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FARMING PRACTICES IN SOUTHERN IDLEB PROVINCE, SYRIA: 1985 SURVEY RESULTS

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by Thomas L. Nordblom*

ABSTRACT

This document reports on farming practices and economics affecting prospects for introduction of an Australian-type ley system of wheat and annual medic pasture in southern Idleb Province, Syria. In addition to six farmers hosting the original MAAR/ICARDA on-farm medic trials in the Tah village area, two farmers known to manage both sheep and crops were interviewed in each of 21 villages selected from the surrounding districts: 7 villages with rainfall similar to Tah, 7 with higher and 7 with lower.

Average holdings of rainfed farmland were 15.5 ha, and 27 of the 48 farmers had additional areas averaging 4.9 ha, of olive, pistachio or other trees. Wire fencing is very uncommon, and grazing sheep are controlled by shepherds.

All reported rainfed crop rotations involve wheat or barley. In the area with rainfall similar to Tah, fallows are rare as farmers mainly use three-year rotations of cereal, lentils and summer crops of water melon or sesame. Adoption of medic pasture in these areas will involve displacement of some crops rather than replacement of fallows. Diversity of crop rotations is greater in the higher rainfall areas, and more two-year sequences and fallows were reported. Cereal-fallow rotations predominate in the lower rainfall areas. For tillage, tractor-mounted cultivators were most common. Seed drills were reported in use by 30 of the 48 farmers.

Ewe diets vary with phases of the reproductive cycle and seasonal availability of grazing. Summer and fall diets are comprised chiefly of grazed crop residues. Hand-fed concentrates and straws (of barley and lentil) dominate winter diets in late pregnancy and early lactation. Grazing of native pasture is most important in March and April. Grazing of cereals, as an alternative to harvest, is important in May.

Summaries of production practices, costs and yields are given for wheat and barley in areas similar to Tah, and for the higher and lower rainfall areas. Lentil, water melon, sesame, chickpea and lathyrus summaries are presented for the combined areas. Assuming mean crop yields, using 1985 costs and prices and counting all labor at the farm wage rate, net incomes per ha (in Syrian Pounds) were: wheat, 1870; barley, 1848; water melons, 974; sesame, 714; and lentils, 504. In a comparison of the main crop rotations in the Tah area over a six-year planning horizon, the wheat-lentil rotation was most profitable. Reported yields for good, normal and poor years were the basis for estimated aggregate means, variances and covariances of wheat, barley, lentil, water melon and sesame.

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Any errors or shortcomings in this document are strictly due to the stubbornness and biases of the author.

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CHAPTER 1. INTRODUCTION

The use of self-regenerating annual Medicago pasture in rotation with cereal crops is an idea developed in southern Australia and widely adopted there in farming areas having a mediterranean climate, with hot, dry summers and with rainfall concentrated in the cooler winter-spring growing season (Puckridge and French, 1983, pp 230-231).

The Australian "ley-farming" system (medic in rotation with cereals) has the advantage that the pasture plants do not need seeding except for their initial establishment. To begin the rotation, the farmer sows a pasture of annual medic at the opening rains of the first season then introduces sheep for grazing at a rate which controls weeds but allows good flowering and seed set of this pasture legume. Sheep again graze the pasture in summer, after plant growth has ceased, maintaining their weight by eating the medic seeds and pods. However, farmers are careful to ensure that enough seeds are left on the ground for the pasture to regenerate. Weeds and some pasture plants germinate after the opening rains of the second season and are controlled by tillage for sowing the cereal crop. Most of the medic seed remains dormant so that regeneration of the pasture occurs only after the opening rains of the third season (Cocks, 1985, pp 1-2).

This report summarizes the results of a reconnaisance survey of farming practices and economic conditions facing the introduction of medic pastures in the area around Tah

village in southern Idleb province, of northwest Syria. It is part of the collaborative research program between ICARDA and the Ministry of Agriculture and Agrarian Reform (MAAR) of the Syrian Arab Republic.

Initial tabulations of the survey results were informally distributed in 1985, and some pieces have already been published (ICARDA, 1986. pp. 282-283). However, the present document is needed to: (1) clarify the survey methods which were used, (2) provide a comprehensive record of the results, (3) show the preliminary implications of these, and (4) point out what needs to be done next on the economics side of the research on medics.

The objective of the survey was to obtain an early quantitative and qualitative assessment of the economic conditions facing the introduction of medic pastures. The essential elements of such an assessment were considered to include (1) soil characteristics, (2) existing rainfed crop rotations, (3) crop-by-crop production practices, costs and yield variations, (4) characteristics, use and costs of tillage and sowing equipment, (5) feed prices, (6) lamb fattening diets in present use, (7) the nutritional calendar of ewe flocks, and (8) the state of farmers' present knowledge about medic pastures. Such information would indicate the degrees of relevance and universality of our current on-farm research, and help identify constraints for more widespread use of medics.

The data would also guide the development of a whole-farm model of crop-livestock interactions through which the economics of medic pasture in this area can be studied. An initial whole-farm model has been developed with the economic parameters derived from this survey, together with biological data from ICARDA's experimental work with crop rotations and sheep nutrition at Tel Hadya, an environment somewhat similar to that of Tah (Nordblom and Thomson, 1987). This was aimed to facilitate whole-farm analyses of medic-cereal-livestock systems; such analysis awaits the on-farm trial results of the medic regeneration year, 1986-87, at Tah. Further survey work is also needed.

The design and methods of the present survey, including the location and classification of twenty-one sample villages in southern Idleb Province, are reported in Chapter 2. Chapter 3, which comprises the bulk of this document, contains the survey results.

The comparison of cereal-medic rotations with existing crop rotations in such environments must take into account the time dimensions of their costs and returns as well as the risks associated with year-to-year variations in yields and prices. Initial analyses on these points, based on the survey data, are presented in Chapter 4. These are aimed to provoke thinking and discussion on how to realistically evaluate the promise of medic pastures.

CHAPTER 2. METHODS

A meeting was held with MAAR staff, at ICARDA on 7 July 1985, to complete plans on the objectives, logistics and questionnaire design for a survey of the economic conditions facing the introduction of medic pasture crops. This was to be a reconnaisance survey with a narrow focus on current crop-livestock practices, and was proposed to cover the districts around Tah village in the southern part of Idleb Province.

Questionnaire Design:

The first questionnaire form, which had been pretested in May 1985, underwent further revision according to the review by MAAR staff. The final version of the questionnaire, in both English and Arabic languages, is given in Appendix C.

The order of questions proceeds from general information on the farmer's resource base, farm size and number of sheep, to details on the sizes, crop rotations and soil characteristics of each of the farmer's fields, to details of production practices, costs and yields for each of the crops grown in the largest field. A set of questions covered the availabilities, operating depths and costs of different cultivation equipment since cultivation depths are considered an important factor in medic pasture establishment and regeneration. Another set of questions was designed to determine the calendar of sheep feeding and grazing used by

the farmer. The final questions were aimed to find out how much the farmers know about medic pasture. Further notes on specific questions, and how the responses were summarized, are given in the relevant sections of chapters 3 and 4.

Selection of villages:

It was proposed to choose a sample of seven villages with rainfall similar to that at Tah, seven villages with rainfall higher than Tah's and seven with lower rainfall. These villages would be purposively selected with the additional criteria that they should be in scattered locations, north, south, east and west of Tah, and that they should be known to have good numbers of sheep.

At the 7 July meeting, twenty one villages were named by MAAR staff familiar with Idleb province. It was agreed that these villages would form the initial sampling framework, but other villages might be substituted if necessary (i.e., if a village were found to have no sheep). In addition, the six farmers at Tah who were participating in the on-farm medic pasture trials would be interviewed with the same questionnaire.

The final selection of villages is shown in Figure 1. The approximate positions of rainfall isohyets, from the Climatic Atlas of Syria (SAR, 1977), shown in Figure 1, were not consulted until after completion of the survey. The categorization of villages as being in rainfall zones higher

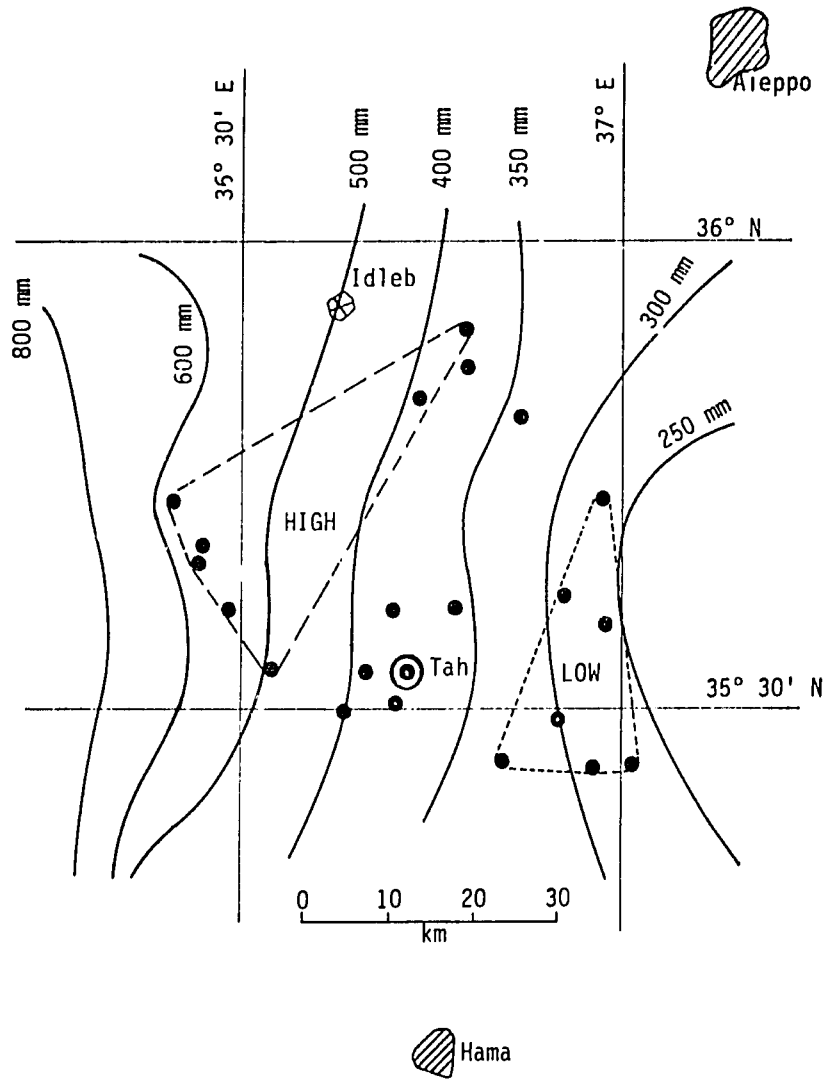


Figure 1 Location and classification of sample villages in southern Idleb Province

than, similar to or lower than Tah were based on the perceptions of MAAR staff regarding differences in farming systems associated with rainfall differences. For example, the higher rainfall class was comprised of villages where there is cultivation of chickpeas. In the area with rainfall similar to Tah, chickpeas are seldom grown.

