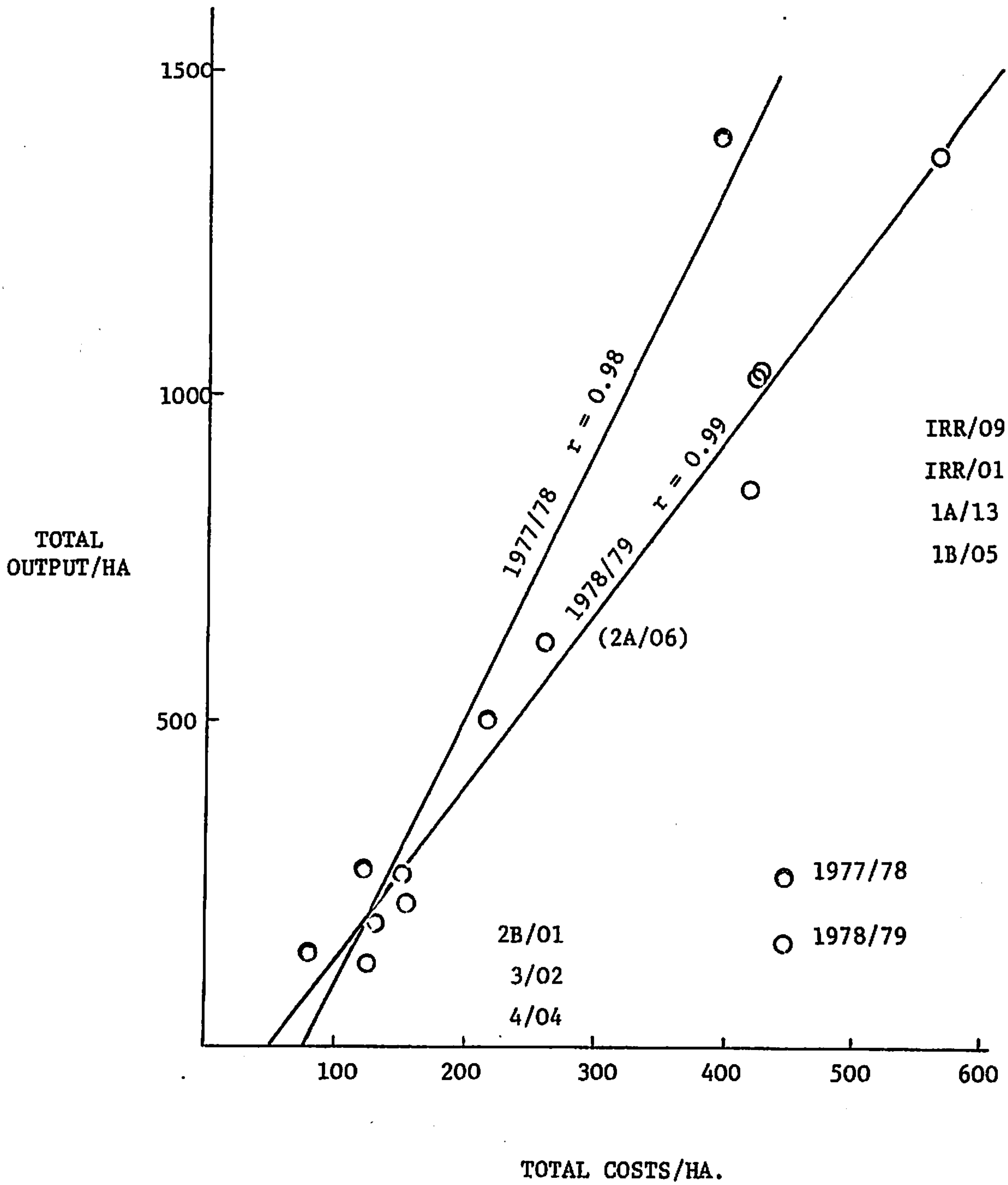
Rate of return

The relationships of Figure 3.11 conceal variation in the profitability of systems: for example, one of low input, low output is not necessarily less profitable than any other level. Table 3.29 shows that this was not the case in the drier villages. Whereas the rates of return (defined as net output expressed as a percentage of costs) were high in the wetter villages -- generally above 140 per cent -- in the drier villages they were much lower.

We must conclude that in the seasons examined, cropping was a distinctly less attractive investment in the drier villages. This data

1/ See section 5 of this report for input levels across the villages.

FIGURE 3.11 OUTPUT AND COSTS FOR RAINFED CROP SYSTEMS IN TWO SEASONS - (Syrian Lira)



would support the contention that people in a poorer environment do not usually realise the same value for money, return or profit, as their luckier neighbours.

These figures should give us food for thought regarding technical change in the drier areas. It may be that low output is a result of low input, in which case there is some scope for improvement, but we need to be very sure of the cost:benefit relationship of any innovation.[1/] A change which resulted in even lower rates of return in poor years would be unacceptable to farmers of the scale found in these areas.

Investment per person

This figure is based on the total cost element of the net output calculation. Levels are generally higher in the wetter villages, but they are also related to land:person ratios.

Thus 1A/13 has higher levels of investment per person, on account of larger landholdings, than village 1B/05, which nevertheless, has higher levels per hectare. This might be taken as an indication that land in village 1B/05 is more intensively farmed, on account of the low land endowments per family. In these two villages, two levels of investment per hectare resulted in season 2 in the same rate of return, but with very different personal investments.

Value of farm-produced output

Referring again to Appendix 3.8 we can compare the values of the major internal transfers: (i) of foodstuffs to the household, and (ii) of feedstuffs and accountable grazing to the livestock enterprise.[2/] These are shown in Table 3.30.

1/ Cost levels in villages 2B/01, 3/02 and 4/04 could hardly be reduced: they include only seed, minimal cultivations and harvest costs.

2/ This transfer subsequently will appear as a cost item in livestock net output calculation. See 3.6.6.

TABLE 3.30

INTERNAL CROP TRANSFERS (L.S.)

VILLAGE	Season	Foodstuffs per person	Feedstuffs per head
1A/13	1	354	78
	2	306	148
1B/05	2	201	434 2/
2A/06	1	270	153
	2	237	193
2B/01	1	97	61
	2	197 1/	103 3/
3/02	1	144	74
	2	85	78
4/04	1	104	134
	2	27	107 3/

1/ 2B/01: plus LS 9.00 from irrigated crops in season 2.

2/ 1B/05: plus LS 50 from irrigated crops.

3/ 2B/01 and 4/04: substantial amounts of whole-crop grazing included in these estimates.

The figures merely reflect all the other trends shown from physical flow analysis. However, they will allow us some comparison with the value of foodstuffs transferred from livestock, and the amount of food expenditure (see 3.8).

3.6 LIVESTOCK PRODUCTION

3.6.1 Village Livestock Data

This section presents and discusses information based on the flock of the aggregate household sample in each village.

A number of basic indices of livestock ownership and stocking density have been shown in Tables 3.1 and 3.3, which indicate lower levels of livestock ownership in the wettest and driest villages (1A/13 and 4/04 respectively) and higher levels in the mid-rainfall villages.

Before presenting the data, a number of points need stressing:

a) Livestock numbers have been followed through two seasons, and an attempt has been made to account for all changes through sales, purchases, births, deaths, slaughterings, and other receipts or disposals.

   This process is subject to some error, which is occasionally considerable, as some farmers are less willing to disclose information on their livestock than on cropping activities. However, by a process of extensive across-checking, we feel that the data present a reasonably accurate picture of the livestock component of the system.

b) Data are based entirely on information given by farmers. Precise recording through measurement was outside the scope of this study, and for this reason data should be treated as measures of comparative performance rather than of having absolute value.

c) Livestock productivity measures are generally less easy to interpret than crop productivity measures, mostly through difficulties in estimating and valuing output.

For example, we might consider milk production per ewe per lactation. Only that part taken surplus to the lamb's suckling requirements can be estimated; a high value might indicate good performance of the ewe, or it might indicate relative deprivation of the lamb. In the latter case, the poorer growth rate of the lamb might be compensated for by higher feeding levels later in the season; thus higher milk output at one point in the cycle might involve increased expenditure at another.

A high consumption of feedstuffs may not result in better physical performance if the balance in terms of ME and DCP and other factors is inappropriate.[1/]

d) Owing to the on-going nature of investment in livestock, a component of productivity has often to be measured in the change in valuation of stock over time. This is a difficult issue, particularly when it comes to assigning valuations based on rapidly fluctuating market prices.

The poorer performance of a milk-deprived, or otherwise under-fed, lamb, may not make itself felt if only average valuation figures can be applied at the end of the season.

We should consider the data with these cautious in mind.

1/ Similar arguments apply to cropping, particularly related to timing and rates of fertilizer application, or date of planting.

3.6.2 Livestock Cycles

The annual cycle of village-based flocks can be considered in terms of reproduction, lactation, grazing and supplementary feeding. The subject is covered briefly here, and in more detail in section 6 of this report.

Reproduction

The first oestrus in the majority of village sheep occurs between mid-June and mid-July. Ovulation may occur in some animals before lactation has ceased.

In good seasons, when feed availability is adequate, most ewes will conceive on the first or second ovulation. In poor seasons, or in particular flocks which are suffering inadequate nutrition, the breeding season becomes extended, and a proportion of ewes may still not be pregnant by the start of winter. This results in an extended lambing season.

Lambing may start as early as October and the peak month is December. A few lambs may be born as late as April or May, resulting from an extended breeding season, or exceptionally, from second pregnancies.

The period for births in goats occurs about one month later than for sheep, and is less well defined.

Lactation

Milking and suckling practices vary slightly amongst the villages. Where a ready market exists for products such as yoghurt, for example village 2B/01, milking starts before lambs are weaned, as early as 30 days after the ewe has given birth. Milking is done one time per day, in the morning, and the lamb is allowed to suckle for the rest of the day.

Ewes and lambs are separated at night. In other villages, for example, 1A/13 and 2A/06, milking starts later.

Weaning occurs at the same time for most lambs, usually in mid-March. Some male lambs will be allowed to suckle longer into April or May; this is particularly common in village 2A/06. March weaning coincides with the peak in the ewe's lactation curve, and the total milk surplus increases considerably in that month. Production keeps high in April, but falls off in May and ceases in June or July. Goats continue milking longer, and with adequate feeding, can remain in production until the Autumn.

Milk may be consumed or sold fresh, or more usually is made into yoghurt, cheese or semneh. Where a ready market exists, a greater proportion is made into yoghurt; where self-sufficiency is the aim, cheese and semneh for home use are important. Cheese and semneh are mostly made from milk in the later stages of lactation when the fat content of the milk is higher.

Grazing

The pattern of grazing across all six villages is broadly similar. During the winter months of November to February, animals are allowed to graze common and range areas around the village on fine days, but are otherwise confined to the farmyard. This is particularly the case with pregnant ewes and ewes with young lambs.

With the flush of plant growth in spring, flocks are taken slightly further afield and graze range and fallow land around the village. They are often amalgamated under the control of one or two herders, re-dividing on return to the village.

In years of average or good rainfall, some animals may be trucked to steppe areas. This mostly applies to the larger flocks, and to barren ewes, yearlings and weaned female lambs. These animals return to the village after the cereal harvest. For the remainder, they continue to graze around the village. Range is supplemented by quantities of hand-pulled weeds from the winter crops, for an average flock about 100 kg of fresh-matter per day.

After harvest, all animals graze stubbles, often at greater distances from the village, until the next winter crop planting comes round again.

The main differences across the six villages relate to:

i) Spring grazing

In the wetter villages, in addition to range area grazing, a certain amoung is permitted on winter crops that will be harvested for grain. However, this grazing is light, and is confined to a few hours per day, mostly on barley but also on wheat.

Provision for grazing is also made from the winter crop area in the form of small plots of barley and vetch, for use by weaned lambs. In these cases, the material is grazed completely, and with barley, higher seed rates are used to give a dense sward.

In the drier areas, winter crops are not usually grazed except for same poaching adjacent to roads and tracks.

ii) Steppe grazing

Villages in the sample with higher livestock densities. i.e., 2A/06 and 2B/01, may send animals to the steppe. However, in

1978/9, a year in which steppe grazing was poor, only three out of 41 livestock owners sent animals away. The rest maintained their flocks and around the village for the whole spring period.

iii) Failed-crops

In the wetter villages, crops rarely perform so badly that they cannot be harvested. However, in the seasons 1977/78 and 1978/79, grazing-off of failed crops at maturity was an increasingly common occurence. For example in 1978/9, 18 and 45 per cent of cereal plots were grazed-off in villages 2A/06 and 4/04 respectively.

iv) Late-summer grazing

Farmers in the lower rainfall villages may move their animals into the wetter zones to graze residues of both rainfed and irrigated summer crops. For example, a few families in village 3/02 sent their sheep in 1978 to al-Jineh, near village 1B/05, to graze sugar beet and cotton residues. In 2A/06, some flocks migrated temporarily to A'azaz.

At this time of year, those flocks remaining in the drier villages generally have to move further afield in their daily forays than do the flocks of wetter villages.

Feeding

The period of supplementary feeding is slightly longer in the drier villages than in the wetter villages. For example, sample farmers in villages 3/02 and 4/04 were feeding animals until March/April in 1979, whereas in 1A/13 and 2A/06, feeding was stopped up to a month earlier. Similarly, feeding re-started in August/September in 2A/06, 2B/01, 3/02 and 4/04, but not until October in 1A/13. The feeding period thus ranged from five to eight months.

Additionally, the drier villages increasingly supplemented their lambs' diet from June and July onwards, and where animals were purchased-in as fatteners, as in villages 2B/01 and 3/02, this placed an additional strain on the feed supply situation.

These differences help explain the generally higher feed consumption figures for the drier villages, presented in Table 3.20.

Implications of these cycles

Several points arising from these observations, which receive further consideration in later sections of this report, are:

a) Systems appear capable of maintaining existing flocks during the period of winter crop growth and development without supplementary feed. Most of the grazing in this period is provided by range, and some by judicious light grazing of cereal and legume grain crops.

b) The converse situation applies to the winter period, and in the drier villages, to some extent in the late summer.

c) Hand-pulled weeds are fed during the months of March and April in all villages in quantities as much as five kilograms per head per day. This could satisfy a considerable portion of an ewe's voluntary dry matter intake, and this should be taken into account in weed control and spring forage production studies.[1/]

1/ Owen and Ingleton (1963) estimate that dry matter intake for unsupplementary grazing ewes with single lambs was 1.2 to 1.3 kg/day after lambing. Five kilograms of fresh herbage at about 20 per cent dry matter could approximately cover this requirement.

d) Ewes in the breeding season (June to September) are being maintained on cereal stubbles, for the most part without supplementation. The effect of such a plane of nutrition on conception rates could be investigated, and also the effects of improved feeding at this time.

3.6.3 Flock Size and Composition

The average household flock size is shown in Table 3.31. Reflecting the trends shown in previous presentations, size increased from village 1A/13 to 2B/01, but then fell again in the two drier villages.

Table 3.31 also shows the composition of the aggregate sample flock. Productive females dominated numbers; goats in village 1A/13 and ewes in the other villages. Non-productive females may have been barren, but more usually were animals that had failed to show pregnancy at the time of counting (November).

Yearling male and female lambs accounted for between zero and 31 per cent of animals. Generally, lambs were sold-off before twelve months of age, but enough females were retained for ewe replacement.

Against the background of feed deficit shown in 3.3.2, keeping lambs until maturity would further aggravate the situation.

3.6.4 Physical Productivity Measures

A number of productivity measures are given in Table 3.32

a) Live births per productive female

This is the ratio of live births to the number of females recorded in November as being pregnant. It therefore, differs

TABLE 3.31

COMPOSITION AND SIZE OF THE PERMANENT VILLAGE FLOCK IN NOVEMBER 1977 AND NOVEMBER 1978

(per cent)

Village 1/	Season	Pregnant Ewes	Non-Pregnant Ewes	Rams	Yearling Lambs	Pregnant Goats	Non-Pregnant Goats	Adult Male Goats	Yearling Kids	Total Head 2/	Average Flock Size 3/
1A/13	1	17.7	1.3	-	-	74.6	5.1	1.3	-	79	13
	2	22.0	-	1.3	-	68.9	3.9	-	3.9	77	13
2A/06	1	58.0	5.1	1.9	10.8	19.1	5.1	-	4.5	157	20
	2	61.5	9.9	3.1	7.3	15.1	0.5	-	2.6	192	24
2B/01	1	56.9	7.3	1.4	31.0	2.4	1.0	-	-	286	48
	2	70.9	2.8	2.8	18.1	3.9	1.1	0.4	-	281	40
3/02	1	63.3	9.6	0.9	5.5	15.1	1.4	3.7	0.5	218	20
	2	57.7	1.8	2.2	17.0	20.5	0.4	-	0.4	224	22
4/04	1	62.5	8.9	2.7	12.5	13.4	-	-	-	112	12
	2	56.4	7.7	2.6	24.8	8.5	-	-	-	117	15

Notes: 1/ Livestock data incomplete for village 1B/05.

2/ Total heads includes numbers in all classes.

3/ Average flock size is based on total heads and number of livestock owners. It excludes holdings with no livestock.