Selection of Farmers for Interviews:

It was agreed that the ICARDA interviewers would be accompanied and assisted each day of the survey by staff from the provincial offices of the MAAR. The MAAR staff would serve as local guides and interpreters in addition to lending the advantage of their friendly contacts with farmers and village leaders in the area.

Prior to each day of the survey, a rendezvous location and time was agreed with the provincial MAAR staff. They were met and followed to the sample village of the day, where they would introduce the ICARDA interviewers to the village leader, "Mokhtar," or farmers' cooperative leader.

During the introductions to the village leader (and others usually present), the purpose of our visit was explained in detail. Then his help was requested to name the farmers in the village who had long experience with, and currently maintained, both cropping and sheep raising activities. It was made clear that we were not looking for the biggest farmers: we only wanted farmers who would be able

to answer detailed questions about crop and sheep production practices, yields and costs.

From the short list of experienced farmers in the village, the names of two farmers were arbitrarily selected by the interviewers. These two farmers were summoned and introduced to the interviewers and our purposes. Sometimes the interviews were conducted in the house of the village leader and sometimes in the farmer's home.

Most often, the interviews were not conducted in private but in the presence of several other farmers who were curious about the proceedings. It was often necessary to remind the group that we were after the answers of the selected farmer only: about his conditions, practices, yields, costs and opinions; as far as possible only his answers were recorded.

In addition to the biases apparent in the selection of villages, toward those with large sheep holdings, our method of selecting farmers certainly was biased toward the more successful and respected farmers in each village, if not the wealthiest and those on the friendliest terms with the village leadership. Thus, no statistical inferences can be made at either the village or provincial levels. This document only reports what was found in a reconaisance survey with these biases.

A single interview, in a single visit to each of the 48 farmers in the survey, gave the data reported in Chapter 3. This follows the approach of Tully (1984), except that here

two farmers in each village were interviewed rather than a single key person. These stand in contrast to the multiple-visit interviews used in earlier surveys by the Farming Systems Program: the "Village Level Studies" (ICARDA, 1980), the sheep survey of Thomson and Bahhady (1983), the "Barley Survey" (Mazid and Hallajian, 1983, and Somel, et al, 1984), the farming systems management study in the Bueda/Breda area (Jaubert and Oglah, 1985a & b), the farm labor study of Rassam (1985), and the survey of wheat production practices in northwestern Syria (ICARDA, 1986, pp 43-51) by Tully and Rassam.

The survey itself, not counting the pretesting phase, was completed in only fourteen days in the field, during the period from 8 July to 7 August 1985, with total road travel of about 3,200 km.

Following the approach used in the 1978-79 survey of lentil and chickpea production, by ICARDA's Farming Systems Program, detailed questions on cropping practices, costs and yields, were only asked with regard to the farmer's largest field. The questions on sheep diet composition benefited from the experience of Jaubert and Oglah (1985a). In contrast to the approach of Tully (1984), farmers were only asked about their own farms and practices, rather than those of the village as a whole.

The focus of the survey broadly included all annual rainfed crops in the study area. The focus was then

narrowed, for analysis, to only the major crops and crop-rotations found at Tah and the seven villages in similar areas. This follows Tully's (1984) approach most closely since the objectives of that survey and the present one had much in common.

Methods for Tabulation and Analysis:

Tabulation of survey results was done largely with a pocket calculator. Only the cross-tabulation of data on soil characteristics and crop rotations, the final summaries of data on ewe diets, and the simulation of correlated random crop yields based on the survey data, were done by computer.

The crop rotation and soils data are summarized as frequency distributions while the crop-by-crop production practices, costs and yields are presented in the form of individual crop budgets on a per-hectare basis. Farmers' estimates of crop yields in good, normal and poor years are summarized graphically. Sheep diets are presented in two tables, one for fattening lambs and one for breeding ewes; the latter shows the mean percent of monthly ewe diets provided by each feed or grazing source. Notes on the summarization method for ewe diets are given in Chapter 3.

In Chapter 4, the crop budget data are employed in an economic analysis of the main crop rotations found in the Tah area. For that analysis, <u>discounted present values</u> are calculated for six-year sequences, beginning with each of the

two or three crops of each crop rotation. These are intended to demonstrate a method for economic comparisons between existing crop rotations, and within rotations according to the initial crop in the six-year sequence.

A preliminary stochastic (probability) analysis of crop yield variations and covariance in the Tah area is based on farmers estimates. While the data from this survey are too sparse to allow formation of a definitive picture of production risks, they do indicate that static budget comparisons will not be adequate to determine the economic viability of medic-cereal systems in this area.

Insufficient data were available on medic pasture yields, in the establishment and regeneration sequence with wheat crops, for a final comparison of traditional rotations with those incorporating medic pasture. Nevertheless, quantitative economic frameworks for this kind of analysis are presented for use with the medic pasture data when it becomes available from the current field trials.

CHAPTER 3. RESULTS

This chapter presents the summaries of results of the survey. In most cases, these are given in formats which allow the reader to see the number of farmers contributing to the information on each point and the levels of variation in their responses.

Holdings of Rainfed Farmland, Trees and Sheep:

The average holding of rainfed farmland among the sampled farmers was 15.5 ha (standard deviation, 12.1 ha). However, 13 of the 48 farmers had only 5 ha or less, and 11 of the 48 had 25 ha or more. Olive, pistachio, fig and other fruit trees are also established around Tah village and in the higher rainfall areas. Twentyseven of the 48 farmers said they own additional areas of rainfed land, averaging 4.9 ha, devoted to trees.

Fortyfour of the 48 farmers reported owning ewes. Among these, two farmers said they had 500 or more, and another seven farmers had 150 or more. Among the remaining 35 farmers, however, the average number of ewes was only 41 head (standard deviation, 33 head).

Only six farmers reported having lamb fattening operations. Among these, the average number of lambs was 126 head (standard deviation, 60 head). Because of the biases in sampling noted in Chapter 2, one can have but little

confidence that these statistics are representative of the area.

In the study area, there is a nearly total absence of wire fencing for livestock control. Exceptions to this rule include a few government facilities and the on-farm trials themselves. Stone and earthen walls are found in and about many villages. Otherwise, and mainly, control of livestock is accomplished by shepherds. Children and older people often serve in this capacity.

Crop Rotations:

The 48 farmers who were interviewed provided crop rotation information on 138 individual fields. Since the sample was purposively selected from three rainfall zones, contrasting patterns of crop rotations emerged (see Figure 2). Several points should be noted in regard to these results:

1. The crop rotations reported for all 138 fields involved rainfed cereals, either wheat or barley. Twenty crop rotations involved wheat with other crops or fallow, thirteen involved barley, and five rotations involved both wheat and barley. It is very questionable whether all of these are distinct long-term rotations, since the information was derived by asking farmers the cropping history of each of their fields over the past three seasons. In the interviews, however, it was clear that farmers are flexible in altering

FIGURE 2. Distribution of crop rotations found in the 1985 survey

CROP ROTATION	number of plots where rotation reported, by rainfall area: higher rainfall, seven villages	similar to Tah rainfall, seven villages	similar to Tah rainfall, Tah village	lower rainfall, seven villages
W,M	*			
W,C,G	*			
W,L,C	*			
W,L,G	*			
B,G,F	*			
W,G,F	*			
W,V,F	*			
W,G,V	*			
W,B,V	*			
W,L,F	**			
W,C,M	**			
B,C	**			
W,G	****			
W,C	*******			
B,L,M	***	**********	***	
W,L,M	*	*****	******	
W,F	*****		*	*********
B,F	*****			**********
W,L	*	*	*	**
B,G	*	*		
W,B,L	**		*	
W,B,M	*		*	
B,M	*		*	**
B,S	*			**
B,L,S		*****	***	**
W,L,S		*	*****	*
W,S		*		**
W,B,B		*		
W,L,U		*		
B,L,U		*		
B,L,F		*		
W,M,F		*		
W,U		*		
W,B,S			**	
W,M,S			*	
B,G,M			*	
B,B				*
B,U				*

Key: W = wheat, B = barley, L = lentils, C = chickpeas,
S = sesame, M = melons, U = cumin, F = fallow
G = forage legumes (lathyrus, vetch or berseem)
V = vegetables (tomatos or faba beans)
* = one field plot

the sequence of crops in a given field according to rainfall, or other factors, in a particular season. The summer crops of water melons and sesame, for example, are sown in late March or early April when the season's total rainfall can be judged as wet, normal or dry. In the wetter seasons, the planting of water melons is favored, while sesame may be favored in a season with normal rainfall. In the driest years the field may be left in fallow, with no summer crop attempted.

2. In the higher rainfall areas there is greater diversity in crop rotations (24 were reported) than in the lower rainfall areas (10 reported). Fruit and nut trees, as well as rainfed vegetable crops and chickpeas, are characteristic of the higher rainfall areas. No sesame crops were reported in the higher rainfall areas; this is in contrast to chickpea crops which were reported only in these areas. Tree cultivation and irrigated crops were ignored in the survey since they were judged to have little bearing on prospects for rainfed medic pastures.

3. Two-course or cereal-fallow rotations predominated in the sample of the lower rainfall areas while three-course rotations of cereals, lentils and summer crops predominated in the samples at Tah village and areas with similar rainfall. A mixture of two and three-course rotations was reported in the higher rainfall areas.

4. Cereal-fallow rotations were rare among the six farmers

at Tah village (one field) and were reported by none of the 14 farmers in the rainfall area similar to Tah. This suggests that adoption of medic pasture in such areas would involve displacement of some crops in the current rotations rather than replacement of fallows. In contrast, cereal-fallow rotations were reported in 10 of the 47 fields of farmers interviewed in the higher rainfall areas, and in 22 of the 35 fields in the lower rainfall areas.

5. In the higher rainfall areas, the total number of fields with crop rotations involving either chickpeas or forage legumes (lathyrus, vetch or berseem) was double the number of those which included lentils. By contrast, in Tah village and similar areas, lentils were the predominant legume species.

Some confusion exists in the naming and reporting of three crops: lathyrus, vetch and berseem. The author has recently received comments suggesting that farmers who mentioned these three names were all refering to one and the same crop: vetch (H.S. Edo, personal communication, 1987). The text and tables of this report remain uncorrected for this possibility and use the three names separately as interpreted during the survey.

Soil Characteristics:

No clear relationships between soil characteristics and crop rotations were determined by the survey. However,

several marked relationships among the soil characteristics were found.

In Table 1, cross-tabulations are given for two- and three-course crop rotations and several soil characteristics. Soil color, depth, stoniness and cracking were divided into discrete classes for this purpose. Ambiguous records, which resulted when farmers reported on field plots with uneven soil depths, colors, etc., were not included in this summary. Thus, the total, row and column percentages in Table 1 are not uniform throughout. Reports of white soils and mixtures of yellow, red and black soils were ignored; likewise for fields with mixtures of cracking and non-cracking soils, or mixtures of shallow and deep soils. Including such mixed cases would add little information while complicating the presentation of results.

Soil color was related to soil depth and cracking: yellow soils were predominantly shallow and non-cracking, while red soils were predominantly deep and cracking. The black soils were mostly deep and stony, and over half were cracking.

Cracking soils tended to be deep (over 50 cm) and non-cracking soils shallow. However, there was no clear relation between cracking characteristics and degree of stoniness, and stoniness had no relation to soil depth.

Cracking may seem to be a negative factor for medic production due to the loss of seed which falls to soil depths below which viable plants can emerge. In Australia, however,

TABLE 1. Cross-tabulation of two- or three-course crop rotations and soil characteristics: **total percentages**

	SOIL COLOR				CRACKING			STONINESS				SOIL DEPTH		
	yellow	red	black	Row Sum (%)	yes	no	Row Sum (%)	few <10 %	10-25%	>25 %	Row Sum (%)	5-50 cm	51-300 cm	Row Sum (%)
ROTATION														
2-course	20	20	10	50	25	23	48	15	18	14	47	27	15	42
3-course	18	27	5	50	22	30	52	33	10	10	53	27	31	58
Col. Sums	38	47	15	100	47	53	100	48	28	24	100	54	46	100
SOIL DEPTH														
5-50 cm	39	12	1	52	10	44	54	27	11	16	54			
51-300 cm	3	35	10	48	33	13	46	27	14	5	46			
Col. Sums	42	47	11	100	43	57	100	54	25	21	100			
STONINESS														
few (< 10%)	18	25	4	47	19	29	48							
10-25%	8	9	10	27	19	10	29							
above 25%	12	13	1	26	9	14	23							
Col. Sums	38	47	15	100	47	53	100							
CRACKING														
yes	4	36	9	49										
no	33	12	6	51										
Col. Sums	37	48	15	100										

according to P.S. Cocks (personal communication, 1987), these are considered "prime" soils for cereal-medic rotations, and the potential loss of seed in cracks is not a serious threat to medics.

The disappointing absence of solid relationships between crop rotations and soil characteristics may be an artifact of the survey method, which relied only on verbal descriptions. In most cases, the fields were not visited by the interview team and no physical measurements were taken.

Crop Production Summaries:

Data were collected for each of the two or three crops which were grown in each farmer's largest field. In cases where a farmer had two or more large fields of the same size, one of them was arbitrarily selected by the interviewers as the focus of questions on cropping practices, costs and yields. The "largest field" was wanted as the basis for such questions in order to minimize the tendency for "rounding errors" in recall. Where labor inputs are measured in "days," material inputs in "shwals" or bags, and outputs are measured in shwals and "trellas" (wagon loads), rounding errors should be smaller in proportion to the totals as field size increases. Each farmer was also asked to provide his own estimates, in kilograms per local unit (shwal, etc.), to allow standardization in this summary.

The questions about crop production in the farmers'

largest fields necessarily depended upon the farmer's recall of normal operations for the two or three crops normally grown in such fields. The cost estimates were given by the farmers in terms of prices in the 1984-85 season. Labor costs are from farmers' estimates of the costs of hired labor for the particular operation even where the farmer and his family normally provided the labor themselves. By counting all such costs against a crop, one may calculate the net return to land and management. By subtracting the labor which is supplied by a particular farmer and his family, and counting only the cost of labor actually hired, one may calculate the returns to family labor, land and management.

All reported crop rotations in the Tah area, and the neighboring districts with higher and lower rainfall, included either wheat or barley. Thus, by asking each farmer to describe the production practices, costs and yields of all crops grown in his largest field, these data were recorded for at least one of the cereal crops in every one of the 48 interviews.

Because of the greater amounts of data available on wheat and barley, the survey results on these two crops are summarized according to rainfall area. Wheat practices, costs and yields at Tah and similar areas are given in Table 2, those for the higher rainfall areas in Table 3, and for lower rainfall areas in Table 4. The next three tables, 5, 6 and 7, for barley, are in the same order.

Production data are reported for five other crops and averaged across all farmers who reported on them: lentils in Table 8, water melons in Table 9, sesame in Table 10, chickpeas in Table 11, and lathyrus in Table 12. Other crops were rarely mentioned in relation to farmers' largest fields and are not included in the production summaries.

The crop information presented in Tables 2 to 12 (given together in the following 11 pages), is presented in a standard format which follows the production sequence. First, the number and total cost of tillage operations are given. The quantity and cost of seed and seeding labor are reported next. Weed control costs are given without details on labor or herbicide use. Use of chemical fertilizer is reported in terms of amounts of triple-super-phosphate (TSP) per ha, and in terms of amounts and osts of actual nitrogen rates per ha in winter and springtime applications. A single, overall estimate of labor costs for fertilizer applications is reported for each crop.

For each crop, the method and average cost of harvesting is reported. In the cases of the cereal crops, both hand harvesting and combine harvesting were reported by farmers; average costs for each method are given. Costs of other operations associated with harvest are also given, along with the average selling price and crop yields. "Straw yields," as given in the summaries, are estimates of amounts of straw collected and stored by farmers.

TABLE 2. WHEAT production practices, costs and yields in Tah and seven villages in similar areas

ITEM	UNITS	Mean of Reported Values	No. of Farmers Reporting (n)	Coeff. of Variation (%)
Number of cultivations	No.	1.27	11	36.7%
Total cost of cultivations	SL/ha 1/	103	11	75.9%
Quantity of seed used	kg/ha	161	11	12.9%
Total cost of seed used	SL/ha	298	11	15.1%
Cost of seeding labor	SL/ha	40	11	27.4%
Cost of weed control	SL/ha	60	3	66.7%
Quantity of Trip. Sup. Phos.	kg/ha	91	11	30.8%
standard cost of TSP:	SL/kg	1.0	--	--
Quantity of N appld in Winter	kg/ha	13	3	66.6%
Total cost of N in Winter	SL/ha	32	3	48.7%
Quantity of N appld in Spring	kg/ha	49	11	39.1%
Total cost of N in Spring	SL/ha	106	11	47.0%
Total cost of fert broadcast	SL/ha	16	11	49.5%
Method of harvest	--	Combine	11	--
Cost of harvest	SL/ha	135	11	26.6%
Cost of transportation	SL/ha	45	11	83.1%
Cost of threshing	SL/ha	--	--	--
Cost of winnowing	SL/ha	--	--	--
Cost of bags and bagging	SL/ha	86	11	35.9%
Selling price of wheat grain	SL/kg	1.55	11	6.0%
High Yields of grain	kg/ha	2,863	11	30.4%
of straw	kg/ha	1,386	7	47.0%
Normal Yields of grain	kg/ha	1,524	11	31.0%
of straw	kg/ha	857	7	64.9%
Low Yields of grain	kg/ha	662	11	58.0%
of straw	kg/ha	471	7	99.3%

1/ SL 3.9 = US$ 1 in 1985

TABLE 3. WHEAT production practices, costs and yields in seven villages in areas with higher rainfall than Tah

ITEM	UNITS	Mean of Reported Values	No. of Farmers Reporting (n)	Coeff. of Variation (%)
Number of cultivations	No.	2	7	28.9%
Total cost of cultivations	SL/ha	371	7	56.0%
Quantity of seed used	kg/ha	179	7	14.2%
Total cost of seed used	SL/ha	304	7	16.7%
Cost of seeding labor	SL/ha	27	7	24.8%
Cost of weed control	SL/ha	75	7	48.7%
Quantity of Trip. Sup. Phos.	kg/ha	108	3	13.3%
standard cost of TSP:	SL/kg	1.0	--	--
Quantity of N appld in Winter	kg/ha	29	2	27.3%
Total cost of N in Winter	SL/ha	63	2	28.3%
Quantity of N appld in Spring	kg/ha	70	7	32.8%
Total cost of N in Spring	SL/ha	146	7	39.4%
Total cost of fert broadcast	SL/ha	19	7	24.0%
Method of harvest	--	Comb.(Hand)	1 (4)	--
Cost of harvest	SL/ha	255 (419)	4 (4)	3.9(43.0)
Cost of transportation	SL/ha	24 (139)	4 (4)	47.2(37.3)
Cost of threshing	SL/ha	-- (68)	-- (4)	-- (34.5)
Cost of winnowing	SL/ha	-- (68)	-- (4)	-- (34.5)
Cost of bags and bagging	SL/ha	59	7	26.5%
Selling price of Wheat grain	SL/kg	1.54	7	6.6%
High Yields of grain	kg/ha	2,038 (1,770)	3 (4)	31.7(39.9)
of straw	kg/ha	-- (1,375)	--(4)	-- (34.8)
Normal Yields of grain	kg/ha	955 (945)	3 (4)	31.4(27.7)
of straw	kg/ha	-- (788)	--(4)	-- (32.1)
Low Yields of grain	kg/ha	455 (240)	3 (4)	74.4(19.5)
of straw	kg/ha	-- (343)	--(4)	-- (48.2)

TABLE 4. WHEAT production practices, costs and yields in seven villages with lower rainfall than Tah

ITEM	UNITS	Mean of Reported Values	No. of Farmers Reporting (n)	Coeff. of Variation (%)
Number of cultivations	No.	1.17	6	35.0%
Total cost of cultivations	SL/ha	40	6	41.8%
Quantity of seed used	kg/ha	166	6	27.7%
Total cost of seed used	SL/ha	316	6	28.7%
Cost of seeding labor	SL/ha	47	6	58.6%
Cost of weed control	SL/ha	125	1	--
Quantity of Trip. Sup. Phos.	kg/ha	108	6	66.4%
standard cost of TSP:	SL/kg	1.0	--	--
Quantity of N appld in Winter	kg/ha	35	1	--
Total cost of N in Winter	SL/ha	75	1	--
Quantity of N appld in Spring	kg/ha	48	5	79.4%
Total cost of N in Spring	SL/ha	105	5	79.7%
Total cost of fert broadcast	SL/ha	10	6	77.8%
Method of harvest	--	Combine	6	--
Cost of harvest	SL/ha	127	6	18.5%
Cost of transportation	SL/ha	9	6	72.0%
Cost of threshing	SL/ha	--	--	--
Cost of winnowing	SL/ha	--	--	--
Cost of bags and bagging	SL/ha	35	6	38.2%
Selling price of wheat grain	SL/kg	1.52	6	2.7%
High Yields of grain	kg/ha	1,490	6	60.9%
of straw	kg/ha	960	5	9.3%
Normal Yields of grain	kg/ha	757	6	57.8%
of straw	kg/ha	520	5	21.1%
Low Yields of grain	kg/ha	314	6	63.8%
of straw	kg/ha	230	5	29.2%