TABLE 3.32

PHYSICAL MEASURES OF LIVESTOCK PRODUCTIVITY

VILLAGE	Season	LIVE BIRTHS PER Productive Female		MORTALITY Deaths per 100 head		MILK PRODUCTION kg/head/lactation
		Lambs	Kids	Lambs & Kids	Adult Sheep & Goats	Sheep & Goats
1A/13	1	1.00	0.88	6.1	5.1	71.5
	2	0.88	0.75	5.5	5.4	98.1
2A/06	1	0.88	1.16	11.0	5.3	65.6
	2	0.92	1.10	5.7	1.2	64.0
2B/01	1	1.01	0.71	7.7	7.7	61.4
	2	0.56	0.64	14.3	0.4	55.9
3/02	1	0.93	0.45	10.5	5.4	64.7
	2	1.00	0.50	13.7	5.4	42.4
4/04	1	1.01	1.00	10.5	11.2	49.9
	2	0.95	1.20	10.7	5.7	43.6

from the conventional "lambing percentage" in that (i) it measures lambs surviving birth rather than lambs weaned, and (ii) it includes ewes thought to be pregnant rather than those put to the ram.

A figure of less than unity indicates losses through abortions, still-births, or possibly mis-judgement of pregnancy.

Goats in villages 2B/01 and 3/02 appear particularly unproductive, and the reason is not known.

b) Mortality: Deaths per 100 head

This figure records total deaths throughout a twelve month period. It gives some idea of losses through disease, as animals that become barren or old are usually slaughtered before they become moribund. Lamb losses ranged between 5.5 and 14.3 per cent, but the causes are not known.1/ For adult animals (including yearling lambs) the figure was from 0.4 to 11.2 per cent.

c) Milk production

The figure estimated here includes both sheep and goats milk, which is often mixed together, and represents the surplus available for consumption or sale over and above the lambs' requirements.

Milk production was higher in both seasons in village 1A/13 and this may reflect the greater proportion of milking goats, and also higher productivity.

1/ For comparison, MLC (1972) estimated losses in UK at 14 per cent for upland flocks and 11 per cent for lowland flocks. Vetter et al. (1960) reported a figure of 15 per cent for single lambs in the USA. (Quoted in Owen (1976), pp 154-155).

Yield generally decreased towards the drier villages, and in the poorer second season. For comparison, recorded steppe and marginal flocks were producing generally less than 50 kg/head in 1978/9.

3.6.5 Sales and Home Consumption

Table 3.33 shows the breakdown of sales by livestock class. With the exception of village 1A/13, the majority of sales are accounted for by lambs and kids. Correspondingly, the sales of yearlings, which represent animals kept back from the previous year, is low, in all cases under 30 per cent of the total. In village 1A/13, most lambs and kids were either slaughtered or held as flock replacements.

Two points emerge, (i) that the total number of heads sold was generally greater in season 2, and (ii) of these, a greater proportion were lambs or kids.

Table 3.34 shows the breakdown for animals slaughtered for home consumption. Again, the majority are lambs and kids. It can also be seen that all villages cut back on numbers slaughtered in season 2 compared to season 1.

It appears that farmers dispose of surplus lambs and kids, rather than keep them into the second season. An alternative policy -- on the assumption that feed supplies are limiting -- would be to carry fewer breeding stock, but to fatten lambs for a longer period. However, this would reduce the absolute levels of milk production, and would imply diversion of investment from stock to feeds.

It can also be seen that absolute numbers of sales exceeded -- often considerably -- numbers slaughtered, and we might conclude that livestock systems are surplus generating for meat.

TABLE 3.33

BREAKDOWN OF LIVESTOCK SALES BY CLASS

(Excluding Trade and Fattening Stock)

Village	Season	ADULTS	YEARLINGS 12-24 Months	LAMBS/KIDS Under 12 Months	TOTAL HEAD
		---- per cent	----	----	
1A/13	1	71.0	0.0	29.0	55
	2	48.7	15.4	35.9	117
2A/06	1	13.3	30.0	56.7	120
	2	28.4	16.7	54.9	204
2B/01	1	13.3	25.7	61.0	199
	2	10.4	1.6	88.0	125
3/02	1	34.7	15.3	50.0	124
	2	32.8	5.2	62.0	192
4/04	1	28.3	15.1	56.6	53
	2	12.8	0.0	87.2	78

TABLE 3.34

BREAKDOWN OF LIVESTOCK SLAUGHTERED FOR HOME CONSUMPTION BY CLASS

Village	Season	ADULTS	YEARLINGS 12-24 Months	LAMBS/KIDS Under 12 Months	TOTAL HEAD
		------------	per cent	------------	
1A/13	1	29.8	2.1	68.1	47
	2	10.0	0.0	90.0	10
2A/06	1	41.2	23.5	35.3	17
	2	28.6	0.0	71.4	7
2B/01	1	25.0	0.0	75.0	8
	2	0.0	0.0	100.0	7
3/02	1	12.9	16.1	71.0	31
	2	25.0	16.7	58.3	12
4/04	1	14.3	0.0	85.7	21
	2	0.0	0.0	100.0	6

Table 3.35 shows the production of milk broken down into sales and home-consumption, and consumption per person. Village 2B/01 stands out in that it sold most of its production -- even at the expense of reducing personal consumption. Personal consumption in village 2A/06 was high. This resulted from the village's remoteness, which made difficult the marketing of milk and yoghurt, coupled with a cropping system that was capable of supporting high livestock densities. A large proportion of 2A/06's milk consumption was in the form of semneh.

Value of home consumption

The easiest way to compare the benefits of livestock keeping in terms of home production of food is to value the separate commodities.[1/] One correction that can be made relates to the classification of animals as "slaughtered" or "died". Most village animals showing signs of illness are slaughtered before death, and many animals recorded as dying may have been eaten.

Table 3.36 shows the value of transfers to the household in Syrian Lira, the breakdown by commodity, and the corrected value assuming that adult deaths contributed to household consumption. Eggs are included in this calculation as poultry consume part of the livestock feed; poultry carcases have been omitted only because it has not been possible to keep track of numbers adequately. Poultry meat was nevertheless an important dietary constituent, particularly for poorer families.

Lowest values occured in village 2B/01 (which had the lowest consumption of milk, and also of wheat), and the highest was in 2A/06. Consumption in 4/04, the poorest village, was no lower than 1A/13 or 3/02.

1/ Livestock valuations are given in Annex 2 "Manual of Methods".

TABLE 3.35

DISPOSAL OF MILK PRODUCTION, AND MILK CONSUMPTION

Village	Season	MILK PRODUCED Percentage Sold	Percentage Consumed	CONSUMPTION PER PERSON kg/year
1A/13	1	24	76	48.6
	2	44	56	43.8
2A/06	1	18	82	105.4 1/
	2	10	90	144.7
2B/01	1	65	35	47.7
	2	73	27	33.2
3/02	1	36	64	54.9
	2	38	62	40.5
4/04	1	22	78	55.2
	2	16	85	55.5

1/ A large proportion of milk in 2A/06 is converted to Semneh.

TABLE 3.36 VALUE AND COMPOSITION OF LIVESTOCK TRANSFERS TO FARM HOUSEHOLDS, PER PERSON

VILLAGE	Season	VALUE OF TRANSFER PER PERSON (L.S.)	per cent[1/] Dairy Products	Meat/Fat/Skins/Wool	Eggs	VALUE OF TRANSFER INCLUDING DEATHS OF ADULT ANIMALS (L.S.)
1A/13	1	178.60	53.9	43.5	2.6	201.60
	2	130.30	54.1	44.5	1.4	144.10
2A/06	1	322.70	57.2	27.6	15.2	369.80
	2	328.20	69.9	23.8	7.1	335.30
2B/01	1	97.30	74.1	20.7	5.2	133.30
	2	103.10	55.0	36.6	8.4	126.10
3/02	1	152.90	63.6	30.3	6.1	186.60
	2	123.00	56.5	39.4	4.1	152.90
4/04	1	176.30	51.5	40.0	8.5	213.60
	2	144.90	67.1	26.3	6.6	161.30

Note: 1/ Percentages are based on the value per person excluding meat from animals recorded as deaths.

Dairy products were the dominant items in all cases. Meat (based on a value for the total carcase) was almost as important in 1A/13, and would be more so if the value of dead animals was included. The total transfer, including these animals, is also shown, but the picture is little changed.

3.6.6 Net Output

Livestock productivity is a complex value involving income, expenditure, internal transfers of feed and livestock products, and valuation changes. Net output, which takes into account all of these, has been calculated for the aggregate livestock enterprise of the sample households and is shown in Appendix 3.9.

The importance of the relative components is shown in Table 3.37. There is considerable variation between villages and seasons, but a common factor is the approximate balancing-out of the two internal transfer factors: (i) transfer of feed from crops and (ii) transfer of livestock products to the household. Where these do cancel, this leaves net output to be explained largely in terms of the valuation change, and the cash flow.

Valuation and cash flow can also be complementary, for example a purchase of stock, reducing the inward cash flow, can result in an increased valuation. This can be seen to be the case in the villages where an adverse cash flow is prominant; 3/02 season 1 and 4/04 season 2. In both cases, large increases in valuation have occurred.

Data in Appendix 3.9 allow us two measures of comparison:

i) Average investment in livestock per person (calculated from the opening and closing valuations) and,

ii) Rate of return, (defined as net output as a percentage of average investment).

TABLE 3.37 COMPONENTS OF LIVESTOCK NET OUTPUT

VILLAGE	Season	Net Output	Valuation Change	Cash Flow	Trans. from Crops	Trans. to Crops	Trans. to House	Other
1A/13	1	+ 100.0	- 25.5	- 103.6	- 373.0	-	+ 591.3	+ 10.8
	2	+ 100.0	+ 61.2	+ 31.4	- 90.9	+ 17.9	+ 80.4	-
2A/06	1	+ 100.0	+ 90.2	+ 3.5	- 143.4	+ 29.1	+ 118.5	+ 2.1
	2	+ 100.0	+ 78.3	+ 61.0	- 105.9	+ 6.1	+ 58.1	+ 2.4
2B/01	1	+ 100.0	- 8.9	+ 71.6	- 38.8	+ 9.9	+ 28.3	+ 37.9
	2	+ 100.0	+ 59.7	+ 71.6	- 61.2	+ 0.8	+ 28.1	+ 1.0
3/02	1	+ 100.0	+ 802.7	-1039.0	- 568.7	+ 5.9	+ 690.4	+ 8.7
	2	- 100.0	+ 4.5	- 89.9	- 339.3	+ 1.3	+ 323.4	-
4/04	1	- 100.0	+ 63.0	- 215.9	- 551.5	+ 12.6	+ 591.8	-
	2	- 100.0	+ 573.9	- 660.4	- 207.9	-	+ 194.4	-

These are shown in Table 3.38. Lowest investment per person was found in village 1A/13, and the highest in 2A/06. There was no consistent trend to higher investment levels in the drier village. Short-term investment in fattening batches in the drier villages would boost the overall level, except that the investment is more usually born by co-operating feed merchants.

The rate of return was highest in villages 2B/01 and 2A/06. This estimate is the closest we can make to measure the overall efficiency of resource use in livestock production.

Net output can also be examined per hectare, per head and per person. These figures allow us to see the absolute and relative contribution of livestock to whole farm productivity and personal net income (see Table 3.39). It can be seen that livestock made a major absolute contribution only in villages 2A/06 and 2B/01.

Factors affecting net output

Comparing information given in Tables 3.34 (components of livestock net output) and 3.36 (Livestock net output comparisons), we can see that net output appears to be associated with cash flow. The cash flow can be adjusted for valuation change to allow for the partial substitution between them, and this estimate can be compared to net output. These measure are highly correlated ($r = 0.94$, $p = 0.01$).

Cash flow is the balance between earned income and cash expenditure, and we can examine these to see how they might affect net output. A significant correlation exists between expenditure and net output ($r = 0.7$, $p = 0.05$) but not between income and net output.[1/]

1/ These correlations are shown in Appendix 3.10

TABLE 3.38

FINANCIAL MEASURES OF LIVESTOCK INVESTMENT AND PRODUCTIVITY

VILLAGE	Season	Average Investment in Livestock per person 1/ L.S.	Annual Rate of Return on Investment 2/ Per cent
1A/13	1	321	9.4
	2	372	43.6
2A/06	1	1027	26.5
	2	1457	38.8
2B/01	1	700	41.4
	2	815	45.0
3/02	1	638	3.5
	2	810	- 4.6
4/04	1	451	- 7.9
	2	740	- 10.0

1/ Based on the average of the opening and closing valuation of livestock and feeds.

2/ Net output as a percentage of average investment.

TABLE 3.39

LIVESTOCK NET OUTPUT COMPARISONS

L.S.

VILLAGE	Season	Per Hectare 1/	Per Head 2/	Per Person
1A/13	1	46.3	23.4	30.3
	2	52.9	151.3	162.2
2A/06	1	116.1	106.5	272.4
	2	234.0	182.7	564.5
2B/01	1	92.7	112.4	289.8
	2	116.1	118.0	366.9
3/02	1	7.3	12.3	22.1
	2	- 13.0	- 21.0	- 36.9
4/04	1	- 11.4	- 24.3	- 35.5
	2	- 30.4	- 51.7	- 74.5

1/ Whole farm area.

2/ Head of adult sheep and goats.

Of the expenditure items, apart from purchase of stock, which would make a direct contribution to the valuation, feed purchase was the major item. Figure 3.12 shows the relationship between feed cost per head and net output. Here, feed cost is the value of supplementary feed brought in from outside the system, which was higher the more deficient the system was in generating home-produced feed.

For all points there is a strong negative correlation ($r = 0.87$, $p = 0.01$), and a very direct relationship appears to exist for villages and seasons except 1A/13 and 4/04 in season 1. If these two data are excluded, the correlation becomes almost perfect ($r = 0.99$), indicating that net output depends almost entirely on the amount of supplementary feed that is brought in.

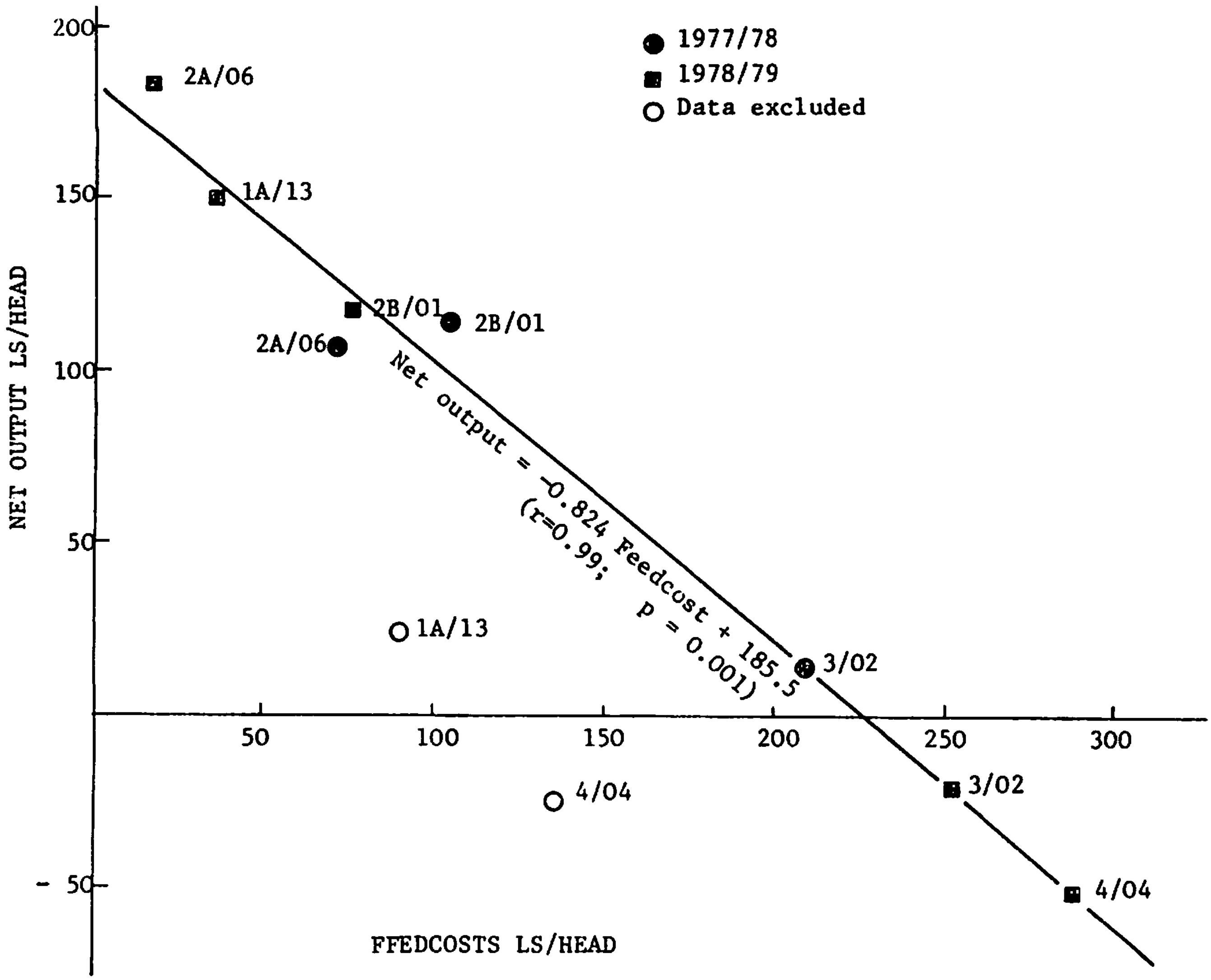
Regarding 1A/13 and 4/04 we can consider the causes of their apparent deviation. In 1A/13, if we exclude those farmers reporting negative net outputs, net output per head would have been LS 71.3, as against a predicted LS 111.3. In village 4/04, farmers having positive net outputs averaged LS 123.0/head, compared to a predicted LS 73.8. In village 4/04 particularly, it has always been considered that livestock information for the first season was unreliable, particularly with regard to output.