TABLE 5. BARLEY production practices, costs and yields in Tah and seven villages in similar areas

ITEM	UNITS	Mean of Reported Values	No. of Farmers Reporting (n)	Coeff. of Variation (%)
Number of cultivations	No.	2.3	10	50.4%
Total cost of cultivations	SL/ha	131	10	83.7%
Quantity of seed used	kg/ha	232	10	28.9%
Total cost of seed used	SL/ha	345	10	40.8%
Cost of seeding labor	SL/ha	25	10	34.8%
Cost of weed control	SL/ha	98	5	37.6%
Quantity of Trip. Sup. Phos.	kg/ha	136	9	30.6%
standard cost of TSP:	SL/kg	1.0	--	--
Quantity of N appld in Winter	kg/ha	0	10	--
Total cost of N in Winter	SL/ha	0	10	--
Quantity of N appld in Spring	kg/ha	62	9	30.5%
Total cost of N in Spring	SL/ha	143	9	25.5%
Total cost of fert broadcast	SL/ha	21	9	34.1%
Method of harvest	--	Combine	10	--
Cost of harvest	SL/ha	167	10	37.0%
Cost of transportation	SL/ha	89	10	66.9%
Cost of threshing	SL/ha	--	--	--
Cost of winnowing	SL/ha	--	--	--
Cost of bags and bagging	SL/ha	132	10	44.1%
Selling price of barley grain	SL/kg	1.46	10	4.5%
High Yields of grain	kg/ha	3,148	10	32.5%
of straw	kg/ha	1,240	5	57.8%
Normal Yields of grain	kg/ha	1,787	10	43.4%
of straw	kg/ha	690	5	30.1%
Low Yields of grain	kg/ha	791	10	44.8%
of straw	kg/ha	280	5	46.6%

TABLE 6. BARLEY production practices, costs and yields in seven villages with higher rainfall than Tah

ITEM	UNITS	Mean of Reported Values	No. of Farmers Reporting (n)	Coeff. of Variation (%)
Number of cultivations	No.	1.75	8	26.5%
Total cost of cultivations	SL/ha	194	8	79.7%
Quantity of seed used	kg/ha	203	8	16.8%
Total cost of seed used	SL/ha	318	8	20.1%
Cost of seeding labor	SL/ha	37	8	48.6%
Cost of weed control	SL/ha	85	5	22.0%
Quantity of Trip. Sup. Phos.	kg/ha	150	3	33.3%
standard cost of TSP:	SL/kg	1.0	--	--
Quantity of N appld in Winter	kg/ha	--	--	--
Total cost of N in Winter	SL/ha	--	--	--
Quantity of N appld in Spring	kg/ha	56	7	53.2%
Total cost of N in Spring	SL/ha	124	7	46.3%
Total cost of fert broadcast	SL/ha	21	7	66.8%
Method of harvest	--	Comb. (Hand)	3 (5)	--
Cost of harvest	SL/ha	196 (595)	3 (5)	18.9(39.9)
Cost of transportation	SL/ha	63 (159)	3 (5)	48.0(49.8)
Cost of threshing	SL/ha	-- (115)	-- (5)	-- (27.2)
Cost of winnowing	SL/ha	-- (75)	-- (2)	-- (47.1)
Cost of bags and bagging	SL/ha	138 (42)	3 (5)	14.9(19.1)
Selling price	SL/kg	1.37 (1.48)	3 (5)	2.1(3.0)
High Yields of grain	kg/ha	3,242 (1,050)	3 (5)	3.1(15.8)
of straw	kg/ha	2,000 (820)	1 (5)	-- (25.0)
Normal Yields of grain	kg/ha	2,065 (662)	3 (5)	8.4(21.8)
of straw	kg/ha	1,000 (500)	1 (5)	-- (40.0)
Low Yields of grain	kg/ha	1,125 (349)	3 (5)	45.6(40.4)
of straw	kg/ha	500 (300)	1 (5)	-- (47.1)

TABLE 7. BARLEY production practices, costs and yields in seven villages with lower rainfall than Tah

ITEM	UNITS	Mean of Reported Values	No. of Farmers Reporting (n)	Coeff. of Variation (%)
Number of cultivations	No.	1.36	11	37.0%
Total cost of cultivations	SL/ha	49	11	46.2%
Quantity of seed used	kg/ha	184	11	26.2%
Total cost of seed used	SL/ha	299	11	25.1%
Cost of seeding labor	SL/ha	38	11	57.0%
Cost of weed control	SL/ha	101	2	33.6%
Quantity of Trip. Sup. Phos.	kg/ha	101	11	55.1%
standard cost of TSP:	SL/kg	1.0	--	--
Quantity of N appld in Winter	kg/ha	28	1	--
Total cost of N in Winter	SL/ha	60	1	--
Quantity of N appld in Spring	kg/ha	43	10	66.3%
Total cost of N in Spring	SL/ha	95	10	64.8%
Total cost of fert broadcast	SL/ha	10	11	63.9%
Method of harvest	--	Combine	11	--
Cost of harvest	SL/ha	143	11	23.4%
Cost of transportation	SL/ha	27	11	55.7%
Cost of threshing	SL/ha	--	--	--
Cost of winnowing	SL/ha	--	--	--
Cost of bags and bagging	SL/ha	78	11	32.4%
Selling price	SL/kg	1.40	11	4.0%
High Yields of grain	kg/ha	2,231	11	35.5%
of straw	kg/ha	971	7	30.7%
Normal Yields of grain	kg/ha	1,140	11	27.5%
of straw	kg/ha	571	7	21.9%
Low Yields of grain	kg/ha	465	11	43.7%
of straw	kg/ha	293	7	50.7%

TABLE 8. LENTIL production practices, costs and yields

ITEM	UNITS	Mean of Reported Values	No. of Farmers Reporting (n)	Coeff. of Variation (%)
Number of cultivations	No.	1.63	19	50.9%
Total cost of cultivations	SL/ha	92	19	71.2%
Quantity of seed used	kg/ha	167	19	13.6%
Total cost of seed used	SL/ha	295	19	25.6%
Cost of seeding labor	SL/ha	30	19	38.7%
Cost of weed control	SL/ha	216	7	69.0%
Quantity of Trip. Sup. Phos.	kg/ha	105	14	37.7%
standard cost of TSP:	SL/kg	1.0	--	--
Quantity of N appld in Winter	kg/ha	30.5	2	71.9%
Total cost of N in Winter	SL/ha	61	2	90.4%
Quantity of N appld in Spring	kg/ha	16	1	--
Total cost of N in Spring	SL/ha	45	1	--
Total cost of fert broadcast	SL/ha	15	3	52.7%
Method of harvest	--	hand	19	--
Cost of harvest	SL/ha	753	19	34.0%
Cost of transportation	SL/ha	140	19	65.4%
Cost of threshing	SL/ha	117	19	45.9%
Cost of winnowing	SL/ha	90	19	60.9%
Cost of bags and bagging	SL/ha	54	19	45.5%
Selling price of lentil seed	SL/kg	1.6	19	11.4%
High Yields of grain	kg/ha	1,485	19	27.8%
of straw	kg/ha	1,357	15	36.7%
Normal Yields of grain	kg/ha	867	19	36.4%
of straw	kg/ha	903	15	27.3%
Low Yields of grain	kg/ha	439	19	66.0%
of straw	kg/ha	513	15	39.6%

TABLE 9. WATER MELON production practices, costs and yields

ITEM	UNITS	Mean of Reported Values	No. of Farmers Reporting (n)	Coeff. of Variation (%)
Number of cultivations	No.	4.4	13	25.6%
Total cost of cultivations	SL/ha	383	13	25.8%
Quantity of seed used	kg/ha	1.5	13	27.2%
Total cost of seed used	SL/ha	69	13	26.9%
Cost of seeding labor	SL/ha	75	13	58.6%
Cost of weed control	SL/ha	126	9	55.1%
Quantity of Trip. Sup. Phos.	kg/ha	117	3	24.7%
standard cost of TSP:	SL/kg	1.0	--	--
Quantity of N appld in Winter	kg/ha	69	1	--
Total cost of N in Winter	SL/ha	150	1	--
Quantity of N appld in Spring	kg/ha	32	3	39.5%
Total cost of N in Spring	SL/ha	73	3	34.3%
Total cost of fert broadcast	SL/ha	16	5	52.7%
Method of harvest	--	hand	--	--
Cost of harvest	SL/ha	60	11	44.5%
Cost of transportation	SL/ha	182	10	70.5%
Cost of threshing	SL/ha	--	--	--
Cost of winnowing	SL/ha	--	--	--
Cost of bags and bagging	SL/ha	--	--	--
Selling price of fresh melons	SL/kg	0.69	12	15.8%
High Yields of melons	kg/ha	5,083	12	71.4%
Normal Yields of melons	kg/ha	2,708	12	72.3%
Low Yields of melons	kg/ha	1,125	12	109.9%

TABLE 10. SESAME production practices, costs and yields

ITEM	UNITS	Mean of Reported Values	No. of Farmers Reporting (n)	Coeff. of Variation (%)
Number of cultivations	No.	3.44	9	15.3%
Total cost of cultivations	SL/ha	316	9	27.5%
Quantity of seed used	kg/ha	2.4	9	41.5%
Total cost of seed used	SL/ha	48	9	38.8%
Cost of seeding labor	SL/ha	36	5	55.3%
Cost of weed control	SL/ha	78	5	53.2%
Quantity of Trip. Sup. Phos.	kg/ha	--	--	--
standard cost of TSP:	SL/kg	1.0	--	--
Quantity of N appld in Winter	kg/ha	23	1	--
Total cost of N in Winter	SL/ha	50	1	--
Quantity of N appld in Spring	kg/ha	--	--	--
Total cost of N in Spring	SL/ha	--	--	--
Total cost of fert broadcast	SL/ha	--	--	--
Method of harvest	--	Hand	9	--
Cost of harvest	SL/ha	133	9	67.9%
Cost of transportation	SL/ha	32	9	35.7%
Cost of threshing	SL/ha	32	9	33.0%
Cost of winnowing	SL/ha	--	--	--
Cost of bags and bagging	SL/ha	12	9	58.7%
Selling price of Sesame seed	SL/kg	14.7	3	10.4%
High Yields of seed	kg/ha	163	9	68.4%
Normal Yields of seed	kg/ha	90	9	92.1%
Low Yields of seed	kg/ha	50	9	111.8%