Implications of the relationship shown in Figure 3.12 would seem to be:

1) Decreasing net output, as greater reliance is made on imported feeds, either because of the village's location or the season's rainfall.

2) A greater spread of results in a generally dry season compared to a wetter one.

FIGURE 3.12 RELATIONASHIP BETWEEN NET OUTPUT/HEAD AND COST OF SUPPLEMENTARY FEED/HEAD



3) Increased reliance on purchased supplementary feed is a result of a decline in farm produced feed with rainfall. However, consumption in the dryer villages does appear high (see Table 3.20), and it may be that a response in increased output to higher levels of feeding is not occuring.

However, a word of caution is called for. The relationship described holds for values which represent the aggregate sample, but not in all cases for individual farms within the sample. In six out of ten cases, the relationship was negative; in three it was zero, and in one, 2B/01 in season 2, it was positive.

3.7 FINANCIAL FLOWS

3.7.1 Relationship of Financial and Physical Flows

The financial flows in farming are of two main types:

i) Those involving a net transfer of goods and services between the farm and the outside world, e.g. purchase of fertilizer, rent of machinery, sales of crop, and

ii) Those not involving such transfers, for example cash loans and repayments and receipts as gifts.

This section discusses flows of the first type, as it is these that are generated by the physical production process. The terms "incurred expenditure" and "earned income" have been used (see Section 3.1.2) to imply that a transaction is matched by either a physical flow of some material, or the completion of a tangible service. The inter-relationships between these financial flows and the physical farming system were shown in Figure 3.1.

That a transaction is classified by either of the above terms does not necessarily imply a simultaneous cash transaction. For example, fertilizer may be purchased in November, but on credit, the cash being settled sometime later. The expenditure is nevertheless incurred in November, and is classed as a payment of type (i), and the cash repayment is classed as type (ii). This procedure allows us to distinguish between the balance of earned income and incurred expenditure (the relative cash flow), which is dependant on the technical system, and the actual cash flow, which is related to credit and indebtedness.

A second advantage is that earned income and incurred expenditure can be used in net output calculations without the need for corrections for outstanding debts or credits.

3.7.2 Relative Annual Cash Flow

Relative annual cash flow is the difference between total earned income and incurred expenditure over a season. It shows what enterprises generate, or consume, disposable cash income. The situation in the six rainfed villages can be seen from Table 3.40.

Rainfed cropping generated a cash surplus only in villages 1A/13 and 2A/06. In 1B/05, the cash situation was negative, despite this village having the highest net output per hectare. This resulted from large components of net output being tied up in internal transfers to house and livestock feed stocks. (See Appendix 3.3). Cropping became an increasingly large consumer of cash in the drier villages, as a greater part of the output was accounted for in internal, non-cash, transfer. The small areas of irrigation in villages 1B/05 and 2B/01 contributed to a cash surplus, but, this benefit did not accure to all farmers.[1/]

With the exception of the two driest villages, livestock cash generation showed the opposite trend. The two-year averages give a better picture -- as large accounting differences can result from the carry over of stock from one season to the next. The picture in villages 3/02 and 4/04 is not encouraging, although some of the negative flow can be accounted for in valuation change.

The balance per person indicates what, in addition to the transfers of foodstuffs from crops and livestock enterprises, individual family members benefitted from farming. There is tremendous variation, from a positive value of LS 1657 per person in 1A/13 to minus 592 in 4/04.

1/ Only one sample farmer in 1B/05 has irrigation, and two in 2B/01. The large difference in relative cash flow in the latter village was due to the carry over of harvested maize for sale during the second season.

TABLE 3.40 RELATIVE CASH FLOW[1/] FOR CROP AND LIVESTOCK ENTERPRISES

Village	Season	CROPS Rainfed	CROPS Irrigated	Livestock	2-Year Average	Balance per person
1A/13	1	102985	-	- 1913	(+ 1604)	+ 1657
	2	48561	-	+ 3517	-	+ 755
1B/05	2	- 1458	+ 4679	N.A.	-	+ 52
2A/06	1	1039	-	+ 493	(+ 9883)	+ 29
	2	5089	-	+ 19273	-	+ 435
2B/01	1	- 9059	- 3782	+ 18785	(17613)	+ 46
	2	- 6654	+ 19718	+ 19441	-	+ 524
3/02	1	- 9521	-	- 26225	(- 14856)	- 337
	2	- 15895	-	- 3488	-	- 185
4/04	1	- 16930	-	- 5143	(- 35167)	- 329
	2	- 6118	-	- 30024	-	- 592

Notes: 1/ Cash flow is defined here as the difference between earned income and incurred expenditure. (See Section 3.1.2). Therefore, negative values can be explained partly by drawing on savings, and partly by increased indebtedness.

Negative values imply that either savings were used up, or cash from other income sources subsidised farming, or, because we are dealing with relative rather than actual cash flow, an increase in indebtedness accounted for the situation. In the dry villages, it was probably a combination of all three. Such are the problems of farming in areas where rainfall, and hence productivity, fluctuate considerably from year to year.

3.7.3 Income and Expenditure Breakdown

A breakdown of earned income and incurred expenditure over two seasons is given in Appendix 3.11, (A) to (E). In spite of some seasonal differences, the two-year average gives a better picture as it overcomes some of the problems of transactions that occur out of sequence in relation to the season they refer to. For example, two seed purchases may arise in one season, and no purchases in another, although the seed was actually used over two seasons.

a) Incurred expenditure by crops

Expenditure largely reflected the crop area allocation shown in Table 3.8. Chickpea and orchard crops accounted for most expenditure in 1A/13; in 1B/05 it was wheat and summer crops. In 2A/06, expenditure was roughly equal on wheat, barley and lentil. Fallows, in 2B/01 and 3/02 do not account for more than 10 per cent of all expenditure.1/

b) Incurred expenditure on crops by input

Seed: high expenditure on seed in 1A/13 reflects the investment in chickpea, where seed shortages over the last year or two have resulted in high unit costs. In 4/04, seed expenditure resulted from having to sell a proportion of barley after harvest to pay off debts, rather than keeping it for the next season.

1/ In net output calculations, the cost of maitaining fallows is charged to the following year's wheat crop.

Fertilizer: was an important component of expenditure (19-44 per cent) in the three wetter villages.

Plant protection: little was spent on plant protection, which was confined to seed dressing, herbicide on some wheat crops, and insecticide on some summer crops.

Labour: was an important item, but especially so in villages 1B/05, 2B/01 and 3/02. This reflects the large areas of cereals, particularly barley, that had to be hand harvested in these villages. Barley harvest can be more expensive than even lentil, at up to LS.400/ha, but in a high yielding crop, where the large volume of straw makes a valuable contribution to animal feed, as in 1B/05, the expense can be justified. However, in the drier areas, the cost of hand harvest is a heavy burden when compared to the potential output.

Combine harvesting costs about LS 100/ha, and so the potential savings are considerable.

Probably the main justification for selecting long-strawed barley varieties for the drier areas is that they would increase the combine harvestable area. This must be set against a possible reduction in the amount of collectable straw, but as shown in Table 3.26 in section 3.4.2, feed quality in the drier zones can be poor, and the savings in harvesting costs could provide more supplementation, increasing overall feed quality.

Mechanisation costs: Expenditure on cultivations, transport (mostly tractor and trailer) and harvesting and threshing together account for 20 to 26 per cent of the total. This figure underestimates machine costs in two ways:

i) it does not include the costs of owner-users, and

ii) it excludes payments in kind, mostly in the form of grain paid to combine harvester owners.

Both these elements can be extracted from the net output calculations and as a proportion of total costs, machinery accounted for:

Village	Per cent of Total Costs
1A/13	41.1
1B/05	44.6
2A/01	31.0
2B/01	15.3
3/02	21.2
4/04	23.6

Thus, in the wetter villages, with more cultivations in summer crops and orchards, and a greater degree of combine harvesting, mechanisation costs are more significant.

Rents: those in Appendix 3 (B) include only cash rents, which in the case of 2B/01, 3/02 and 4/04 are those payable to Government for land received under the Land Reform.

c) Incurred expenditure on livestock, by input

In all villages, purchase of stock was the most significant item. Of the remainder, feed costs, especially those of concentrated feeds, were by far the most important item. Excluding livestock purchases, feedcosts accounted for between 60 and 87 per cent of expenditure.

d) Earned income, by crop

The pattern of earned income again reflects land allocation. The importance of wheat in villages 2B/01 and 3/02 may seem surprising, but against the background of low average productivity, this represents the sales between farmers. The absolute values of earned income were also much lower in drier villages.

Chickpea and olives were the most important contributors in 1A/13, and breadwheat and summer crops in 1B/05. Had summer crops yielded better, they would probably have been the main cash contributor.

Barley and lentil were important in village 2A/06, and lentil also was a contributor in 3/02.

Barley sales were virtually the only source of crops income in 4/04.

e) Earned income from livestock

Sheep: Sales of home-stock animals were important in all villages, accounting for 28 to 55 per cent of income. Fattening animals, including trade ewes, were of greater importance in the drier villages, accounting for a maximum of 41 per cent of sales in 2B/01.

Goats: Goats were more important in the wetter villages, and fattening animals contributed 23 per cent to income in village 3/02.

Dairy products: Of the non-stock items, dairy products were the most important. Village 2B/01 had the highest proportion of its income from yoghurt, and 1A/13 from semneh and cheese. The proportion of total livestock income from all dairy products ranged from 3.1 per cent in village 4/04, to 12.2 per cent in 1A/13.

3.7.4 Relative and Actual Cash Flow

The periods in an agricultural cycle when expenditure is required and when income is generated, are frequently marked by considerable peaks and troughs. Peak expenditures can be a strain on financial resources, but may be mollified by credit arrangements. In particular, cash loans may be taken and more commonly, payments may be deferred until some later time when the incoming cash situation has improved. Alternatively, expenditure may be financed from savings, and from the incoming cash from another farm enterprise or some other source of income.

The times of greatest cash demand and generation in a system are shown by the relative cash flow. Examples for the crop and livestock enterprises in two villages, 2A/06 and 4/04, are shown in Figure 3.13. The flows are broken down into their components of earned income and incurred expenditure.

The pattern of rainfed crops was similar in both villages, with major peaks at planting and harvesting, and in the case of 2A/06, in spring at the time of preparation for summer crops. In 4/04, the harvesting peak was almost as great as the planting one, on account of the high costs of hand harvesting cereals. On the income side, sales of crops were delayed longer in 2A/06, whereas in 4/04, much of the material was sold soon after harvest.

Livestock patterns differed more greatly, but both were characterised by extreme peaks in expenditure and income, caused by the purchase, on credit, of fattening animals and feedstuffs.

It would appear that livestock were partly complementary to cropping. In both villages, major livestock sales were timed to cover planting expenses, and crop sales themselves also contributed. Sales of milk products and young lambs in spring provided income during the growing period for crops, and in 2A/06, crop sales in July preceded livestock purchases in August. If it were not for fattening stock, livestock income and expenditure patterns would generally have been much more regular than that of cropping.

Farmers in all villages consider the buffering effect of livestock to be very important. In higher rainfall areas, the inclusion of summer crops and orchards allows a fairly regular investment in cropping throughout the year. In the drier areas, any cash surpluses from crop sales could either be saved, if in excess of immediate requirements, or invested in livestock. This would make sense in any situation where a positive livestock net output was expected, as this would represent the "interest" on the investment. Other advatages in saving through livestock are the production of dairy products for the house, and the fact that animals can be sold easily and quickly if cash is needed.

Records of transactions over two years indicate a rapid turnover of livestock in small numbers, with much buying and selling of even productive animals, which further suggests a "bank account" function. However, the complimentarity of crops and livestock should not be over-estimated. The balance of the relative cash flow for both enterprises in villages 2A/06 and 4/04 was negative in eight and nine months out of twelve respectively.

The actual cash flows in these villages differed from the relative flows shown above. In 2A/06, the difference was only slight, in that most farmers postponed payment on cultivations for periods ranging from one to six months. For livestock the peak in August was reduced in cash terms by taking animals and feed on credit and repaying this value out of sales in October.

Village 4/04 was in marked contrast to this, and for most farmers, debts were carried through until harvest. For livestock also, payment on many expenditures was deferred, and repaid later out of sales.

The effect of these deferrments on the debt situation in this village is shown in Figure 3.14. The amount of debt on cropping increased rapidly in the planting period, was only slightly reduced over the spring, and increased further as harvest costs were incurred. At the same time, the oustanding debt on livestock was increasing, although a large part of this was accounted for in the value of fattening animals, which it could be considered remained the property of the cooperating merchants.

Debts on both enterprises were reduced following sales of crop and animals, but in both cases, owing to the mediocre crop productivity, debt levels remained higher than they had been at the start of the season.

This situation, which was the worst of all six villages, explains why farmers were obliged to sell barley after harvest at prices as low as LS 0.45, and to buy it back again a few months later for feed and seed at LS 0.70.[1/]

1/ See Section 3.4.2 Table 3.18 for data relating to the low utilization of home-grown feed.

FIGURE 3.13 SEASONAL PATTERN OF INCOME AND EXPENDITURE 1977/1978

(Syrian Lira per holding)

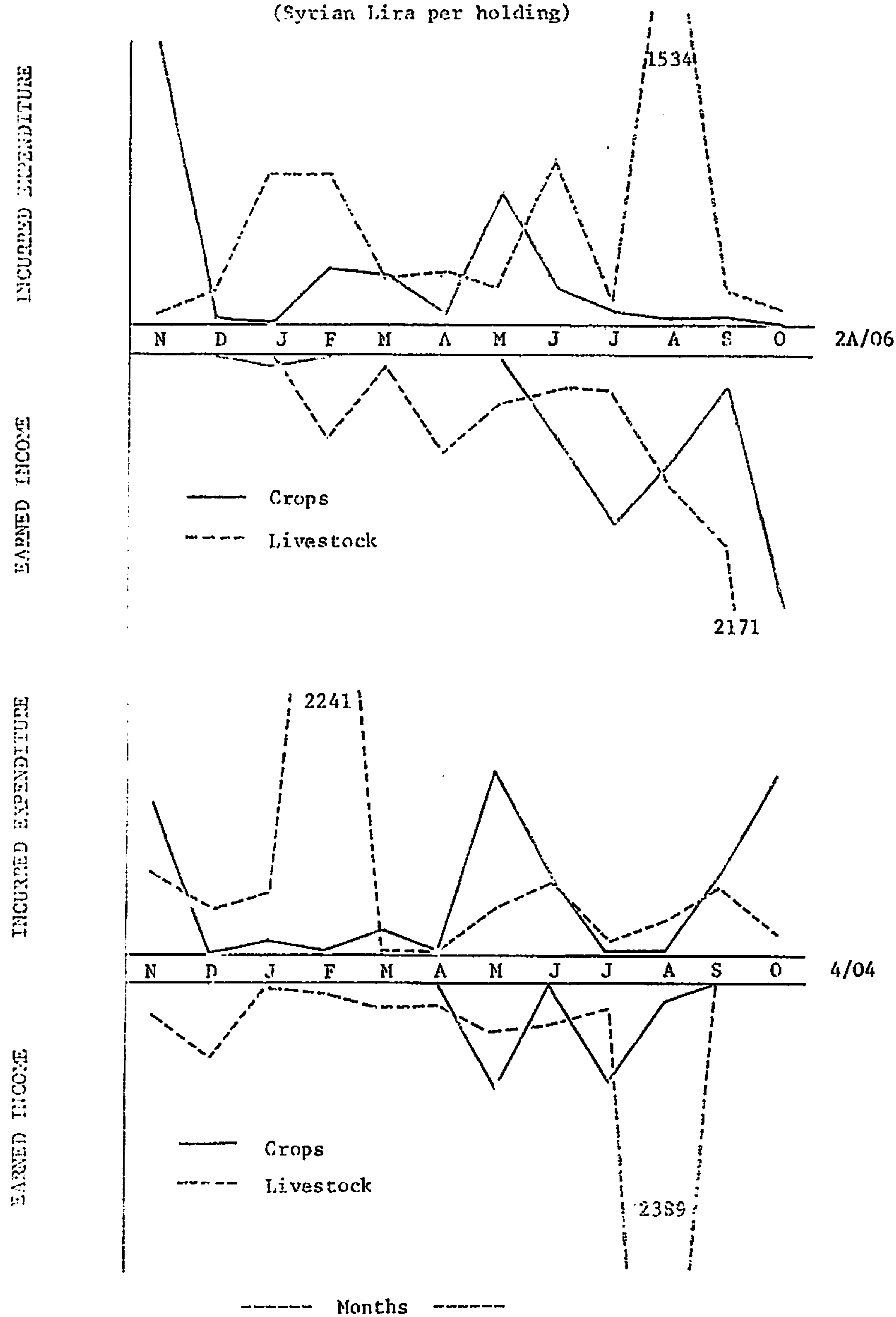
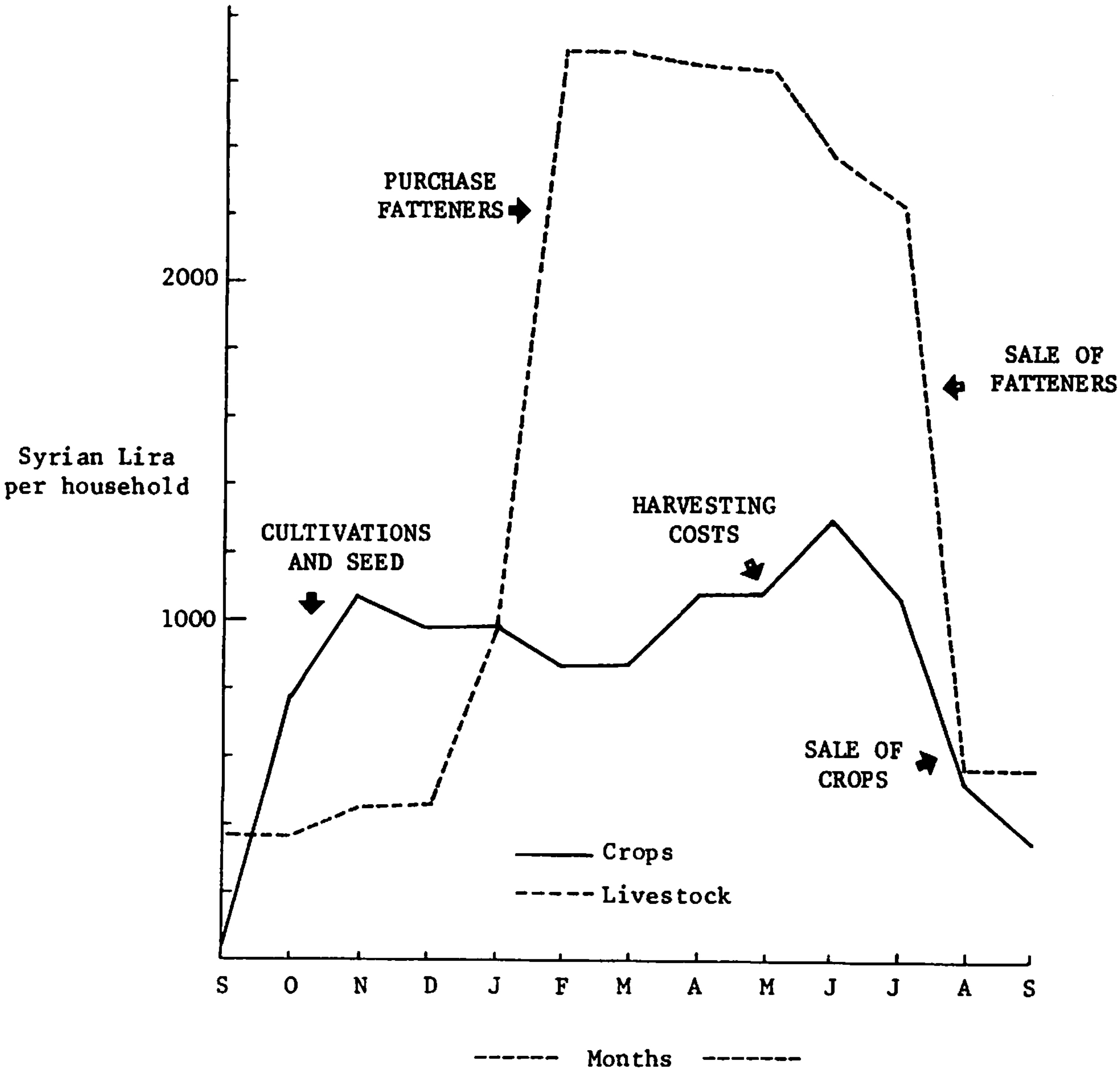


FIGURE 3.14 CUMULATIVE DEBT OVER A SEASON, VILLAGE 4/04, 1977/78



3.7.5 Balancing Cash Flow

Different arrangements were made, and to various extents, by sample farmers to overcome adverse cash flows. These include credit arrangements, and payments in kind.

a) Machinery charges

Payments for machinery services that were obtained locally were frequently deferred even by larger, wealthier farmers, who paid cash for other transactions. This is partly a matter of convenience, in that a single payment can be made after all operations have been completed, but it appears in all villages that tractor owners are prepared to carry the expenses of smaller farmers for considerable periods of time. Some 72 per cent of sample farmers received tractor services on credit. The extreme case for deferred payments on cultivations was village 4, in season 1, where nearly all repayments were made after harvest.

It has not been possible to detect whether machinery credit carries a hidden interest rate; hiring charges were generally the same for farmers either paying cash or deferring payment. What is not known is whether the actual repayment differs from the calculated value. As in all matters of credit, the most information we can frequently get is "all debts paid". In fact repayments, when specified, often differ from the calculated value; sometimes by more, sometimes less. Our experience dealing with farmers who keep no records is that there is always some degree of inexactness regarding credit.

Payments for harvesting are usually made in kind. Combine harvester operators take from 6 to 20 per cent of the crop depending on crop and field conditions. In 1978/79 and 1979/80, this amount was equal to LS 90.00 ± 20.00. The system benefits both parties; the farmer is not required to transport and sell small quantities to raise cash, and the contractor does not have to spend time collecting his dues. Only in 1979, in areas below 350 mm, were farmers insisting on cash payment in order to keep as much grain as possible on the farm.

b) Other crop inputs

Seed is sometimes bought on credit. About one quarter of the sample farmers did this, mostly in the drier villages where the recent poor harvests have depleted stocks. In the wetter villages, seed credits were mostly short-term, being repaid after a few months.

The Agricultural Cooperative Bank provides credit for major inputs, the most important of which is fertilizer. However, over the period 1977/79, only sample farmers in villages 1A/13 and 1B/05 were obtaining credit in this way. In 2A/06, the non-functioning of the Cooperative prevented many farmers from taking fertilizer from the Bank on credit. The alternative way to buy it on the free market, at a slightly higher price, or for cash from the Bank which involves some bureaucratic procedures. In village 2A/06, the cooperative situation was regularised in 1979 and farmers were able to obtain inputs on Bank credit.

c) Animal feedstuffs

Feedstuffs are an item commonly bought on credit, mostly from merchants operating in sub-district and district towns. The period involved can be anything up to six months, sometimes longer.

Feedstuff purchases in the villages are characterised by small quantities, frequent deferrment of payment, and high prices. Most purchases from 1977 to 1979 involved quantities of between 50 and 200 kilograms of any one commodity, and less than 10 per cent of sample farmers obtained feed (except barley) in large quantities from the General Organisation for Feeds (GOF). Table 3.41 gives the average prices paid in the four drier villages compared to the official GOF prices.

TABLE 3.41

AVERAGE AND OFFICIAL FEEDSTUFF PRICES 1977/78

(Syrian Piasters per Kilo)

	Barley	Cotton Seed Cake	Cotton Seed Hulls	Wheat Bran
2A/06	60.0	75.3	75.0	35.0
2B/01	62.4	75.6	59.6	40.7
3/02	71.2	78.2	-	47.8
4/04	68.4	82.4	68.6	46.4
GOF Official Price	54.0	60.0	30.0	20.0

Two things stand out from this information. Free-market prices are higher than the official prices, sometimes considerably so. This differential reflects the penalty that farmers, not belonging to a cooperative, or not wishing to become embroiled in lengthy administrative procedures, have to pay. Possibly without GOF subsidisation, feedstuffs for small farmers would be even more expensive, but a considerable part of the benefit is absorbed in the unofficial distribution system.

The second point is that the average prices were generally higher in the drier villages.[1/] This reflects the greater amount of credit involved, and gives yet another indication of the relatively disfavoured position of dry area farmers. Some 66 per cent of farmers in the three drier villages received credit for feed purchases, but none in the three wetter villages.

d) Purchase of animals and fattening

In the wetter villages, purchases of stock were mostly for cash, and only one farmer, in 2A/06, purchased lambs for fattening on credit. In the drier villages, receiving animals on credit is common, involving over 50 per cent of farmers.

Strictly speaking, ownership of such animals remains vested in the financing partner, who is usually a merchant-associate. Various arrangements exist regarding purchase of both animals and feed, and commonly poorer farmers provide capital for neither. In this case the profit split gives the majority share to the financier and the farmer is rewarded only for his labour.

Fattening apparently proved a generally unprofitable enterprise in villages 3/02 and 4/04. There are indications that lack of management skill, and the ad hoc nature of the business, may have contributed to this.[2/] In cases where the farmer had no financial involvement, the returns would be expected to be low.

1/ These prices exclude transport.

2/ Large variations were also reported for fattening cooperatives in ICARDA's Livestock Credit Study (Internal Report to IBRD/MAAR, Syria), Farming Systems Research Report No. 7.

e) Cost of credit

Credit is a sensitive area of discussion, especially in the poorer villages, but our data nevertheless indicate a marked distinction between villages, and to some extent between farmers within villages. The distinction relates to the amount of credit, and its source.

i) The higher rainfall villages required higher levels of inputs to crops, but were in a better position to obtain these at low rates of interest from the Agricultural Bank. Farmers did not use credit for livestock.

ii) In the lower rainfall villages, not only was credit required to a greater extent, but it was obtained from private sources, at higher interest rates. It is difficult to calculate these rates, but indications, such as the abnormally low barley prices received in 4/04, suggest that they might exceed 40 to 50 per cent per annum.

This would need further study, but clearly it affects the overall profitablity of dryarea farming.

3.8 TOTAL SYSTEM PRODUCTIVITY

3.8.1 Whole System Productivity

Crop and livestock productivity have been separately discussed in 3.5.2 and 3.6.6. Together, they give a measure of comparative productivity for the whole farming system.

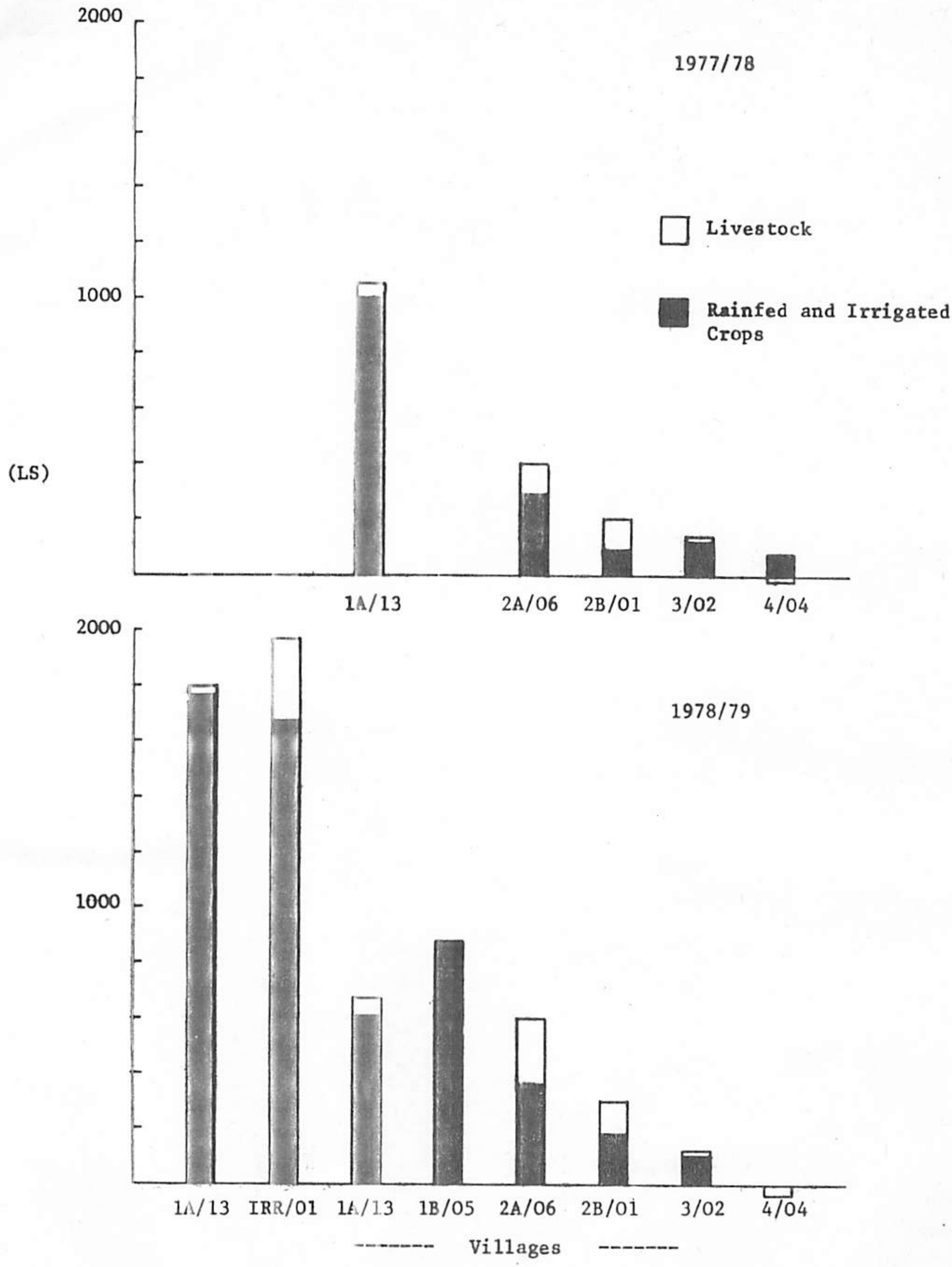
Figure 3.15 illustrates this in terms of net output per hectare. For the rainfed Aleppo villages in 1977/78, the range is tremendous from LS. 1042/ha in village 1A/13 to LS 56/ha in 4/04. It is even more extreme in 1978/79 with the added comparison of the two irrigated IRR/01 and IRR/09.

The relative importance of the crop and livestock enterprises can also be seen. Livestock was of greatest importance in the middle rainfall villages, although in absolute terms the largest contribution came from IRR/01's growing dairy industry. The very poor performance of both crops and livestock in the dry villages makes it difficult to estimate what the situation might have been had the seasons been better. There is also the problem of the somewhat artificial distinction between cropping and animal-keeping. If a crop system is strongly geared to livestock there is every justification for thinking of it as part of the livestock enterprise. This idea is again confounded in the case of 4/04, where the low stocking rate (see Table 3.3) and the fact that cropping also acts as a cash generator suggests it has a partly independant status.

3.8.2 Productivity per Person

Productivity measured on a per person basis, so as to indicate what farm family members benefitted from farming, shows a slightly different picture. The change reflects the different land resource endowments across villages.

FIGURE 3.15 WHOLE FARM NET OUTPUT PER HECTARE



The use of land/person ratios as the main basis for sampling allows us to make some tentative adjustments in order to set the sample data in the village and agricultural zone context. Table 3.3, which compared land/person ratio and livestock per person for the sample and the village as a whole, forms the basis of the first adjustment. Table 2.12 (section 2), which compared the sample villages with other villages from which they were selected, forms the basis for the second adjustment.[1/]

Figure 3.16 shows productivity per person for:

(a) the aggregate sample

(b) the village, by adjustment

(c) the agricultural zone, by adjustment.

Whilst the overall pattern remains unchanged, it can be seen that these progressive adjustments tend to narrow the range by reducing the extreme values. Thus the 1A/13 sample value is progressively reduced, as the land/person ratio for the sample was greater than average for the village, which in turn was greater than for other villages in the group.

In 1B/05, the very low land resource endowments compared to other villages result in a considerable betterment in the position at zone 1B level. A similar situation occurs in the drier villages, particularly 4/04. In this case, we can only hope the levels shown in (c) really do better reflect the situation of people in that zone.

1/ This adjustment can be made only for the six rainfed villages. The sample of irrigated villages was too variable, and did not represent uniform crop system areas.

3.8.3 Physical and Financial Productivity

Various aspects of system productivity have been covered in previous chapters, and need only be summarised here. This is done in Table 3.42.

Against the background of whole farm output per hectare and per person, it can be seen that systems performed more or less adequately in the two poorish seasons from IRR/09 down to 2B/01. The drier villages, however, were in a worse position, and their systems were inadequate in terms of self-sufficiency and the level of livelihood they offered.

Such a situation has increasingly forced families in these areas to seek alternative sources of income.