TABLE 11. CHICKPEA production practices, costs and yields

ITEM	UNITS	Mean of Reported Values	No. of Farmers Reporting (n)	Coeff. of Variation (%)
Number of cultivations	No.	4.8	4	10.3%
Total cost of cultivations	SL/ha	503	4	39.8%
Quantity of seed used	kg/ha	118	5	39.0%
Total cost of seed used	SL/ha	400	5	31.8%
Cost of seeding labor	SL/ha	57	5	42.8%
Cost of weed control	SL/ha	308	3	20.4%
Quantity of Trip. Sup. Phos.	kg/ha	288	2	104.5%
standard cost of TSP:	SL/kg	1.0	--	--
Quantity of N appld in Winter	kg/ha	115	1	--
Total cost of N in Winter	SL/ha	250	1	--
Quantity of N appld in Spring	kg/ha	--	--	--
Total cost of N in Spring	SL/ha	--	--	--
Total cost of fert broadcast	SL/ha	25	1	--
Method of harvest	--	Hand	5	--
Cost of harvest	SL/ha	325	5	18.8%
Cost of transportation	SL/ha	84	5	26.1%
Cost of threshing	SL/ha	80	5	85.1%
Cost of winnowing	SL/ha	48	5	68.2%
Cost of bags and bagging	SL/ha	47	5	49.2%
Selling price of chickpeas	SL/kg	3.6	5	22.2%
High Yields of grain	kg/ha	1,432	5	32.7%
of straw	kg/ha	725	4	81.5%
Normal Yields of grain	kg/ha	891	5	44.6%
of straw	kg/ha	600	4	49.1%
Low Yields of grain	kg/ha	555	5	69.8%
of straw	kg/ha	388	4	58.1%

TABLE 12. LATHYRUS production practices, costs and yields

ITEM	UNITS	Mean of Reported Values	No. of Farmers Reporting (n)	Coeff. of Variation (%)
Number of cultivations	No.	2.0	4	0%
Total cost of cultivations	SL/ha	338	4	37.0%
Quantity of seed used	kg/ha	238	4	28.0%
Total cost of seed used	SL/ha	446	4	27.8%
Cost of seeding labor	SL/ha	23	4	10.6%
Cost of weed control	SL/ha	110	2	12.9%
Quantity of Trip. Sup. Phos.	kg/ha	100	1	--
standard cost of TSP:	SL/kg	1.0	--	--
Quantity of N appld in Winter	kg/ha	--	--	--
Total cost of N in Winter	SL/ha	--	--	--
Quantity of N appld in Spring	kg/ha	--	--	--
Total cost of N in Spring	SL/ha	--	--	--
Total cost of fert broadcast	SL/ha	--	--	--
Method of harvest	--	Hand	4	--
Cost of harvest	SL/ha	542	4	30.6%
Cost of transportation	SL/ha	134	4	48.0%
Cost of threshing	SL/ha	63	4	57.1%
Cost of winnowing	SL/ha	63	4	57.1%
Cost of bags and bagging	SL/ha	40	4	45.9%
Selling price of lathyrus seed	SL/kg	1.85	4	7.0%
High Yields of grain	kg/ha	1,250	4	29.6%
of straw	kg/ha	1,888	4	26.5%
Normal Yields of grain	kg/ha	688	4	42.1%
of straw	kg/ha	1,113	4	30.8%
Low Yields of grain	kg/ha	280	4	56.2%
of straw	kg/ha	575	4	51.9%

Readers will note, in Tables 2 to 12, that "high," "normal" and "low" yields are given for each crop. These summarize farmers' responses when asked to give their own estimates of yields from their largest field in good years, normal years and poor years. No exact definitions of good, normal and poor years were imposed, except to say we were not asking for the extremes (or highest and lowest yields in memory). Rather we asked for the farmer's idea of a "better than average," an "average" and a "poorer than average" crop from the field. These yield estimates were intended to allow for analyses of weather risk as discussed in the next section.

Average wheat yields reported in the higher rainfall areas (Table 3) are lower than those in the Tah area (Table 2). That half of the 8 reported wheat fields in the high rainfall area were hand-harvested may indicate shallower or stonier soils than those in the Tah area where all 11 reported wheat fields were mechanically harvested by custom combine operators. The yield difference may also be an artifact of the small sample sizes in this survey, and the bias caused by sampling only among farmers who own sheep.

Each item in the production summaries (Tables 2 to 12) is given in terms of the mean reported value, the number of farmers reporting these values, and the coefficient of variation. The coefficient of variation (C.V.) is simply the standard deviation expressed as a percentage of the mean. It provides a measure of variation within the sample of farmers.

When the number of farmers reporting on a particular item is large and the variation in their responses is small, one may have more confidence in using the mean value for budgeting purposes than if the reverse were true. For example, only two farmers of the 19 reporting on lentils (Table 8) said they apply nitrogen fertilizer in winter, while 14 of them apply triple-super-phosphate. Such results are most useful in deciding which inputs, and which input levels, should be included in budget analyses of the various crops. Chapter 4 of this report presents simple budget analyses for the main crop rotations in Tah village and similar areas, based on the production summaries given above.

Joint Distributions of Crop Yields:

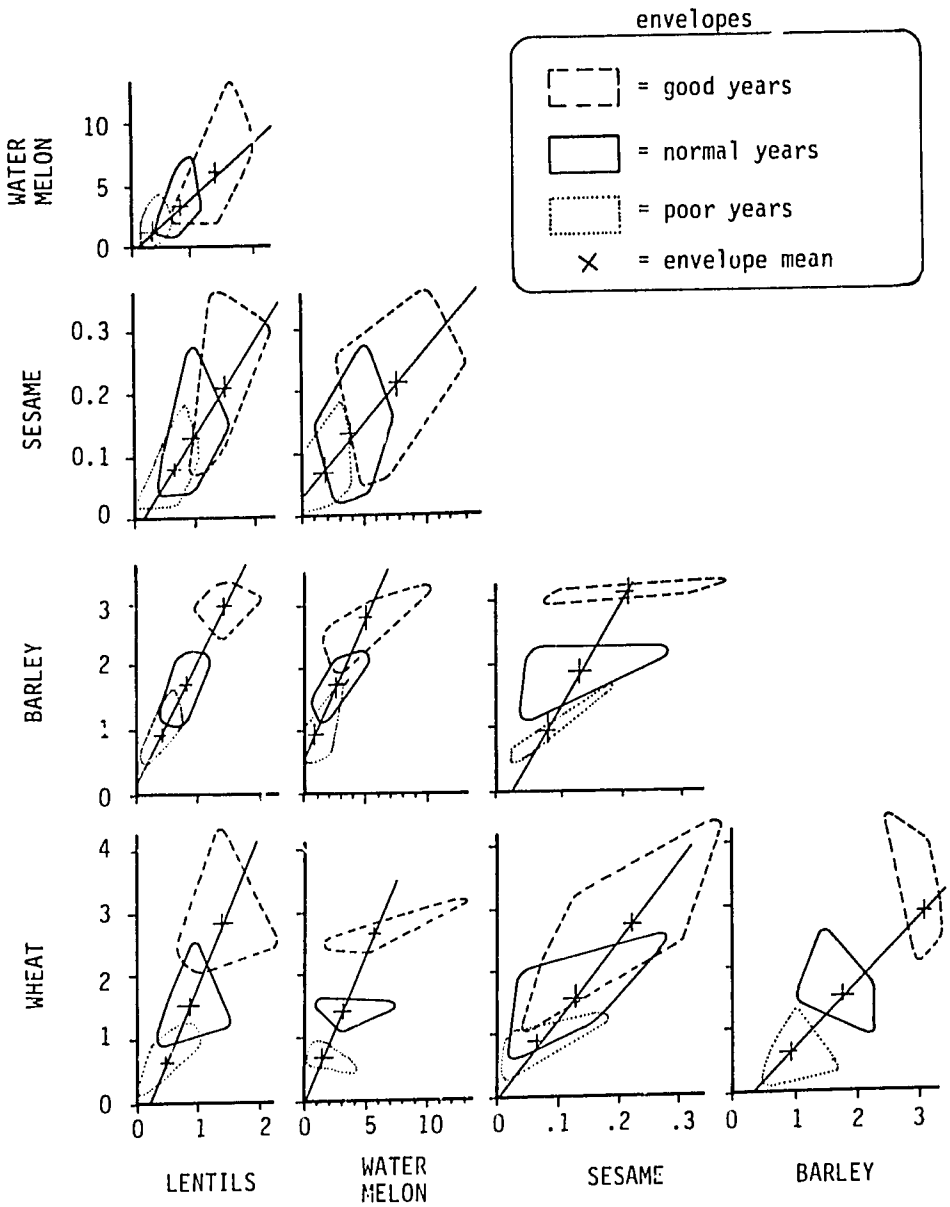
As mentioned above, farmers in the survey were asked to say what yields they would expect for the crops in their largest field in good, normal and poor years. Their answers have been summarized, on a crop-by-crop basis, in Tables 2 to 12, under the heading of high, normal and low yields. Since many farmers gave such estimates for two or three crops, we have the basis for making a preliminary study of (1) variations over time within crops, and (2) correlations of yields between crops. Since this is a dryland farming area where yields depend on winter and spring rainfall, and this rainfall is highly variable from year to year, it is reasonable to expect fairly strong positive correlations

between crops, over time.

Several assumptions are necessary in order to combine the crop-by-crop interview results for the purpose of estimating correlations between crops. First, it is assumed that for a particular farmer's largest field, the high, normal and low yields for one crop may be paired with the respective yields he has from another crop. This is based on the notion that a good year for one crop will also be a good year for other crops, and so on for normal and poor years. Thus, from each farmer who was able to estimate such yield levels for two crops, six data points, in three pairs, were obtained. It is assumed that joint yield distributions for two crops in Tah village and similar areas may be specified by aggregation of the paired yield estimates of high, normal and low yields for these crops, across the sample of farms (Figure 3, and Appendix A).

Reminded again of biases in the sampling of farmers, the reader will take due caution in the interpretation of these results. One cannot say the crop yield relationships presented here are representative of those in the true population of farms in the Tah area. The data base used in plotting the pairwise good, normal and poor crop yields in Figure 3 is sparse, at best (Appendix A). However, the results are provocative enough to suggest the need to pursue the subject as part of a subsequent survey. They also suggest that such a survey should have a larger sample size,

Figure 3 Pairs of reported crop yields in the Tah area for good, normal and poor years (t/ha)



if the sparseness of farmers' paired yield estimates in this survey is any guide. With proper two-stage or stratified random sampling, an accurate picture of farmers' experiences with crop yields could be obtained. Such a picture is needed for the analysis of economic risks under alternative crop rotations and livestock management plans.

Several points should be made in regard to Figure 3. The strong positive correlations apparent in all ten pairs of the five main crops is due to the assumption that good yields for one crop should be paired with good yields of the others, normal yields paired with normal, and poor with poor.