3.8.4 Other Sources of Income

Of the households regularly interviewed between 1977 and 1980, 88 per cent had some source of income other than that generated by cropping and livestock. The main sources in the Aleppo villages were:

Source	No of households
Labouring	14
Sons working away	12
Machinery ownership	7
Agricultural labouring	4
Lorry/pickup ownership	2
Mill	1
Guard	1
Councillor	1
Livestock trader	1
Shop	1
Miscellaneous	2

FIGURE 3.16 **WHOLE FARM NET OUTPUT PER PERSON**

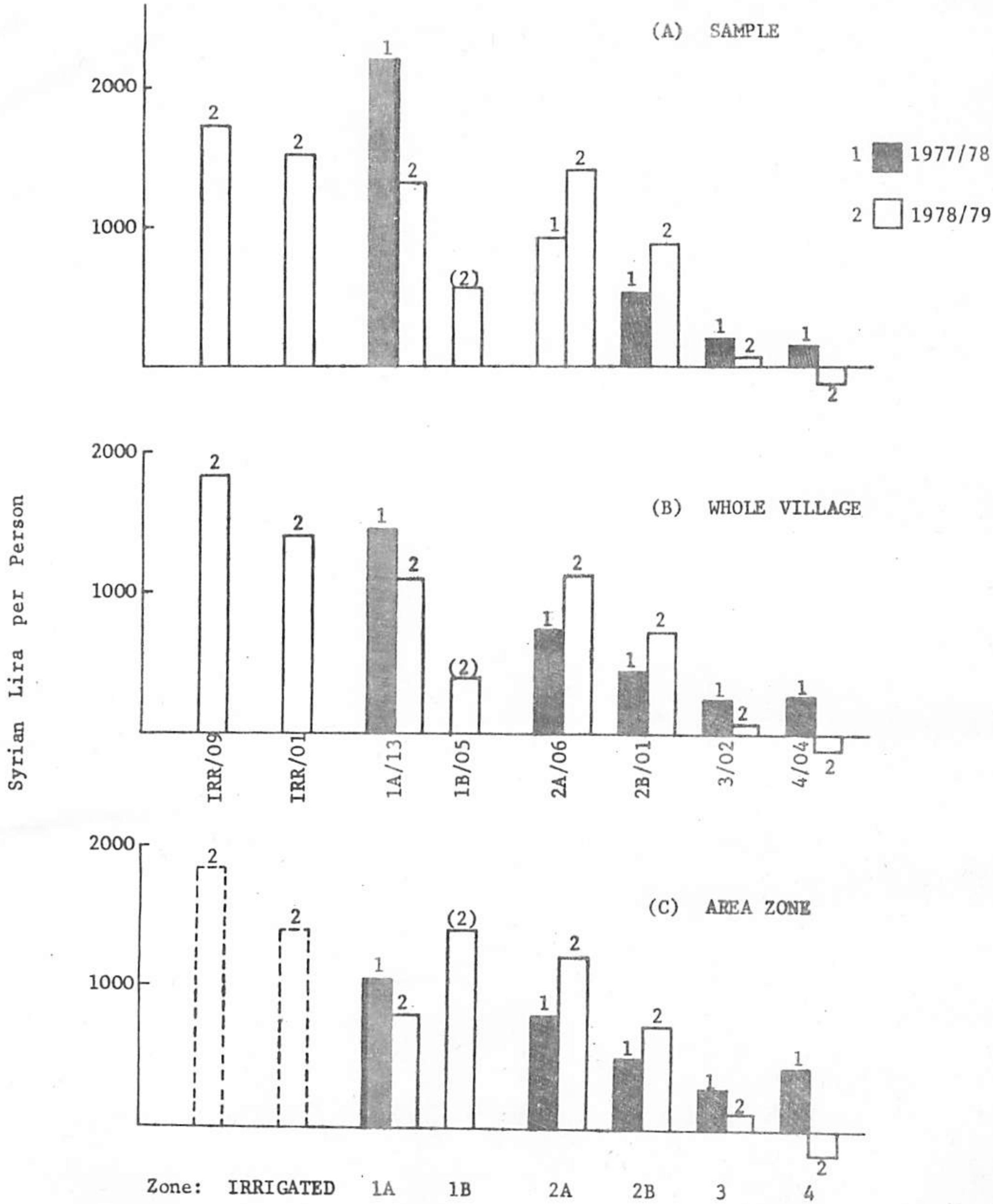


TABLE 3.42 SUMMARY OF SYSTEM PRODUCTIVITY IN EIGHT VILLAGES

	IRR/09	IRR/01	1A/13	1B/05	2A/06	2B/01	3/02	4/04
Wheat system	Surplus	Surplus	Surplus	Surplus	Self-sufficient	Self-sufficient	Self-sufficient	Deficient
Animal feed system 1/	Deficient	Deficient	Slightly deficient	N.A.	Self-sufficient	Deficient	Deficient	Deficient
Grain legume system	-	-	Surplus	Surplus	Surplus	-	Slightly Surplus	-
Cash balance-Crops	Positive	Positive	Positive	Positive 2/	Positive	Positive 2/	Negative	Negative
Cash balance-Livestock	Positive	Positive	Positive	Positive	Positive	Positive	Negative	Negative

Notes: 1/ Animal feeds on an energy basis. Probably all systems are protein deficient.

2/ Cash flows positive in 1B/05 and 2B/01 only if irrigated crops of a minority of farmers are included.

Many households had several or changing sources. For example, income from working in Saudi Arabia was used for purchase of tractors and pick-ups; lorries were sold to go into livestock fattening. However, for most families, income came from either regular or occasional labouring, or as remittances from sons who had left the village to look for work.

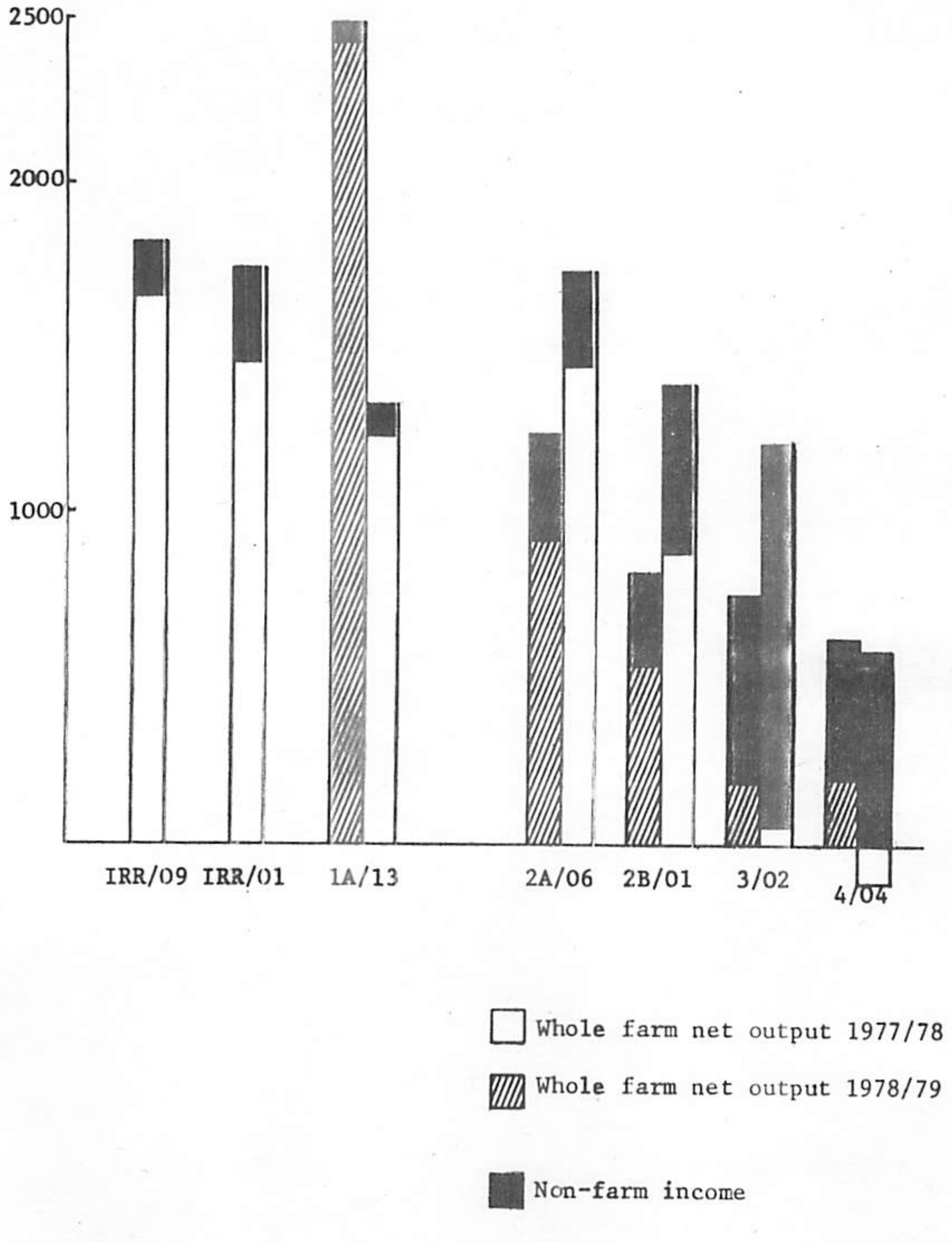
During the recording period, there has been a significant change in the level of outside income in the two drier villages, 3/02 and 4/04. In 3/02 this has largely come from the increased numbers of men going to Saudia. The impact on village life has yet to be seen, but it is likely to be considerable. One family received a net income from sons working away of LS. 30,000 in 1979, as against crop and livestock net outputs of LS. 2095 and LS. 2945 respectively.

In village 4/04, whilst in 1977 only about one in three households had other sources, by the end of 1979 all but one family on the sample were receiving extra income. Simply put, the two poor seasons, the low productivity and the increase in indebtedness has forced people to seek work. It is fortunate to that industrial and military development to the east of Aleppo has made jobs available.

It is difficult to record other income with great accuracy, as families are reasonably reticent in disclosing such information. However, Figure 3.17 includes our best estimates of the value of non-farm income compared to whole-farm income (i.e. net output). These estimates do not include income from machinery ownership, as this is almost impossible to calculate with the level of information available. This omission affects mostly village 1A/13, and to a minor extent 2B/01 and 4/04.[1/]

1/ Four households on the sample make income from tractor ownership; one household in 2B/01; and two households share one tractor in 4/04. In 2A/06, tractor owners claim to use their equipment only on their own land.

FIGURE 3.17 FARM AND NON-FARM INCOME PER PERSON



The importance of non-farm income in the drier villages stands out clearly, as do the higher levels in 1978/79 compared to 1977/78 in the three drier villages. Non-farm income goes a considerable way to improving overall income levels and overcoming the deficiencies of low-rainfall agriculture. However, this is at the cost of dislocation, family fragmentation and the insecurity posed by jobs such as casual labouring.

3.8.5 Standard of Living

Standard of living measures are notoriously hard to make, but one basic index is the value of food consumption. The inclusion of recording on household food expenditure and consumption allows us to make some estimate of this.

From Table 3.43 it can be seen that the value of total food consumed ranges from LS. 632/person/year to LS. 1252. The low value in 2B/01 is probably explained by a higher, unrecorded, consumption away from the village; many family members regularly commute to al-Bab and Aleppo. Otherwise, the value appears higher in the dry and mid-rainfall villages than in 1A/13. However, it should be remembered that the values for 1A/13 and 2A/06 are probably underestimates, as it is unlikely that we have recorded fully items such as home produced fruits, vegetables and oil. The dry village estimates are probably nearer actual consumption, as there is little else in the way of food value coming out of the system.

In judgement of our interviewers, who have now known most of the sample families for two or three years, is that village 4/04 is undoubtedly the poorest. This is not surprising in view of the data presented in this section. The position of families in village 3/02 is very variable, largely depending on whether a new outside income source has been found. Some families are now quite well-off. A son from a fairly poor family recently returned from Saudia with a second-hand car. Other families, particularly those who cannot find the money to finance a Saudia visa, and widows, remain poor.

TABLE 3.43 VALUE OF CONSUMED FOODSTUFFS PER PERSON

Village	Season	From Own Crops	From Own Livestock	Farm Total	Purchased Food	TOTAL
1A/13	1	354	202	556	364	920
	2	306	144	450	N.A.	N.A.
2A/06	1	270	370	640	505	1145
	2	237	336	573	N.A.	N.A.
2B/01	1	97	133	230	402	632
	2	206	126	332	N.A.	N.A.
3/02	1	144	187	331	719	1050
	2	85	153	238	N.A.	N.A.
4/04	1	104	214	318	934	1252
	2	27	161	188	N.A.	N.A.

In 2B/01, standards vary, but many families are now in a position to have a reasonable living standard. The recent investment in small pumps suggests that the cash is available, and the location of the village helps those who seek outside work.

Village 2A/06 is the first one where a reasonable number of families are making a living from agriculture and related activities. There are poorer families - two on our sample - and other families who have had to seek work outside.

In 1B/05 and 1A/13, our impression is that most families are living reasonably comfortably, some extremely so by rural standards. But even here, poorer families exist in most cases, those having little land, and income is frequently supplemented from outside.

3.9 FARM AND VILLAGE LEVEL COMPARISON

We have so far examined farming systems at village level using aggregated data from the sample farmers. This approach was taken because every farming household employs a system that differs slightly from other farms according to that household's special circumstances. A degree of generalisation has been necessary to allow comparison of the essential differences in systems spanning such a wide range of agro-ecological zones.

However, we need to consider some of the differences between farms.[1/] It is necessary to do this within the context of the village system as clearly, grouping farms, for example in terms of size or land/person ratios, across all villages means little where productivity per hectare can vary by a factor of ten.

3.9.1 Village 1A/13 - Kawkabeh

Table 3.44 presents measures of resource endowment and productivity for sample farmers.

The sampling method has given a reasonable spread of holding sizes (5.8 to 52.0 ha) and it can be seen how family size modified this to give land/person ratios ranging from 7.4 to 58.0 donums per person.

The quality of land, as shown by the percentage of types one and two soil, was generally even across farms, but this is not a particularly useful measure in 1A/13 as olive areas, which can be highly profitable, are excluded.

Net output per hectare was highest for farmers having a large proportion of their land under productive olive and chickpea. Lower outputs reflected higher proportions of wheat, and to some extent the costs of establishing olive orchards, which proved a drain on resources.

1/ For further details on individual farms, see Section 3, Annex 1 "Summary data on sample farmers in the Farming Systems Program Village Level Studies".

TABLE 3.44

VILLAGE 1A/13

RESOURCE ENDOWMENT AND PRODUCTIVITY

FARMER No.		20	30	15	28	22	16	10	39	21
Whole farm area (donums)		58	59	82	92	111	122	174	295	520
Family size		1	8	7	5	12	8	12	13	15
Land/person ratio (donums)		58	7.4	11.7	18.4	9.3	15.3	14.5	22.7	34.7
Proportion of land in soil class one and two (per cent)		67	75	68	69	100	60	76	41	57
Milking head/person		0.0	0.5	0.0	0.8	0.83	0.63	1.50	1.15	1.20
Crop net output/ha	77/78	519	N.A.	N.A.	578	N.A.	682	1275	2138	606
	78/79	69	462	-	N.A.	307	339	1146	577	625
Crop net output/person	77/78	3011	-	-	1064	-	1040	1849	4851	2101
	78/79	398	340	-	-	284	301	1720	1309	2166
Livestock net output/person	77/78	-	-	-	- 11	-	129	33	187	162
	78/79	-	4	-	-	406	77	59	-150	169
Whole farm net output	77/78	3011	-	-	1053	-	1169	1882	5038	2263
	78/79	398	344	-	-	690	378	1779	1159	2335

Of particular note is the variation between farms and seasons. The reasons are different for each farmer: some olives were in a low part of their cycle, a wheat crop was badly affected by smut and weeds, a chick-pea crop failed through late-planting, and so on. It is impossible to suggest from the data what constituted a successful farmer: one who is regarded as a highly competant husbandman (No. 16) achieved lower outputs than one (No. 39) who is generally thought of as a slap-dash operator. The difference is caused by the large mature olive area of the latter.

Livestock output was also variable, and low. The combined crop and livestock net output (shown as whole farm net output per person) was also extremely variable, ranging from LS 344 to LS 5038/person across farms and seasons. Whilst it would be expected that some correlation could be shown between land/person ratio, and whole farm net output per person, the small sample and the variation preclude this.

However, the data do illustrate the circumstances under which farm families live: one of extreme variation caused by what might be termed random catastrophic events.

In terms of wheat budgets, the Δ system value ranged from - 376 to + 1321 kg/person. In 1977/78, six out of seven sample farmers were self-sufficient and in the following season, five out of seven. The deficient farmers were those with smaller holdings and smaller areas of wheat planted per person, except in one case where low yield was the main cause. Wheat consumption ranged between 0.43 and 0.82 kg/person/day.

Livestock feed consumption also varied between farms, from 0.99 to 3.02 GJME/head and 7.9 to 19.0 kg DCP/head in 1977/78, and 0.96 to 1.99 GJME and 8.1 to 11.8 kg DCP/head in 1978/79. Milk production ranged between 60 and 103 kg/head in 1977/78 and between 60 and 83 kg/head in 1978/79. There were no significant correlations between feed consumption and milk production except one for DCP and yield in 1978/79 ($r = 0.77$; $p = 0.05$).

Livestock net output per head varied considerably, from LS - 324.7 to 222.0 in 1977/78, and LS - 324.7 to 442.9 in 1979/80. These variations again reflect somewhat random events: the death of a cow, an unusually poor sale price for several animals, or disease.

Negative correlations can be shown between net output and feed cost (r - 0.71 and - 0.63 in 1977/78 and 1978/79 respectively), which, although statistically insignificant, follow the trend shown earlier in Figure 3.11.

3.9.2 Village 1B/05 - Atareb

Village 1B/05 was shown in section 3.2 to 3.4 to have the highest productivity per hectare of all the Aleppo villages. However, like 1A/13, this covers a considerable range, from LS 211 to 1072/ha. If we look at the breakdown of these extreme values, the reasons for the variation become clear. The highest value resulted from farmer No. 4, one of the poorest in the sample, having 73 per cent of the land under winter crops, which performed reasonably well in 1978/79. Farmer No. 1, with the lowest value, had 64 per cent of his crop land under water melon, which gave a low yield and produced a negative net output. However, farmer No. 1's wheat yielded as well as No. 4's.