In Figure 3, the yield estimates for good years in each pair of crops are contained by a dashed line envelope. Those for normal years are in the solid line envelope, those for poor years, in the dotted envelope. The mean values for each of the three envelopes are also plotted. In each crop pair, the three envelope means fall very close to a straight line. This simply indicates, on average, farmers' estimates for the increase in yields from normal to high, were in fairly stable proportion to their estimates for the decrease from normal to low yields. The average ratio of high minus normal to normal minus poor mean yield differences was 1.5 to 1, with a coefficient of variation of only 8%. However, this surprising stability between pairs may only be an artifact of the interview method and the tendency of many farmers to define a "high" yield as double the "normal" yield. A statistical summary of the data is given in Appendix B.

Even though positive correlations between crops were forced by our assumption of pairing good with good and poor with poor, the correlations apparent in Figure 3 are far from perfect; the envelopes represent aggregations across farmers and reflect a confounded mix of differences in management, perception, and cropping contexts. There are other grounds for expecting less than perfect correlations between yields of the different crops; for example, rust diseases affect only cereals, and melons will respond to rains in May-June where cereals have already finished growing (P.S. Cocks, personal communication, 1987). Thus, it is not surprising to find some correlation coefficients of raw paired data as low as 0.59 (see Appendix B). An example of how this kind of information is used as a basis for risk analysis is given in Chapter 4.

Collection of Cereal Straw:

Straw biomass production may be calculated as 1.44 and 1.13 times the grain yield of barley and wheat, assuming harvest indices of 41 and 47, respectively. In the case of hand-harvested cereal crops, in fields too small or with yields too low for machine harvest, most of the straw biomass is collected with the grain. However, where cereal crops are mechanically harvested, some proportion of the straw and stubble is left in the field for grazing.

The highest proportions of straw biomass may be collected in low grain yield conditions as far as these are associated with low rainfall and high market value for straw. The lowest proportions come with the highest grain yields which may be associated with high rainfall and low straw prices.

The following quadratic equation was fitted to 15 paired estimates of amounts of machine-harvested barley grain and straw collected by farmers in Tah village and similar areas:

$$\text{STRAW} = 323 + (0.000728)\text{GRAIN} + (0.0000639)\text{GRAIN}^2 \qquad R^2 = .90$$

Visual inspection of this gently upward curving function suggested the following linear model (with STRAW and GRAIN in kg/ha) would serve just as well for rough calcuations:

$$\text{COLLECTED STRAW} = 295 + (0.3)\text{GRAIN}$$

This function is offered for use in budget estimates with grain yields in excess of 400 kg/ha. An example of such use can be found in Nordblom and Thomson (1987, pp 7-10).

Tillage and Sowing Equipment:

Among the sample of farmers, the ducks-foot cultivator was the most commonly used tillage implement, followed by the disc plow, mold-board plow and horse drawn faddan plow. Only 8 of the 48 farmers reported using the latter (see Table 13). Since depth of tillage is a critical factor in the success of establishment and regeneration of medic pasture (Puckridge and French, 1983, p 256), questions on this subject were put to the farmers. The results seem to indicate similar minimum and maximum depths of tillage are expected by these farmers with ducks-foot, disc and faddan plows. Compared with these, the mold-board plow was reported to have about ten centimeters greater tillage depth at both minimum and maximum levels.

The relatively close agreement among farmers regarding tillage depths (C.V.'s in the 20 to 40 % range) seems to indicate that farmers are well aware of differences in the performance of the various implements and would easily understand the how and why of a recommendation for shallow tillage. On the other hand, the most shallow tillage in use by these farmers (mean minimum greater than 10 cm) may be too deep for the best management of medic seed. If this is true, some emphasis may need to be given to the meaning and importance of shallow tillage as part of a package of recommendations to go with medic pasture production. The mold-board plow, according to the farmers' estimates of minimum tillage depth (23 cm), would be quite unsuited for

TABLE 13. Summary of farmers' answers on cultivation depths and costs for seed-bed preparation and sowing

	Ducks-Foot	Disc Plow	Mold-Board	Faddan Plow	Seed Drill	Tabban
MINIMUM DEPTH						
Mean Answer(cm)	12.1	12.6	23.7	10.6	--	--
No. of farmers	40	28	15	8	--	--
CV (%)1/	32.1	38.1	23.2	39.3	--	--
MAXIMUM DEPTH						
Mean Answer(cm)	20.0	23.2	33.3	18.1	--	--
No. of Farmers	40	28	15	8	--	--
CV (%)	24.0	27.7	22.4	29.3	--	--
COST PER HECTARE						
Mean Answer (SL)	54	110	183	226	36	22
No. of Farmers	40	28	14	8	30	5
CV (%)	40.1	13.9	15.4	25.7	66.2	20.3

1/ coefficient of variation = standard deviation / mean

use in a medic-wheat system.

Seed drills were used by 30 of the 48 farmers in the sample, while the tabban (a heavy bar pulled behind the cultivator or plow) was used by only five farmers.

Costs per ha are summarized in Table 13 for all the above implements according to the farmers who reported using them. These costs represent the local custom-hire rate, including tractor and labor, for a single operation. Differences in costs between implements may reflect differences in required draft power, time required per ha, capital cost of the equipment, soil conditions and field sizes. The faddan plow, for example, is typically used in small, stony fields or those with rock outcroppings, where tractor drawn implements are less appropriate.

Feed Prices:

Since sheep ownership was one of the criteria for selection of farmers in the survey, all farmers who were interviewed were able to provide information on feed prices and feed use. In Table 14, the prices of 14 hand-fed feedstuffs and 9 grazing sources are reported. The number of farmers providing price information, and the coefficient of variation in price reports, for each feedstuff and grazing source are also given.

TABLE 14. Summary of feed prices reported by farmers in 1985

	Mean Price Syrian Lira (SL)	No. of Responses (n)	Coeff. of Variation (%)
HAND-FED FEEDS			
1. Barley Grain	1.47 /kg	45	8.9
2. Wheat Grain	1.56 /kg	21	3.8
3. Cotton Seed Cake	1.31 /kg	35	27.5
4. Cotton Seed Hulls	.88 /kg	27	41.3
5. Wheat Bran	.55 /kg	33	30.9
6. Legume Grain	1.64 /kg	14	10.5
7. Sugar Beet Pulp	.89 /kg	7	27.5
8. Cotton Seed	1.40 /kg	4	16.5
9. Lathyrus Grain	1.70 /kg	1	--
10. Barley Straw	.62 /kg	19	26.9
11. Wheat Straw	.50 /kg	4	16.3
12. Lentil Straw	.90 /kg	31	11.0
13. Chickpea Straw	--	0	--
14. Harvested Weeds	--	0	--
15. Lathyrus Straw	.80 /kg	2	35.4
16. Berseem Straw	.80 /kg	3	10.8
GRAZED FEEDS			
17. Cereal, Green Grazed	850 /ha	1	--
18. Cereal, mature Grzd.	722 /ha	33	53.4
19. Cereal, stubble Grzng	182 /ha	33	62.6
20. Mature Legume Crops	813 /ha	4	50.3
21. Weeds in Fallow	--	0	--
22. Cotton Residues	578 /ha	29	35.1
23. Common Grazing	--	0	--
24. Steppe Grazing	--	0	--
25. Sugar Beet Crop	11,875 /ha	8	18.3
26. Sugar Beet Residues	573 /ha	11	49.4
27. Maize Residues	650 /ha	2	32.6
28. Sunflower Residues	--	0	--
29. Summer Crp Residues	105 /ha	8	46.7

Several contrasting points should be noted with regard to Table 14 on feed prices. Most (45) of the sample farmers reported on barley grain prices and there was little variation among their estimates. A majority of farmers (33) reported values for grazing mature cereal crops (SL 722 /ha) and cereal stubbles (SL 182 /ha); however, the coefficient of variation in each case was large (over 50 %). Such grazing resources have wide variation in nutritive content per hectare and grazing fees vary accordingly. Prices for lentil straw were recorded in 31 interviews, for barley straw in 19 and for wheat straw in only 4: a decreasing order corresponding to the nutritive values and prices of these feedstuffs

Most surprising were the reports by eight farmers on grazing sugar beet crops at prices approaching SL 12,000 per ha. Only one of the 48 farmers reported a price for grazing of cereal crops at the green stage; the high price given, however, indicates that such grazing was complete and no crop would be harvested.

Feeds and Grazing in Sheep Diets:

Most (42) of the sample farmers reported on the diets of their flocks of breeding ewes while only six farmers reported on fattening lambs. The ewe diets tend to change radically from season to season depending upon feedstuff availability and farmers' knowledge of nutritional requirements at different stages of the reproductive calendar. Diets for

fattening lambs were less complicated because no grazing was involved.

Lamb Fattening Diets:

A summary of fattening diets, averaged from the responses of only five farmers, is given in Table 15. Diet information the sixth farmer with a fattening operation, was considered unusable and is not included in the summary.

Farmers were asked first to name the feeds included in their lamb fattening diets, then to estimate the percentage by weight accounted for in the diet by each of these feeds. Taking the responses for the five farmers together, they add up to five hundred per cent. Summing percentage values within feeds across the five farmers, then dividing by five, gave the weighted average percentage of each feedstuff in the fattening diets. These values are given with the number of farmers reporting use of each feedstuff.

Barley grain was the predominant component of the fattening diets. Wheat and legume (lentil and vetch) grains were the next most important sources of energy and protein in the diets. Most of the farmers provided protein supplements in the form of wheat bran and cottonseed cake. Two of the five farmers used substantial proportions of lentil straw in the fattening diet. All five farmers reported the use of salt, vitamins and mineral supplements, totaling on average less than two per cent of the diet. Other minor ingredients were reported by some farmers.

Table 15. Summary of diets for fattening lambs, comparing 1985 survey results in the Tah area with 1979 survey results in Syria

Feedstuff	1985 survey in Tah area: Mean Percent in Diets	1985 survey in Tah area: Number of Farmers Using	1979 survey[1/]: Mean % in Diets
barley grain	40	5	50.4
wheat grain	14	5	6.0
cottonseed cake	5	4	10.5
cottonseed hulls	1	2	8.5
wheat bran	5	4	6.7
legume grain	13	5	6.1[2/]
lentil straw	17	2	10.4[3/]
salt, vitamins and minerals	2	5	0.3[4/]
sugar beet pulp	0.5	1	- -
fish oil	0.5	1	1.1
soybean meal	2	1	- -
	100%		100%

1/ combining estimates for winter and summer fattening diets reported for 1979 by Nygaard, Martin and Bahhady, 1982, p 83

2/ vetch grain

3/ legume straw

4/ salt only

Comparable figures are available from a 1979 survey of 13 fattening cooperatives in Syria in which 53 farmers were interviewed (Nygaard, et al, 1982). Combining estimates of that survey, for winter and summer fattening diets, gives the average composition listed in Table 15. With the exception of vitamins and minerals, sugarbeet pulp and soybean meal, the list of ingredients of fattening diets in the present survey is similar to that of the earlier survey, although proportions do differ. The sample size of fattening operations in the Tah area was so small, however, that one cannot say whether the differences from the earlier results are statistically meaningful.

Diets of Breeding Ewes:

Most (42) of the sample farmers in the 1985 survey had flocks of breeding ewes and were able to provide detailed estimates of ewe diets, and how these change throughout the yearly production cycle. The interview procedure on these points required several steps.

First, the farmer was asked which feeds and grazing sources are normally offered to his ewes in each period of the year; the narrowest time resolution for recording the farmer's answers was one month, and the widest generalization for any farmer was eight months. However, most farmers divided the year into several feeding periods, each of two to four months duration.

Next, the farmer was asked to estimate the percentage composition of the hand-fed portion of the diets of each feeding period, such that 100% of the hand-fed feed was distributed among the feedstuffs mentioned in the first step. This provided an opportunity for the farmer to reflect upon and revise his original list of feeds and dates. The same questioning process was repeated with regard to the grazing resources, distributing 100% of the grazing done in each period to the various sources.

The third step was to ask the farmer to estimate the percentage contributions of hand-fed feeds and grazing to the total diet of ewes in each period. These final estimates were used later in statistically weighting the percentage values given to each feedstuff and grazing source, to derive monthly estimates of ewe diet compositions. After the farmer had identified the various items in the diet, he was finally asked to provide an estimate on the price of each. A summary of these price estimates was given in Table 14.

The data on ewe diets from all 42 farmers were aggregated on a month-by-month basis, with equal weighting given to the information from each farmer. The summary is given in Table 16, where the percentage value for each feed in each month is the mean of 42 observations. Except for rounding errors, the percentage values for each month sum to 100%.

Several striking results should be noted with regard to Table 16. First is the virtual absence of grazing resources

TABLE 16. Summary of feed use and grazing sources as percent of monthly ewe diets, of forty-two flocks in the Tah area

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
HAND-FED FEEDS												
Barley Grain	30	28	11	3	0	0	1	1	2	11	20	30
Wheat Grain	3	3	1	1	0	0	-	-	1	1	2	3
Cotton Seed Cake	6	6	2	1	0	0	-	-	-	3	4	6
Cotton Seed Hulls	5	5	2	-	0	0	0	0	0	2	4	5
Coton Seeds	1	-	-	-	0	0	0	0	0	-	1	1
Wheat Bran	9	9	3	-	0	0	-	-	-	3	6	9
Legume Grain	2	1	1	-	0	0	0	-	-	-	1	2
Sugar Beet Pulp	1	1	1	-	0	0	0	0	0	-	1	1
Barley Straw	13	13	4	1	0	0	1	2	2	4	8	13
Wheat Straw	2	2	1	-	0	0	0	0	0	0	1	2
Lentil Straw	23	22	9	2	0	0	0	0	1	10	18	23
Lathyrus Straw	3	3	-	0	0	0	0	-	-	1	2	3
Berseem Straw	2	2	-	0	0	0	1	1	1	1	1	1
GRAZING SOURCES												
Green Cereal Grazing	0	1	1	2	0	0	0	0	0	0	0	0
Mature Cereal Grazing	0	0	5	16	40	21	13	16	10	1	0	0
Cereal Stubble Grzg.	0	0	0	0	15	76	82	65	29	4	0	0
Mature Legume Crops	0	1	3	4	6	0	0	0	2	0	0	0
Cotton Residues	0	0	0	0	0	0	0	0	7	46	26	0
Common Grazing	0	2	40	49	24	1	0	0	1	1	1	0
Steppe Grazing	-	-	14	21	15	2	2	0	0	0	-	-
Sugar Beet Crop	0	0	0	0	0	0	0	7	14	2	0	0
Sugar Beet Residues	0	0	0	0	0	0	0	6	20	6	1	0
Summer Crop Residues	0	0	0	0	0	0	0	1	10	2	3	0

Fractions greater or equal to 0.5 percent were rounded up to the nearest integer, while those less than 0.5 percent were dropped. Values between zero and 0.5 percent are indicated by "-", while cases where no farmer reported use of the feed are indicated by "0". Due to rounding error, monthly sums do not always total to 100 percent.

in ewe diets in the months of December and January, while in May and June the diet is comprised only of grazed materials. Thus, hand-fed concentrates and straws comprise the entire diet in December and January, and nearly so in February, but give way largely to common grazing and some grazing of cereal crops by March and April. By May, the emphasis shifts to grazing mature cereal crops and cereal stubbles, and by June these two sources, particularly the stubbles, account for nearly the entire diet of ewes. The predominance of cereal stubbles in the diets is maintained through September, even as sugar beet crops and their residues enter the picture. By October and November the most important grazing resources are the residues following cotton harvest on irrigated plots.

Such quantitative information on feed use is most valuable in developing a dynamic picture of the nutritional environment for flocks in the existing farming system. This will be used in conjunction with current on-farm trial data on the timing of medic pasture availability, and expected levels of offtake, under different grazing options. An example of how such data are used in whole-farm analysis of a similar farming system is given by Nordblom and Thomson (1987, p.20).

Farmers' knowledge of medic as a pasture:

Farmers' responses to our questions on their ideas about medic pasture are not summarized quantitatively. In general, the six farmers who were participating in the first year of

on-farm trials with medic pasture in the Tah area were well informed on the basic concepts involved, but had not seen the medic-wheat rotation in practice. Farmers at most of the other villages were unfamiliar with the notion of medic as a consciously managed pasture, although many did seem to recognize the plant by its local names or from verbal descriptions.

Medic occurs in the area as a weed in cultivated fields, on road sides and in uncultivated grazing lands. The idea of managing this species as a pasture in rotation with wheat appeared to be virtually unknown in the study area in the summer of 1985, except among farmers in and around Tah village.

CHAPTER 4. ANALYSIS AND CONCLUSIONS

The five main crops found in Tah village and similar areas were wheat, barley, lentils, melons and sesame (recall Figure 2). These crops were most commonly reported to be grown in three-course rotations: cereal (wheat or barley), lentils, and summer crop (melon or sesame). Two-oourse rotations were less common and cereal-fallow rotations were rare. Wheat-medic rotations were non-existent except those found within the on-farm trial plots, and these were in their establishment year.

In order to compare a medic-wheat rotation fairly with others, the third year, in which medic pasture regenerates, must be taken into consideration. At the time of the survey, and the time of this writing, the third year's results were not yet available. Nevertheless, a fairly complete picture of other crop rotations has been assembled. This allows a preliminary economic analysis of the conditions facing the introduction of annual medic pasture crops in the Tah area.

In the medic establishment year, high costs and low pasture yields are expected relative to costs and yields in the regeneration years. Thus, a farmer will face the prospect of paying <u>today</u> for benefits expeoted three, five and even more years in the future. There is nothing unusual in this: farmers in the area plant olive and pistachio tree crops which incur costs and return no income in the first several years; and such points must be considered in

comparing the medic-wheat rotation with others.

Discounting Future Costs and Revenues:

Planners commonly use calculations of discounted present value to compare alternative sequences of expected future costs and revenues. Such calculations employ a discount rate, which reflects risks, other production opportunities, or time preferences in consumption, such that costs or revenues in the distant future weigh less heavily on a decision than equal ones in the near future. For example, the reader may consider the question:

"How much money would you be willing to pay today for the promise of receiving SL 100 one year from today?"

A positive discount rate is implied if the most you are willing to pay for such a promise is less than SL 100. A discount rate of zero is implied if you would be willing to pay the full amount of SL 100.

With a discount rate of zero, one may calculate the present value of a future stream of costs and revenues by simply summing up their nominal values. However, if one does wish to discount the values of future costs and revenues, one may use a standard formula (Rae, 1977, p.282) to calculate the present value of each:

$$\text{Discounted Present Value} = A/(1+r)^{n} = A/(1+r)^{(m/12)}$$

where:

A = amount of money changing hands in the future; this may be a cost or revenue item,

n = number of years (and fractions of years) in the future,

m = number of months in the future, and

r = the annual discount rate.

This method is appropriate for simple budget comparisons of crop rotations having different sequences of expected future costs and returns. The amount of each expected cost or revenue item in the future may be reduced to a "present value," with the formula, given an estimate of the length of time to its occurrance, and given a specific discount rate.

For the sake of simplicity, we may consider there are three times in each crop season at which costs or revenues occur: (1) crop establishment, (2) at harvest , and (3) when the crop is sold. In Table 17, considering 1 November as the starting date for calculations, the approximate dates of crop establishment (TE), harvest (TH) and sales revenues (TR) are expressed as the number of months in the future for each of the five main crops in the Tah area. Presented in the same table are estimates of the costs and revenues expected at these dates, as derived from the survey results for Tah village and similar areas, and are expressed in nominal prices for the 1985 sason. Yields of "normal" years were used with these prices to estimate gross revenues.

TABLE 17. Summary of Annual Crop Budgets in the Tah Area, 1985

		WHEAT[1/]	BARLEY[2/]	LENTILS[3/]	SESAME[4/]	MELONS[5/]
Establishment Costs[6/] (SL/ha)	E =	654	801	542	400	527
Time of Estab. (months from Nov. 1)	TE =	0	0	2	5	5
Mid-season & Harvest[7/] costs (SL/ha)	H =	267	388	1154	209	368
Time of H (months from Nov. 1)	TH =	8	8	7	11	10
Gross Revenue[8/] (SL/ha)	R =	2791	3037	2200	1323	1869
Time of R (months from Nov. 1)	TR =	9	9	8	11	10
Timeless Net Revenue[9/]	R - E - H =	1870	1648	504	714	974

1/ wheat costs and revenues derived from Tables 2 and 14.

2/ barley costs and revenues derived from Tables 5 and 14.

3/ lentil costs and revenues derived from Tables 8 and 14.

4/ sesame costs and revenues derived from Table 10.

5/ water melon costs and revenues derived from Table 9.

6/ includes tillage, seed, seeding and fertilization costs

7/ includes weed control, harvest and post-harvest costs

8/ includes grain and straw sales for cereals and lentils, and seed and melon sales for the sesame and water melon crops

9/ assumes a discount rate of zero

Six-year Budget Horizons:

To compare three-course and two-course crop rotations, budgeting sequences with six-year time horizons are appropriate, because six is the lowest number divisible by both two and three. The formula used for calculating the present values of crop rotations over the six-year sequence is given in Figure 1. The cost and revenue values for the first crop in the rotation were entered for "Season No. 1" in the formula; those for the second crop, in "Season No. 2", and so on. This means each crop in a two-course rotation will appear three times in the formula, and each one in a three-course rotation will appear two times.