Farmer No. 3, in spite of having irrigation on 66 per cent of his area, had only an average overall output on account of low yields of cotton, faba bean, and sugar beet.

The allocation of land to summer crops is obviously something of a gamble, as the decision has to be taken early in the season before the rainfall pattern can be judged. It is interesting to note that in the subsequent 1979/80 season, some farmers, for example No. 1, swung over to a predominantly winter crop mix which at least should guarantee a reliable income.

TABLE 3.45 VILLAGE 1B/05

RESOURCE ENDOWMENT AND PRODUCTIVITY

FARMER No.		2	4	3	7	1	6	5
Whole farm area (donums)		30	35	50	61.5	63.5	93	98.5
Family size		8	8	11	11	6	4	16
Land/person ratio		3.8	4.4	4.6	5.6	10.6	23.3	6.2
Proportion of land in soil classes one and two (per cent)		79	100	100	83	92	70	79
Crop net output/ha (LS)	1978/79	902	1072	605	960	211	726	804
Crop net output/person (LS)	1978/79	1026	394	275	537	224	1688	426

Only three out of seven families rely on agriculture and agricultural labouring. Others receive income from machinery ownership, labouring outside, driving and possibly other sources. It is impossible to estimate the total income position for this village, as neither livestock nor other sources were recorded in detail.

From our knowledge of the seven families in 1B/05, we can conclude that outside, or at least non-agricultural, income sources are of considerable importance, in spite of the high land productivity.

3.9.3 Village 2A/06 - Aqburhan

Measures of resource endowment and productivity for sample farmers are given in Table 3.46. In this village, the sampling method resulted in two rather discrete groups of holdings: four farms of under five hectares, and six farms of over 19 hectares. The smaller farms generally had higher proportions of good soil -- which was a result of redistribution in the Land Reform. Livestock ownership per person was higher, with one exception, in the group of larger holdings.

Unlike village 1A/13, data from this village shows an expected relationship between land/person ratio and whole-farm output per person: for both seasons the positive correlation is highly significant.

Net outputs per hectare for crops showed less variation than in 1A/13 between farm and season, although overall productivity levels were lower.[1/] However, the difference in land/person ratio increased the variability in whole-farm net output considerably (C. of V. 72 per cent).

1/ Coefficients of variation in net output/ha were 85 and 48 per cent respectively in 1A/13 and 2A/06.

TABLE 3.46

VILLAGE 2A/06

RESOURCE ENDOWMENT AND PRODUCTIVITY

FARMER NO.		34	32	29	11	19	8	20	1	16	17
Whole farm area (donums)		15	40	41	49	191	195	206	230	292	302
Family size		4	8	2	8	7	5	3	14	7	9
Land/person ratio (donums)		3.8	5.0	20.5	6.1	27.3	39.0	68.6	16.4	41.7	33.6
Proportion of land in soil class one and two (per cent)		100	100	100	96	45	86	45	80	81	81
Milking head/person		0.0	0.6	5.0	1.5	3.0	2.6	3.0	1.7	3.1	2.1
Crop net output/ha	77/78	461	204	430	-	196	267	354	322	-	230
	78/79	-	910	505	462	434	-	295	165	368	320
Crop net output/person	77/78	173	102	882	-	534	1042	2432	529	-	772
	78/79	-	455	1034	283	1183	-	2025	272	1534	1075
Livestock net output/person	77/78	-	-44	329	-	917	330	595	242	-	68
	78/79	-	539	1047	317	1481	-	1343	153	1169	176
Whole farm net output/person	77/78	173	160	1211	-	1451	1372	3027	771	-	840
	78/79	-	994	2081	600	2664	-	3367	425	2703	1251

As in other villages, fluctuations in net output are explained by random inter-actions of crop mix and environment. For example, farmer No. 32 planted 50 per cent of his land to summer crops in 1977/78, and suffered a crop failure. In 1978/79 he increased the barley area considerably, and achieved the highest yield on the sample, and the effects on overall net output were considerable.

There is some indication that smaller farms achieved higher net output per hectare ($r = 0.53$; $p = 0.05$), but this reflects differences in soil class, and the fact that larger farms had tree areas the production of which was probably under-recorded.

For individual farmers, the value of wheat Δ system ranged from - 205 to + 88 kg/person in 1977/78 and - 180 to + 883 kg/person on 1978/79. In the first season, four out of eight farmers were deficient, and in the second year three out of eight. Not all farmers aimed for wheat self-sufficiency; the areas planted per person ranged from 0.75 to 11.1 donums, the smaller areas being planted by holdings with small land/person ratios. One smaller farmer grew no wheat at all in the second season, splitting his area between barley and summer crops. This illustrates a modification to the general self-sufficiency rule: where land/person ratios are small, the proportion of land under wheat does not increase indefinitely, but is constrained either by rotational principles, or by choice should other crops be more profitable. The maximum area that wheat could occupy is 50 per cent of any farm, and if other crops are required, for example lentil for cash, or vetch for fodder, the proportion must be less.

The consequences of having cereals follow cereals, which is the result of increasing either the wheat or barley area too much, are low yields, as experienced by farmer No. 1 in season two, when a considerable area of barley was planted after barley in an attempt to provide feed.

Livestock feed consumption ranged between 2.1 to 5.2 GJME/head and 11.6 to 30.6 kg DCP/head in 1977/78, and 1.6 to 4.7 GJME and 8.1 to 27.8 kg DCP/head in 1978/79. Milk production was between 46 and 77 kg/head in 1977/78, and between 58 and 138 kg/head in 1978/79. Livestock net output varied from LS - 39 to + 139 per head in 1977/78, and LS 63 to 447 in 1978/79.

No relationships can be shown between consumption of either feed energy or protein and milk production. As in 1A/13, negative correlations exist between net output and feed consumption, but the sample is too small for these to be significant.

The actual livestock density (in terms of milking ewes and goats per hectare) ranged from 0.63 to 2.44 head/ha. The value of home produced feed per hectare was correlated with this livestock density indicating that there was an attempt by individual farmers to balance the feed generating capacity of the cropping mix to the desired level of livestock held. This concurres with the overall picture given by the feed energy Δ system values for the whole system (Appendix 3.5).

Village 2A/06 is of particular interest amongst all those included in the present study, for it employs a balanced mixed farming system, in which both cropping and livestock are of importance. Located at about 325 mm mean annual rainfall, its system could be said to represent the "average" between the crop-dominated systems of the higher rainfall areas, to the livestock biased systems of the drier areas. This village, and others like it, would be very suitable for continuing work concerned with increasing combined crop and livestock productivity, as it illustrates the case where animals are of obvious importance, but where there is also a reasonably high crop potential.

3.9.4 Village 2B/01 - Deir Qaaq

Village 2B/01 marks the change from systems of medium to high productivity, represented by villages IRR/09 to 2A/06, to systems of low productivity. The change is brought not only from a further decline in rainfall, but also by a deterioration in soil quality which is particularly marked in this village.

Given years of exceptionally good rainfall, crop productivity in 2B/01 would tend to be less than in "drier" villages where soil characteristics, particularly depth, are more favourable. However, productivity estimates shown in Section 3.4 and 3.7 are slightly affected by the small areas of irrigated deep soil that only some farmers have access to: thus the position individual farmers find themselves in can vary considerably. This is indicated in Table 3.47. By the end of 1979, four of eight farmers on the sample had acquired pumps, but the effect of this on net outputs was not significant in most cases owing to operating and water shortage problems. However, the potential impact of irrigation can be seen from Farmer No. 2 who was one of the earliest in the village to acquire a pump.

Land/person ratios vary considerably, but in the case of farmer No. 17 -- with 98 donums per person, this is to little advantage as the soil is of very poor quality. Crop outputs are all exceedingly low, as much of the village is under fallow, and livestock outputs are generally higher. The importance of livestock, which became apparent mainly in 2A/06, is further illustrated in this system.

Between farms and seasons, the level of personal income was very variable (C. of V. 80 per cent), and six out of eight farms were significantly dependant on other sources.

TABLE 3.47

VILLAGE 2B/01

RESOURCE ENDOWMENT AND PRODUCTIVITY

FARMER NO.		32	31	16	5	18	25	2	17
Whole farm area (donums)		138	185	202	214	220	288	335	979
Family size		5	12	8	7	12	12	10	10
Land/person ratio (donums)		27.6	15.4	25.3	30.6	18.3	24.0	33.5	97.9
Proportion of land in soil class one and two (per cent)		8	9	14	9	15	5	14	4
Milking head/person		1.0	4.1	2.5	0.0	1.25	0.33	2.7	4.8
Crop net output/ha (LS)	77/78	8	N.A.	79	39	85	49	173	- 2
	78/79	15	-	133	117	171	100	379	46
Crop net output/person	77/78	198	-	200	120	155	119	578	-173
	78/79	407	-	345	359	300	239	1260	436
Livestock net output/person	77/78	-78	-	872	24	213	507	473	356
	78/79	-116	-	1320	2	424	-27	476	764
Whole farm net output/person	77/78	120	-	1072	144	368	620	1051	183
	78/79	291	-	1665	361	724	212	1706	1200

Whilst the aggregate samples wheat sufficiency was more or less adequate in 1977/78 and surplus producing in 1978/79, this was the result of the production of a minority of farmers irrigating part of their area (two farmers in the first season and four in the second). The wheat Δ system value for individuals was from - 116 to + 495 kg/person in 1977/78, and from - 12 to + 1076 kg/person in 1978/79. It can be seen that self-sufficiency was effectively possible for all farmers in the second season, but for only two out of eight in the first.

Data on areas planted to wheat per person shows that this declined with land/person ratio ($r = 0.98$; $p = 0.01$), indicating, as in 2A/06, that wheat area is determined more by rotational factors than by family requirements. As it is essential that wheat follows a fallow in this environment, the upper limit on wheat inclusion in the rotation is easily appreciated.

Livestock net output figures per head are confounded by the effect of fatteners -- assuming that "head" includes the "permanent" flock only. In 1977/78, it ranged from LS - 77.8 to + 256.0, and in 1978/79 from LS - 109.7 to + 620.9. Apparent feed consumption was from 0.57 to 6.84 GJME/head and 3.4 to 43.7 kg DCP/head in 1977/78, and 2.26 to 8.56 GJME and 10.0 to 58.8 kg DCP/head in 1978/79. The upper limits include fattener feed and are therefore overestimates.

In the first season, three out of eight farms produced more feed energy from their crops than the animals consumed, but in 1978/79 it was only one. All other farms were deficient, sometimes considerably so. This supports the general contention that in the drier villages, low crop productivity encourages livestock investment to give an alternative income source, but simultaneously ensures that the feed supply is deficient, throwing the system out of balance.[1/]

1/ This is not to suggest that livestock and crop systems need be complementary: many of the world's livestock industries are based on feed imported into the system. But the absolute nature of the deficiency in villages like 2B/01 needs to be appreciated, to dispel any illusions that small ruminants in these areas are closely interdependant with crops.

No significant relationships can be shown between feed consumption and milk production. However, in 1978/79 there was a highly significant ($r = 0.91$; $p = 0.01$) correlation between the amount of feed purchased and the net output, a trend that is contrary to those shown in other villages and between villages. The usual negative relationships can be explained by assuming that the less animals are dependant on imported feed, from having more of their requirement met from local grazing, the more profitable the system. We can only guess that the positive relationships here reflects an efficient use of feed through fattening, rather than permanent, animals. It is certainly the impression of Farm Systems staff that farmers in 2B/01, and 2A/06, are better livestock husbandry men than farmers in either the wetter, or the poorer drier villages.

3.9.5 Village 3/02 - Aqrabeh

Whilst having only a slightly lower mean annual rainfall than village 2B/01, 3/02 differs in several important ways. Firstly, while there is overlap in the range of land/person ratios, 3/02 has many smaller holdings resulting in ratios of between 2 and 12 donums/person. This is nevertheless counteracted slightly by there being a much larger proportion of deeper soil: it can be seen from Table 3.48 that the 3/02 sample's smaller holdings had a high percentage of their land in soil classes one and two.

Secondly, the livestock enterprise in 3/02 is dominated by lamb fattening operations, rather than by a large permanent flock. There may be several reasons for this, but it largely results from the higher human population density. Small land/person ratios must also result in small animal heads/person ratios. (See Table 3.3 in Section 3.1.2).

Thirdly, through a system of family interrelationships, the possibility of seeking work in Saudi Arabia is made much greater in 3/02 than in other dry villages in the study. As shown in Figure 3.15 in Section 3.8.4, village 3/02 was the one most dependant on outside sources of income. For the sample farmers, these were:

TABLE 3.48

VILLAGE 3/02

RESOURCE ENDOWMENT AND PRODUCTIVITY

FARMER No.		69	52	40	49	20	72	8	9	2	26	5	16
Whole farm area (donums)		24	34	36	40	64	111	140.5	162	169	231	307	432
Family size		10	8	8	8	7	9	5	8	10	11	9	13
Land/person ration (donums)		2.4	4.3	4.5	5.0	9.1	12.3	28.1	20.3	16.9	21.0	34.1	33.2
Proportion of land in soil class one and two (per cent)		100	100	100	100	70	70	46	67	68	86	57	72
Milking head/person		3.6	0.5	3.0	0.4	1.9	1.4	0.8	1.0	1.1	2.4	0.3	0.6
Crop net output/ha (LS)	77/78	145	359	4	342	135	211	140	123	80	100	1	96
	78/79	169	1	-9	173	1	151	133	43	20	23	15	48
Crop net output/person	77/78	35	153	19	171	127	260	394	249	135	221	2	320
	78/79	41	N.A.	-41	86	9	186	404	87	34	48	52	161
Livestock net output/ person	77/78	-4	4	-236	254	-426	345	-22	-189	515	102	102	-142
	78/79	148	N.A.	332	38	-285	19	119	49	143	-268	-79	-226
Whole farm net output/ person	77/78	31	N.A.	-217	425	-299	605	372	60	650	-323	104	178
	78/79	189	N.A.	291	124	-276	205	523	136	9	-220	-27	-65

Receiving income from:	Number of households in: 1977/78	1978/79
Cropping	12	12
Permanent livestock	12	12
Fattening livestock	7	3
Agric. labouring - village	3	1
Agric. labouring - away	5	4
Non-Agric. labouring - village	1	1
Non-Agric. - away	6	0
Non-Agric. - Saudia	5	8
Regular employment	1	1
Trading - small goods	1	0
Trading - livestock	1	1
Trading - international	0	2
Total households	12	12

Most households had several sources but income from Saudia replaced in 1978/79 that from local labouring, lamb fattening, and to some extent cropping. This is shown by the fact that for eleven out of twelve households, the fallow area increased in the second year as a result of farmers not bothering to plant their poorer soils.

Table 3.48 shows the generally low levels of farm output and personal income. The variation in whole farm net output per person was extremely high across farm and season (C. of V. of 190 per cent). Six out of 22 values were negative.

The very poor performance of the livestock sector needs some comment, for it can be seen from Figure 3.13 that a break occurs between villages 2B/01 and 3/02 in what appears to have been a trend to the increasing importance of livestock. The gross feed insufficiency, illustrated in Appendix 3.5, is possibly involved, and this is supported by a strong negative correlation in season 2 ($r = -0.93$; $p = 0.01$) between the amount of supplementary feed purchased and net output.

The heavy dependance on fattening is also implicated for two reasons. First, farmers reported that in many fattening deals, profitability was extremely low owing to the unusually high costs of feed in recent seasons, and partly to unfavourable market price fluctuations. Second, farmers in 3/02 were generally too poor to invest much of their own capital in fattening. In many cases, the merchant partner supplied both animals and feed, in which case the farmer's return was low, rewarding him only for his labour. Thirdly, the fattening operations in 3/02 were performed in an ad hoc manner: farmers had no regular cycle of purchase and sale, and it is likely that this led to some inefficiency compared to farms with better organisation, for example some of the fattening cooperatives.

Wheat production was surplus to requirements in four farms in 1977/78, but only one in 1978/79. The Δ system/person values ranged from - 137 to + 280 kg in the first season, and - 297 to + 15 kg in the second season. Deficit farmers were generally, though not always, those with smaller land/person ratios.

Milk production ranged between 48 and 75 kg/head in 1977/78, and 23 to 100 kg/head in 1978/79. Low yields were reported by farmers to be due to disease early in the lactation period.

With regard to villages such as 3/02, the question of greatest importance relates to the availability of alternative income, and the uses to which it might be put. In particular, we should address ourselves to the question: can agriculture be made an attractive enough investment to absorb some of the newly generated cash surplus, for the evidence of two seasons is that it has not proved at all attractive. Without high levels of supplementary income, or improved prospects in agriculture, families in such high density dryland villages are bound to join the already considerable urban drift.

3.9.6 Village 4/04

As with village 3/02, it is only non-farm income that has kept village 4/04 alive in the two seasons under study. Even though data from these two villages is in general less reliable than the others, farmers in whom our interviewers have some confidence can be seen to have had a very hard time (see Nos. 7, 19, 20, 21, 28 in Table 3.49).

However, in 1977/78, when rainfall in 4/04 was not particularly good, but not disastrous, some individual families' personal incomes from farming were fair (e.g. 6, 21), and even exceeded those of some of the worse placed families in the higher rainfall villages. However, the variation in whole farm net output per person was tremendous over all farms and seasons, with a coefficient of variation of over 500 per cent.

This level of variation, coupled with the adverse debt situation illustrated for this village in section 3.7, suggests that this environment is not conducive to agricultural investment. The same factors help explain the unpopularity of fallowing: sample farmers stated that whilst they thought there was some benefit to be had from regular fallowing, it made more sense to plant a larger area. If the season was good, the extra area would more than compensate for the losses of a dry season.

The wheat budget situation of all sample farmers was very poor, and all families had negative Δ system values in both seasons. The worst values in seasons one and season two respectively were - 722 and - 800 kg/person, and all values were relatively large compared to personal consumption figures.

TABLE 3.49

VILLAGE 4/04

RESOURCE ENDOWMENT AND PRODUCTIVITY

FARMER No.		6	7	17	5	1	21	19	20	28
Whole farm area (donums)		165	170	175	180	185	205	232	237	275
Family size		6	9	3	8	2	4	9	7	13
Land/person ratio (donums)		27.5	18.9	58.3	22.5	92.5	51.3	25.7	33.9	21.2
Proportion of land in soil class one and two (per cent)		76	76	76	76	76	71	71	71	71
Milking head/person		0.7	0.9	0.0	1.1	3.5	1.3	0.4	2.9	1.0
Crop net output/ha	1977/78	83	146	- 5	39	52	106	54	42	66
	1978/79	-15	-43	-17	5	-78	-10	5	- 2	- 4
Crop net output/ person	1977/78	228	276	-30	87	477	542	140	141	139
	1978/79	-43	-81	-94	103	-721	-52	12	- 7	- 9
Livestock net output/ person	1977/78	272	-32	N.A.	-42	-1240	145	0	- 3	-113
	1978/79	97	+21	-710	-101	-973	-343	107	-104	+144
Whole farm net output /person	1977/78	500	244	N.A.	45	-763	687	140	138	26
	1978/79	140	-60	-804	2	-1694	-395	119	-111	135

Livestock net output was from LS - 248 to + 408/head in 1977/78, and from LS - 274 to + 321/head in 1978/79. These values were negatively correlated with feed purchases in the both seasons, significantly so in 1977/78 (r = -0.72; p = 0.05). No relationships were apparent between feed consumption and milk production, which ranged between 40 to 112 kg/head in season one, and 15 to 105 kg/head in season two.

The extremely low productivity in village 4/04 between 1977 and 1979 is possibly not unique; it is reported through the farming systems survey contacts in the marginal areas, i.e. those in the immediate hinterland of zone four, that over the same period, many families sold up their livestock and migrated to other areas. Families in 4/04 generally do not have enough animals to sell in order to finance such a move, but at least they have the opportunity of looking for work in various projects to the east of Aleppo.

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APPENDIX 3.1

AGRICULTURAL ZONING AND SOIL PRODUCTIVITY CLASSIFICATIONS IN NW SYRIA

A) Agricultural Zoning

The official classification of the Ministry of Agriculture is based on rainfall, and identifies five Agricultural Stability zones, the first of which is divided into two sub-zones. They are:

Zone 1 a	Average rainfall over 600 mm
Zone 1 b	Average rainfall between 350 and 600 mm
Zone 2	Average rainfall between 250 and 300 mm and not less than 250 mm in two years out of three
Zone 3	Average rainfall over 250 mm and not less than this in one year out of two
Zone 4	Average rainfall 200-250 mm and not less than 200 mm in one year out of two
Zone 5	Below 200 mm, and covering the rest of the country.

B) Soil Productivity

Farmers in the Farm Systems Village Level Studies (VLS) recognise several soil types by their productivity and physical characteristics. Broadly speaking they are as follows:

Type 1	Red/black, deep with a high cracking clay content
Type 2	Red/yellow, medium to deep, lower clay content
Type 3	Red/yellow/white, shallow to medium depth, frequently rocky.

An idea of the combined productivity differences according to rainfall zone and soil type is given in the Table below:

GRAIN YIELD OF BARLEY BY AGRICULTURAL ZONE AND SOIL TYPE, 1979 SEASON - (kg/ha)

ZONE	1	2	3	4
Soil Type				
1	2244	1362	584	471
2	1681	929	587	464
3	1185	696	505	281

Source: Farmers' Field Sampling, VLS

For a further discussion of agricultural zoning and soil types see:-

Farming Systems Project Report No. 1, Section 2 (Physical Environment) and 3.2 (Crops), and Farming Systems Project Report No. 2, Section 5.

APPENDIX 3.2 VILLAGE INFORMATION AND BASIC ANALYSIS

VILLAGE 1A/13

	Total	n	$\bar{x}$	S.E.	C.V. (%)
Age: Farmer	-	37	45		
Age: Wife 1	-	38	39		
Age: Wife 2	-	4	29		
Total Household (Farming)	286	39	7.3	0.7	60.9
Children <9	83	25	3.3	0.3	42.3
Children 9-16 total	73	25	2.9	0.1	60.9
Children 9-16 school	27	15	1.9	0.3	59.2
Young P. 17-24 total	38	19	2.0	0.3	66.7
Young P. 17-24 abs.	4	4	1		
People 24-45	57	29	2.0	0.2	46.0
People >45	38	23	1.7	0.1	34.7
Land area (ha)	398.9	39	10.2	1.4	85.2
Area owned	139.8	9	15.5	3.9	75.6
Area from Land Reform	259.1	36	7.2	0.5	42.8
Area from State	0				
Area farmed	398.9	39	10.2	1.4	85.2
Area owned and shared	0				
Rainfed Land					
Type 1: area	199.8	38	5.3	0.6	69.7
plots	56	38	1.5	0.1	51.7
Type 2: area	40.3	21	1.9	0.4	95.5
plots	28	21	1.3	0.1	43.3
Type 3: area	20.4	4	5.1	3.1	122.6
plots	7	4	1.8	0.5	54.7
Type 4: area	0				
plots	0				
Irrigated Land	0				
area	0				
plots	0				
Trees area	138.4	33	4.2	0.8	107.9
plots	62	33	1.9	0.1	43.6
Sheep	227	20	11.4	2.2	88.5
Goats	210	27	7.8	1.3	87.1
Dairy cows	4	3	1.3	0.3	43.3
Poultry	436	31	14.1	1.5	61.2
Draught animals	14	12	1.2	0.1	33.4
Tractor & plough	5	5			
Cultivator	4	4			
Combine	5	5			
Pick up	0	0			
Bank Loan	34				
Read and write	10				
Cooperative members	33				

APPENDIX 3.2 VILLAGE INFORMATION AND BASIC ANALYSIS

VILLAGE 1B/02

	Total	n	$\bar{x}$	S.E.	C.V. (%)
Age: Farmer		98	47		
Age: Wife 1		96	40		
Age: Wife 2		10	35		
Total Household (Farming)	898	98	9	0.4	46.0
Children 9	363	92	4	0.2	49.8
Children 9-16 total	157	71	2	0.1	55.6
Children 9-16 school	98	53	2	0.1	56.5
Young P. 17-24 total	124	53	2	0.2	55.6
Young P. 17-24 abs.	27	18	2	0.1	41.2
People 24-45	155	75	2	0.1	57.5
People 45	102	55	2	0.1	33.5
Land are (ha)	560.3	98	5.7	0.3	60.5
Area owned	370.7	94	3.9	0.2	61.1
Area from Land Reform	183.0	33	5.5	0.3	35.7
Area from State	0				
Area farmed	626.6	94	6.6	0.5	66.0
Area owned and shared	41.0	8	5.1	1.5	88.8
Rainfed Land					
Type 1: area	214.9	83	2.6	0.2	60.0
plots	289	82	3.5	0.3	75.6
Type 2: area	124.6	72	1.7	0.2	73.4
plots	213	72	2.9	0.3	74.9
Type 3: area	103.2	29	3.6	0.4	58.2
plots	89	29	3.1	0.3	51.5
Type 4: area	63.5	21	3.0	0.5	68.8
plots	52	21	2.5	0.3	52.1
Irrigated Land					
area	9.2	5	1.8	0.3	34.5
plots	5	5	1		
Trees: area	48.1	76	0.6	0.05	73.9
plots	124	76	1.6	0.1	53.7
Sheep	594	42	14.1	3.4	155.6
Goats	167	62	2.7	0.2	75.6
Dairy cows	11	8	1.4	0.4	77.1
Poultry	974	71	13.7	1.8	110.2
Draught animals	82	63	1.3	0.1	47.1
Tractor & plough	10	10	1		
Cultivator	7	7	1		
Combine	2	2	1		
Pick up	8	8	1		
Bank Loan	2				
Read and write	56				
Cooperative members	12				

APPENDIX 3.2 VILLAGE INFORMATION AND BASIC ANALYSIS

VILLAGE 2A/06

	Total	n	$\bar{x}$	S.E.	C.V. (%)
Age: Farmer		39	42		
Age: Wife 1		37	35		
Age: Wife 2		2	36		
Total Household (Farming)	283	39	7	0.5	39.7
Children 9	102	32	3	0.3	44.7
Children 9-16 total	63	27	2	0.2	47.5
Children 9-16 school	35	19	2	0.2	41.5
Young P. 17-24 total	25	13	2	0.4	68.7
Young P. 17-24 abs.	2	2	1		
People 24-45	61	35	2	0.1	32.2
People 45	60	21	2	0.2	49.2
Land area (ha)	500.5	39	12.8	2.0	94.9
Area owned	454.5	27	16.8	2.4	75.3
Area from Land Reform	46.0	13	3.5	5.4	55.2
Area from State	0				
Area farmed	503.5	39	12.9	1.9	93.8
Area owned and shared	0				
Rainfed Land					
Type 1: area	222.5	34	6.5	1.0	92.0
plots	54	34	1.6	0.1	41.3
Type 2: area	121.5	24	5.1	1.5	143.1
plots	43	24	1.8	0.3	69.8
Type 3: area	120.3	24	5.0	1.0	96.1
plots	36	24	1.5	0.1	48.2
Type 4: area	0				
plots	0				
Irrigated Land					
area	0				
plots	0				
Trees area	39.1	17	23	0.7	121.3
plots	33	17	1.9	0.3	56.1
Sheep	606	32	19	3.1	91.1
Goats	111	27	4	0.8	95.5
Dairy cows	0				
Poultry	959	38	25	1.8	43.2
Draught animals	10	8			
Tractor & plough	10				
Cultivator	10				
Combine	1				
Pick up	0				
Bank Loan	18				
Read and write	16				
Cooperative members	17				

APPENDIX 3.2 VILLAGE INFORMATION AND BASIC ANALYSIS

VILLAGE 2B/01

	Total	n	$\overline{x}$	S.E.	C.V. (%)
Age: Farmer		46	48		
Age: Wife 1		43	41		
Age: Wife 2		0			
Total Household (Farming)	391	46	9	0.4	34.9
Children 9	124	37	3	0.3	45.7
Children 9-16 total	94	40	2	0.1	39.2
Children 9-16 school	58	32	1.8	0.2	53.2
Young P. 17-24 total	65	31	2.1	0.2	59.5
Young P. 17-24 abs.	19	15	1.3	0.2	46.9
People 24-45	57	34	1.7	0.1	38.1
People 45	51	31	1.6	0.1	40.2
Land area (ha)	870.0	45	19.3	1.0	36.2
Area owned	68.0	3	22.7	5.7	43.3
Area from Land Reform	802.0	44	18.2	0.9	33.3
Area from State	0				
Area farmed	1064.0	44	24.2	2.0	54.4
Area owned and shared	39.5	2	19.8	2.3	16.1
Rainfed Land					
Type 1: area	15.6	14	1.1	0.2	70.1
plots	15	14	1.1	0.1	24.9
Type 2: area	70.1	41	1.7	0.2	59.7
plots	58	40	1.5	0.1	41.2
Type 3: area	699.3	44	15.9	0.9	37.3
plots	131	44	3.0	0.2	38.0
Type 4: area	0				
plots	0				
Irrigated Land					
area	10.8	6	1.8	0.3	40.5
plots	6	6	1		
Trees: area	59.7	22	2.7	0.4	69.2
plots	41	22	1.2	0.1	49.9
Sheep	976	25	39	6.9	88.4
Goats	71	14	5.1	0.9	64.5
Dairy cows	0				
Poultry	1291	33	39.1	4.3	63.2
Draught animals	17	15	1.1	0.1	45.6
Tractor & plough	1				
Cultivator	1				
Combine	0				
Pick up	0				
Bank Loan	38				
Read and write	20				
Cooperative members	41				

APPENDIX 3.2 VILLAGE INFORMATION AND BASIC ANALYSES

VILLAGE 3/02

	Total	n	$\bar{x}$	S.E.	C.V. (%)
Age: Farmer		63	48		
Age: Wife 1		60	37		
Age: Wife 2		13	32		
Total Household (Farming)	571	64	9	0.5	47.4
Children 9	229	59	4	0.2	49.0
Children 9-16 total	97	39	2	0.2	46.9
Children 9-16 school	28	20	1	0.1	42.7
Young P. 17-24 total	79	39	2	0.2	58.7
Young P. 17-24 abs.	10	10	1		
People 24-45	104	54	2	0.1	47.1
People 45	58	37	2	0.1	35.4
Land area (ha)	1058.0	58	18.2	1.6	66.8
Area owned	8.0	2	4.0	1.0	35.3
Area from Land Reform	0				
Area from State	1052.5	55	19.1	1.6	62.5
Area farmed	1067.5	63	16.9	1.6	73.4
Area owned and shared	25	1			
<u>Rainfed Land</u>					
Type 1: area	538.5	64	8.4	0.3	79.5
plots	491	64	7.7	0.08	80.1
Type 2: area	274.5	45	6.1	0.6	65.7
plots	301	45	6.7	0.7	70.0
Type 3: area	217.0	40	5.4	0.6	68.0
plots	186	40	4.6	0.5	73.1
Type 4: area	16.0	4	4.0	1.6	79.1
plots	5	4	1.2	0.2	40.0
<u>Irrigated Land</u>					
area	0				
plots	0				
Trees: area	0				
plots	0				
Sheep	1081	44	24.6	33.3	
Goats	128	31	4.1	0.6	81
Dairy cows	2	2			
Poultry	647	46	14.1	1.2	58.3
Draught animals	25	18	1.4	0.1	43.6
Tractor & plough	1				
Cultivator	1				
Combine	-				
Pick up	-				
Bank Loan	33				
Read and write	25				
Cooperative members	51				

APPENDIX 3.2 VILLAGE INFORMATION AND BASIC ANALYSES

VILLAGE 4/04

	Total	n	$\bar{x}$	S.E.	C.V. (%)
Age: Farmer		28	53		
Age: Wife 1		23	41		
Age: Wife 2		2	30		
Total Household (Farming)	193	30	6	0.6	51.1
Children 9	66	19	3	0.3	44.3
Children 9-16 total	32	15	2	0.3	49.7
Children 9-16 school	15	9	2	0.3	52.0
Young P. 17-24 total	23	13	2	0.2	41.0
Young P. 17-24 abs.	7	5	1	0.2	39.0
People 24-45	41	25	2	0.1	42.7
People 45	31	24	1	0.1	42.6
Land area (ha)	589.5	30	19.7	6.4	18.0
Area owned	0	0			
Area from Land Reform	589.5	30	19.7	6.4	18.0
Area from State	0				
Area farmed	589.5	30	19.7	6.4	18.0
Area owned and shared	0				
<u>Rainfed Land</u>					
Type 1: area	198.0	30	6.6	1.7	14.1
plots	30	30	1	-	-
Type 2: area	246.0	30	8.2	3.4	22.7
plots	30	30	1	-	-
Type 3: area	145.5	30	4.9	2.1	23.5
plots	30	30	1		
Type 4: area	0				
plots	0				
<u>Irrigated Land</u>					
area	0				
plots	0				
Trees: area	0				
plots	0				
Sheep	286	23	12.4	2.3	89.2
Goats	44	16	2.8	0.4	65.7
Dairy cows	0				
Poultry	197	26	7.6	0.6	37.7
Draught animals	30	21	1.4	0.1	47.3
Tractor & plough	0				
Cultivator	0				
Combine	0				
Pick up	0				
Bank Loan	30				
Read and write	5				
Cooperative members	30				

APPENDIX 3.3

WHEAT FLOW BUDGETS 1977/78 (SEASON 1) AND 1978/79 (SEASON 2)

(kilograms)

	1A/13		1B/05	2A/06		2B/01		3/02		4/04	
	1	2	2	1	2	1	2	1	2	1	2
CROPS SECTOR											
START STOCK	4860	4436	1552	2460	1295	3070	1505	4085	2165	700	630
+ Purchased seed	–	136	540	1105	1557	1980	1313	960	2364	2267	2130
– Trans. in seed	250	196	–	–	125	–	1800	–	–	–	–
– Consumed seed	5110	4568	2092	3565	2977	3120	4618	5045	3645	2967	2540
HARVESTED	53988	30948	25645	20810	18675	16620	33275	25619	10445	8680	2150
– Trans. combine	4379	3489	915	1105	1309	600	1088	1334	–	875	–
– Share crop	–	–	917	–	–	1295	11513	–	–	–	–
– Trans. out	3075	1250	905	615	1075	–	–	765	750	227	–
– Trans. house	15167	12580	8488	12090	10281	8710	13737	17215	8834	6573	1632
– Trans. feeds	2650	5250	–	1720	–	–	2287	175	–	–	–
– Losses	1184	245	–	2000	460	–	–	–	–	–	–
– Sales	23142	5194	13775	1875	3225	6440	2250	4275	–	–	–
= END STOCK	4391	3140	645	1405	2325	1505	3125	1855	1745	1005	738
HOUSEHOLD SECTOR											
START STOCK	8655	9405	N.A.	4880	9296	5812	5645	7918	7078	3570	4726
+ Purchased	120	–	–	1874	4924	2060	369	4502	8729	13658	11361
– Trans. from crops	15167	12580	–	12090	10281	8710	13737	17215	8834	6573	1632
– Consumption	15612	11957	–	11572	12116	5645	9011	22380	20246	18190	14354
= END STOCK	8330	10028	–	7271	12385	10937	10740	7255	4395	5611	3365
ANIMAL FEEDS SECTOR											
START STOCK	850	–	N.A.	25	1000	–	–	–	–	–	–
+ Purchases	250	–	–	100	–	630	1010	1180	–	–	–
– Trans. from crops	2650	5250	–	1720	–	–	2287	175	–	–	–
– Consumption	3650	1000	–	1845	1000	630	3297	1295	–	–	–
= END STOCK	100	4250	–	–	–	–	–	–	–	–	–
Δ Flows	+29976	+ 9601	+15972	515	– 997	+ 3665	+10357	– 268	–10343	–15050	–13491
Δ Stocks	– 1544	+ 2327	– 907	1312	+ 3119	– 1732	+ 6715	– 2893	– 3103	+ 2346	– 1253
Δ System	+28432	+11928	+15065	+ 1827	+ 2122	+ 1933	+17072	– 3161	–13446	–12704	–14744

APPENDIX 3.4

FEED VALUES USED IN FEED FLOW CALCULATIONS, AS-FED BASIS

Commodity Code	Commodity	Metabolisable Energy MJ/kg	Digestible Protein Crude (per cent)
W1, 2	Wheat grain	11.5	10.8
B	Barley grain	11.0	6.7
L	Lentil grain	11.8	18.6
Fv	Vetch grain	12.9	18.3
Tw	Wheat straw	6.8	1.4
TB	Barley straw	7.4	1.6
TW/B	Cereal straw, Ave	7.1	1.5
Leg	Legume straw	7.6	2.8
WB	Wheat bran	10.6	9.1
LH	Lentil hull	9.5	8.1
CSC	Cotton seed cake	10.0	16.6
CSH	Cotton seed hull	11.3	0.3
SBP	Sugar beet pulp (dry)	9.7	N.A.
DB	Dried bread	10.0	-

Sources: 1) Metabolisable energy calculated for sheep from values collected by Farmkey Ltd. in "First Livestock Development Project, Final Report Appendices I to VI". IBRD/MAAR (Syria)/Farmkey 1979.

2) Digestible protein calculated from crude protein estimates given by Farmkey and digestibility values for sheep derived from "Nutrient Requirements for Sheep", National Academy of Science, Washington, Bull. No. 5, 1968.

APPENDIX 3.5 COMBINED ANIMAL FEED FLOW BUDGETS FOR TWO SEASONS 1977/78 (SEASON 1) AND 1978/79 (SEASON 2)

(Gigajoules of Metabolisable Energy)

VILLAGE:	1A/13		1B/05	2A/06		2B/01		3/02		4/04	
Season	1	2	2	1	2	1	2	1	2	1	2
CROP SECTOR											
START STOCK	11.0	20.4	-	47.7	84.0	20.2	16.5	40.5	15.2	27.1	85.0
+ Purchase seed	4.4	4.0	-	16.8	3.0	1.7	12.6	34.0	35.4	125.0	48.1
+ Trans. in	-	-	-	-	-	-	3.9	-	-	-	-
Consumed as seed	15.4	24.4	-	64.5	87.0	21.9	33.0	74.5	50.6	152.1	133.1
HARVEST	142.8	125.9	359.4	496.6	736.2	260.7	368.8	427.4	246.1	616.9	100.0
- Trans. combine	-	-	-	4.3	35.3	-	1.1	-	-	50.0	-
- Share crop	-	-	-	-	-	-	-	-	-	-	-
- Trans. out	2.3	3.0	-	-	19.4	27.8	19.8	-	2.8	17.5	-
- Trans. house	-	-	-	-	-	-	-	-	-	-	-
- Trans. feeds	130.3	122.9	300.2	279.9	406.9	200.0	285.9	301.6	197.4	290.9	80.3
- Losses	-	-	-	-	-	-	-	-	-	-	-
- Sales	-	-	44.0	42.7	202.4	23.3	33.8	108.6	30.1	146.1	-
= END STOCK	10.2	0.0	18.2	69.7	72.2	9.6	28.2	17.2	15.8	112.4	19.7
ANIMAL FEEDS SECTOR											
START STOCK	40.5	39.9	N.A.	193.6	305.9	212.3	217.2	269.5	158.2	65.9	100.1
+ Purchased	110.5	52.5	-	145.2	50.6	659.8	447.5	895.6	803.5	290.9	337.2
+ Trans. from crops	130.2	122.9	-	379.9	406.9	200.0	285.9	301.6	197.4	290.9	80.3
- Consumption	211.3	114.7	-	495.3	500.0	853.8	759.9	1294.8	991.2	502.7	427.6
= END STOCK	70.0	100.6	-	223.4	263.4	218.3	190.7	171.9	167.9	145.0	90.0
Δ Flow	-112.7	- 53.5	N.A.	-115.1	+203.4	-610.4	-409.3	-821.0	-808.9	-202.4	-385.2
Δ Stock	+ 28.6	+ 40.2	N.A.	+ 51.9	- 54.3	- 4.6	- 14.8	-120.9	+ 10.4	+164.4	- 75.4
Δ System	- 84.1	- 13.3	N.A.	- 63.2	+149.1	-615.0	-424.1	-941.9	-798.5	- 38.0	-460.6

APPENDIX 3.6

QUANTITIES OF FEEDS CONSUMED

(kilograms)

VILLAGE:	1A/13		2A/06		2B/01		3/02		4/04	
Season	1	2	1	2	1	2	1	2	1	2
Barley grain	7389	3526	18565	20172	27608	25736	75994	56489	18036	14300
Wheat grain	3650	1000	1845	1000	630	3297	1355	295	-	-
Lentil grain	-	100	-	-	-	200	260	-	-	-
Vetch grain	-	100	2488	1105	-	495	-	-	-	-
Cereal straw	800	600	9500	9000	22600	29900	39680	33085	27145	23150
Legume straw	7870	5400	15415	22250	8700	2900	7310	2300	-	-
Cotton seed cake	700	1100	1210	1508	12104	7605	1550	1575	3652	4750
Cotton seed hulls	40	110	1000	335	8750	3970	1000	25	5140	2910
Wheat bran	100	140	450	50	6075	1885	7200	8595	1605	1750
Lentil hulls	-	-	2500	-	-	-	-	-	-	-
Sugar beet pulp	-	-	-	-	-	-	-	700	-	-
Dried bread	1416	300	-	-	-	5500	-	-	-	-
Concentrated	-	-	110	-	-	-	-	-	-	-
Onion	-	-	-	-	3000	-	-	-	-	-
Total kg fed	21965	12376	53083	55420	90717	81488	134329	103064	55578	46860

APPENDIX 3.7 GRAIN LEGUME FLOW BUDGETS 1977/78 (SEASON 1) AND 1978/79 (SEASON 2)

	LENTIL							CHICKPEAS	
VILLAGE:	1A/13		1B/05	2A/06		3/02[1/]		1A/13	
Season	1	2	2	1	2	1	2	1	2
CROP SECTOR									
START STOCK	260	540	724	2335	1875	1250	670	2070	2855
+ Purchase	140	-	335	112	45	1399	580	1236	480
+ Trans. in	-	-	-	-	-	-	-	-	-
- Consumed as seed	400	540	1059	2242	1763	2649	1250	3306	2555
HARVEST	935	518	4105	15915	5702	6005	785	21742	14345
- Trans. out	-	-	50	955	-	260	25	157	-
- Trans. house	475	163	805	316	275	695	95	368	121
- Trans. feed	-	100	-	-	-	260	295	-	-
- Sales	390	255	2110	13674	3922	3875	-	18442	10429
= END STOCK	70	-	1140	1170	1662	915	370	2775	3795
Δ Flow	250	+255	+1825	+14629[2/]	+3877	+2736	-555	+17368	+ 9949
Δ Stock	-190	-540	+ 416	+ 1133	- 213	- 335	-300	+ 705	+ 940
Δ System	+ 60	-285	+2241	13496	+3664	+2401	-855	+18073	+10889
Δ System/ha	+ 20	- 7	+ 365	+ 710	+ 271	+ 92	- 72	+ 647	+ 366
Yield/ha	311	130	667	837	422	231	67	779	482

Notes: 1/ Insignificant areas of lentil in villages 2B/01 and 4/04.

2/ Flow and stock calculations in 2A/06, season 1, take into account household stock changes. In all other cases these are insignificant and can be omitted.

APPENDIX 3.8

CALCULATION OF OVERALL CROP NET OUTPUT

(Syrian Lira)

Village	Season	Opening Value	Expenditure	Machinery Charges	Tr. from Livestock	Rents	TOTAL COSTS	Income	Tr. to L'stock Feeds	Tr. to Household	Other Disposals	Closing Value	Total Output	1/ TOTAL OUTPUT
RAINFED AREA														
1A/13	1	9680	25199	17858	-	-	52737	128182	6136	21574	16746	13782	186420	133683
	2	16577	21382	16743	-	-	54702	69943	10923	21134	5362	26330	133692	78990
1B/05	2	3783	16359	2956	963	210	24271	14901	21696	12620	3257	6679	59153	34882
2A/06	1	6698	15149	4574	-	-	26421	16188	20311	14025	2400	8428	61352	34931
	2	13345	12629	9293	-	1429	36696	17718	33461	13249	7354	12669	84451	47755
2B/01	1	3914	12930	539	2177	1784	21344	3871	8549	6189	3023	11153	32785	11441
	2	9343	17132	809	225	9456	36965	10458	16016	12196	10644	12231	61545	24580
3/02	1	5860	18667	1030	-	182	25739	9146	15100	15238	1676	4702	45862	20123
	2	4702	18250	-	49	250	23251	2355	14443	8900	886	5680	32264	9013
4/04	1	1382	23510	3025	-	-	27917	6580	13136	6325	4284	9775	40100	12183
	2	9775	12913	402	-	-	23090	6795	9450	1632	-	3467	21344	-1746
IRRIGATED AREA					IRRIGATION									
1B/05	2	6555	10881	617	2259	-	20312	15560	2520	-	-	4646	22726	2414
2B/01	1	82	3782	-	4267	9093	17224	-	-	-	9093	9460	18553	1329
	2	9460	2470	-	2735	-	14665	22188	-	530	-	434	23152	8487

Note: 1/ This is Net Output I. To obtain Net Output II, add in to output the value of Rents.

APPENDIX 3.9

LIVESTOCK NET OUTPUT CALCULATIONS

VILLAGE	Season	Opening Value	Expenditure	Tr. from Crops	TOTAL COST	Income	Tr. to Household	Tr. to Crops	Other Disposals	Closing Value	TOTAL OUTPUT	NET OUTPUT
1A/13	1	19810	13612	6886	40308	11699	10898	-	200	19357	42154	1846
	2	21919	25950	10176	58045	29467	8993	2010	-	28770	69240	11195
2A/06	1	47023	29530	20311	96864	30023	16780	4125	300	59799	111027	14163
	2	69184	29337	33461	131982	48610	18378	1913	750	93944	163595	31613
2B/01	1	54145	32636	8549	95330	47421	6228	2177	8345	52187	117358	22028
	2	52187	51279	16616	120082	70720	7629	225	260	68397	147234	27152
3/02	1	60495	125613	14355	199463	99388	17425	150	220	84924	201987	2524
	2	84924	81241	13173	179338	77753	12556	49	-	85098	175456	-3882
4/04	1	28226	35230	13136	76702	30087	11814	300	-	32119	74320	-2382
	2	32119	56032	9450	97601	26008	8839	-	-	58208	93055	-4546

APPENDIX 3.10

CORRELATIONS RELATING TO LIVESTOCK NET OUTPUT

ALL FIGURES ON A PER HEAD BASIS

VILLAGE	Season	(1) Net Output	(2) Cash Flow	(3) Expenditure	(4) Income	(5) Purchased Feeds
1A/13	1	23.4	-29.9	172	148	90.1
	2	151.3	140.1	328	373	36.8
2A/06	1	106.5	99.8	222	225	72.6
	2	182.7	254.0	170	281	18.7
2B/01	1	112.4	70.5	167	247	105.7
	2	118.0	155.0	223	307	77.2
3/02	1	12.3	- 8.8	613	485	207.6
	2	-21.0	-17.9	439	420	251.5
4/04	1	-24.3	-13.3	359	307	135.6
	2	-51.7	-44.7	637	296	288.6

Net Output:	Cash flow	(1) (2)	$r = 0.94$	$p = 0.01$
Net Output:	Expenditure	(1) (3)	$r = 0.70$	$p = 0.05$
Net Output:	Income	(1) (4)	$r = 0.20$	NS.
Net Output:	Purchased Feed	(1) (5)	$r = 0.87$	$p = 0.01$

APPENDIX 3.11

A) INCURRED EXPENDITURE BY CROP - (TWO YEAR AVERAGE)

	W1	W2	B	L	CHP	Forage	Summer Crops	Fallow	Orchard	Other
1A/13	4.5	21.7	0.7	1.7	31.5	-	8.1	-	26.8	5.0
1B/05 1/	7.2	19.8	13.5	16.8	7.8	15.3	18.0	-	1.6	-
2A/06	17.6	5.8	22.5	23.1	-	4.4	9.9	-	4.9	27.2
2B/01	32.1	3.5	18.8	6.3	-	1.8	-	9.7	12.4	-
3/02	35.9	-	27.9	18.6	-	-	0.1	8.9	-	-
4/04	19.2	3.0	74.6	0.1	-	-	-	3.1	-	-

Notes: 1/ Single year's data.

W1 = Durum wheat; W2 = Bread wheat; B = Barley; L = Lentil; CHP = Chickpea.

APPENDIX 3.11
(continued)

B) INCURRED EXPENDITURE ON CROPS BY INPUT

(per cent)

	Seed	Fertilizer	FYM	Plant Protection	Labour	Cultivation	Transport	Harvest Thresh	Sacks	Rent	Other
1A/13	20.5	18.7	-	3.1	20.0	17.0	3.3	0.2	3.8	-	13.4
1B/05	9.3	25.8	0.4	1.7	30.6	17.8	4.6	3.7	6.1	-	-
2A/06	12.2	44.2	-	0.8	19.6	16.5	3.2	0.8	2.3	-	0.4
2B/01	5.6	2.5	8.7	0.5	47.0	18.9	5.1	1.4	1.2	8.1	1.0
3/02	19.2	0.6	-	-	50.7	18.2	7.1	0.1	0.2	3.9	-
4/04	40.9	-	-	-	28.5	17.7	3.7	2.2	3.1	3.9	-

APPENDIX 3.11
(continued)

C) INCURRED EXPENDITURE ON LIVESTOCK BY INPUT

(1)	Feed Concentrate	Feed Bulks	Rent for Grazing	Fees for Herding	Transport	Vet Costs	Taxes	Purchase of Stock	Other
1A/13	23.9	1.0	1.7	4.5	0.3	0.3	0.4	67.4	0.5
2A/06	15.8	5.5	3.3	7.1	2.5	0.5	0.4	64.6	0.3
2B/01	44.0	1.9	2.8	2.3	0.8	0.1	0.4	47.3	0.4
3/02	39.6	3.5	3.9	2.8	0.7	0.7	0.2	47.4	0.5
4/04	33.8	8.6	6.6	3.9	0.1	0.4	0.2	46.0	0.4

Notes: (1) Livestock data not included in village 1B/05.

APPENDIX 3.11

(continued)

D) EARNED INCOME FROM CROPS, BY CROP

	W1	W2	B	L	CHP	Forage	Summer Crops	Orchard	Other
1A/13	0.4	6.9	-	1.0	41.6	-	8.3	42.4	-
1B/05	10.9	37.5	1.0	12.5	-	18.7	19.4	-	-
2A/06	6.1	5.0	37.6	35.1	-	-	12.9	3.3	-
2B/01	45.6	26.7	17.7	9.4	-	-	-	-	0.6
3/02	54.0	-	11.1	34.9	-	-	-	-	-
4/04	1.5	-	98.5	-	-	-	-	-	-

APPENDIX 3.11
(continued)

E) EARNED INCOME FROM LIVESTOCK

(per cent)

	SHEEP		GOATS							
	Home-stock	Fattening	Home-stock	Fattening	Cattle	Milk/ Yogurt	Cheese Semneh	Poultry	Eggs	Other
1A/13	38.7	-	45.0	-	1.5	3.4	8.8	1.0	0.6	1.0
2A/06	49.6	29.5	15.3	-	0.8	2.4	0.6	-	1.8	-
2B/01	43.5	40.6	1.5	-	-	12.0	-	1.6	0.7	1.6
3/02	28.5	37.5	5.9	22.9	-	2.4	2.0	0.8	-	0.8
4/04	55.0	35.9	5.7	-	-	2.6	0.5	-	0.2	-