In addition to comparing the crop rotations with each other, it was convenient to examine the question of the extent to which the particular crop coming first in a rotation sequence influences the discounted present value of the rotation. Thus, the calculations were repeated for each rotation to let each crop come first in the sequence. The results for seven crop rotations, with five discount rates, are presented in Table 18.

The seven crop rotations analyzed in Table 18 were chosen for particular reasons. The first four (WLS, BLS, WLM and BLM) were the predominant rotations found in Tah Village and similar areas. The two course wheat-lentil, wheat-fallow and barley-fallow rotations, although rare in the area, were included since they would be the ones most directly

FIGURE 4. Formula for calculating present value of a crop-rotation, in the Tah area, with a six-year horizon.

Summing up from the starting date of sequence, 1 November Season No. 1:

Season No. 1

$$- E_1/(1+r)^{(TE_1/12)} \quad - H_1/(1+r)^{(TH_1/12)} \quad + R_1/(1+r)^{(TR_1/12)}$$

Season No. 2

$$- E_2/(1+r)^{((12+TE_2)/12)} \quad - H_2/(1+r)^{((12+TH_2)/12)} \quad + R_2/(1+r)^{((12+TR_2)/12)}$$

Season No. 3

$$- E_3/(1+r)^{((24+TE_3)/12)} \quad - H_3/(1+r)^{((24+TH_3)/12)} \quad + R_3/(1+r)^{((24+TR_3)/12)}$$

Season No. 4

$$- E_4/(1+r)^{((36+TE_4)/12)} \quad - H_4/(1+r)^{((36+TH_4)/12)} \quad + R_4/(1+r)^{((36+TR_4)/12)}$$

Season No. 5

$$- E_5/(1+r)^{((48+TE_5)/12)} \quad - H_5/(1+r)^{((48+TH_5)/12)} \quad + R_5/(1+r)^{((48+TR_5)/12)}$$

Season No. 6

$$- E_6/(1+r)^{((60+TE_6)/12)} \quad - H_6/(1+r)^{((60+TH_6)/12)} \quad + R_6/(1+r)^{((60+TR_6)/12)}$$

= **DISCOUNTED PRESENT VALUE** of the six-year sequence of crop-rotation costs and returns,

where all costs and revenues are in SL/ha and:

E_i = crop establishment costs in $_i$th season: tillage, seeding, fertilizer.

H_i = mid-season and harvest costs in $_i$th season: weeding, harvest, transport, threshing, winnowing, bags and bagging.

R_i = gross revenue in $_i$th season: price X yield for grain and straw.

r = the annual discount rate

TE_i, TH_i and TR_i = time in months from 1 November of the ($_i$th) season to the expected dates of crop establishment, harvest and crop sales, respectively.

TABLE 18. Discounted Present Values[1] of Tah Area Crop Rotations over a Six-year Sequence with Five Discount Rates

Discount Rate:	Present Value (SL/ha) of Six-year Sequence				
	r = 0	r = .05	r = .10	r = .20	r = .40
Crop Rotation and Sequence					
Wheat/Lentil/Sesame					
W L S W L S	6176	5288	4587	3570	2393
S W L S W L	6176	5207	4447	3356	2117
L S W L S W	6176	5078	4235	3052	1770
Barley/Lentil/Sesame					
B L S B L S	6132	5237	4532	3508	2321
S B L S B L	6132	5159	4397	3304	2066
L S B L S B	6132	5033	4189	3009	1733
Wheat/Lentil/Melons					
W L M W L M	6696	5713	4940	3822	2536
M W L M W L	6696	5675	4874	3718	2397
L M W L M W	6696	5525	4622	3354	1970
Barley/Lentil/Melon					
B L M B L M	6652	5662	4885	3759	2464
M B L M B L	6652	5628	4824	3665	2346
L M B L M B	6652	5479	4577	3310	1933
Wheat/Lentil					
W L W L W L	7122	6077	5253	4059	2680
L W L W L W	7122	5907	4967	3638	2172
Wheat/Fallow					
W F W F W F	5610	4854	4251	3361	2304
F W F W F W	5610	4623	3864	2800	1646
Barley/Fallow					
B F B F B F	5544	4781	4172	3274	2211
F B F B F B	5544	4553	3792	2729	1579

where:

r = the annual discount rate

W = wheat, B = barley, L = lentils, S = sesame, M = melons, F = fallow

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1/ calculated according to the formula in Figure 4.

comparable with a wheat-medic rotation.

At first glance, it seems a paradox that lentils (the least profitable crop) when joined with wheat in a two-course rotation, shows the highest overall present value of all the seven rotations (Table 18). This is explained by the fact that the high-value wheat crop appears three times in the six year sequence of wheat and lentils, compared to only two times in the wheat-lentil-summer crop rotations.

This leads to an optimistic preliminary hypothesis for the prospects of medic-wheat systems: medic pasture would only have to out-perform lentils to make this rotation the most profitable of all. However, because the present analysis is both partial and static in nature, considerable caution about this statement is in order. The analysis does not account for the possible roles of lentils or medic in crop rotation hygiene (insect, disease and weed control), or soil fertility. Questions also remain on the availability of medic grazing at various times of the sheep feeding calendar in these areas.

In the case of the zero discount rate, the present value of a particular crop rotation is unaffected by which crop comes first. However, differences do appear when even a low discount rate (i.e., r = .Ø5 or 5%) is used, and these differences are magnified as the rate is increased. These are due to the unequal profitabilities of the different crops in a rotation: in Table 17, the cereal crops show the highest

net revenues, and lentils the lowest.

Given a positive discount rate, when a cereal crop comes first in a three-course sequence, its high expected profits in the near future outweigh the low-profit lentil crops two and five years in the future. However, when lentils are first in the sequence, the discounted profits expected from cereal crops, three and six years in the future, add considerably less to the present value of the rotation.

The most surprising result in Table 18 is, with the high discount rate (r = .4), differences in present values <u>within</u> rotations were greater than <u>between</u> rotations. With cereal crops coming first, the greatest difference in present values between rotations, was only SL 469/ha; by contrast, differences within rotations due to the crop which comes first in the time sequence ranged from SL 508/ha to SL 656/ha.

These points are made with a view toward the decision on where to "break" an on-going crop rotation with the introduction of medic pasture: the indication is that the "cereal year" should not be displaced by medic; rather, the lower value crops, and fallows, would be the first candidates for displacement <u>if</u> medic proves to be more profitable than them.

At the time of this writing, on-farm trial results are incomplete and no whole-farm analyses, comparing wheat-medic pasture systems with existing crop-livestock systems in Syria, have been conducted. Because the medic pasture is marketed through sheep products, whole-farm analysis is needed to show the full benefits of its introduction. Such research should make use of the on-farm trial results on medic regeneraton when it becomes available in 1987. Initial whole-farm analysis at Tel Hadya (Nordblom and Thomson, 1987), dealing with crop rotations, sheep nutrition and native pasture, was intended to serve as a building block adaptable to economic analysis of medic pasture in the farming systems of the Tah area.

Throughout the budgeting and present value analyses, above, constant crop yields and nominal 1985 prices were used. To the extent that crop yields and price ratios for the various inputs and outputs stay the same over time, the comparisons made between the crop rotations will remain valid. Of course, this is not expected to happen and questions on this point are raised in the following section. In any case, the present value analyses are incomplete or "partial" in the sense that the crop-livestock relationships have not been brought together in a whole-farm context.

Estimation of Crop Yield Variations Over Time:

Year-to-year yield variations are a major feature of rainfed crop produotion in the ICARDA region. That this is true in the study area is shown by farmers' estimates as summarized in Figure 3. This leads to the necessity of explicitly accounting for production risk in comparisons of alternative crop-livestock systems. The sparse data from the present survey permit only a preliminary analysis of crop yield variabiliy. However, this will give an early quantitative indication of crop yield variability in an area where introduction of medic pasture is being considered, and serve to show how a more complete data set can be used.

In the interviews, farmers were asked to estimate their crop yields in good, normal and poor years without being given any particular definition of good, normal or poor. Certain assumptions regarding the frequency of occuranoe for good, normal and poor years must now be made in order to summarize the data across year types. This problem can be avoided in future surveys by asking each farmer to estimate the frequency of each type of year, then say what yield level he expects in each case. Maerz (1986) has described such an approach and a method to aggregate the resulting information for risk analysis.

The assumptions used in the present analysis regarding frequency of occurrance for good, normal and poor years are guided by several thoughts. First, normal years should be

the most frequent, based on the way the questions were put to the farmers, with poor and good years being less frequent. Second, the overall mean yield, combining the three types of years, should be the same as that of the normal year; this point implies certain limits on the weights which can be used for the poor and good years in deriving a weighted average yield. The third simplifying assumption is that the poor, normal, good and aggregate yield distributions are continuous, symetrical and characterizable by their means and standard deviations.

With regard to the problem of weighting the poor and good yields in a way that results n a mean equal to that of normal years, it was most convenient to use the principle of balancing the products of moment and weight on each side of a pivot point. It was noted earlier that the ratio of good minus normal yields to normal minus poor yields was approximately 1.5, on average, for the ten pairs of five main crops (see Figure 3 and Appendix B). Simplifying this picture; if we take the "moment" of poor years to be 1.Ø, we should take 1.5 as the "moment" of good years. Giving a weight of 1.Ø to good years, the balancing weight on poor years would have to be 1.5 ; poor years would have to occur at 5Ø% greater frequency than good years in order for their weighted averages to balance out close to the mean of normal years.

An arbitrary weighting scheme which satisfies the above requirements was used: poor years, 3 years out of 10; normal years, 5 out of 10; and good years, only 2 years in 10. The weighted aggregation of good, normal and poor year means is now a straightforward process (see Table 19).

Aggregation of measures of dispersion are another matter. The approach used here to obtain an estimate of the aggregate standard deviation was to determine, for each year type, the yield value of the mean minus one standard deviation, then subtract the weighted average of these from the aggregate mean, (see Table 19).

Several points should be made with respect to Table 19. Both the aggregate mean and standard deviation calculated for each crop are close to the respective values shown for "normal" years. These aggregate values can be used to compute C.V.'s of 34% and 40% for wheat and barley, respectively, which are close to the 35% and 52% values derived for these crops from national average statistics of Syria over the period 1966-1984 (Cooper, Harris and Goebel, 1987, fig. 1). A single sample from the distribution characterized by the aggregate mean and standard deviation would represent the mean yield across farms in the area for a particular year. One may imagine a distribution of individual farmers' yields around any such estimate for a given year. One would not expect to see extremely high aggregate yields in a sample of years, while individual farmers may occasionally attain outstanding yields.

TABLE 19. Parameters of crop yield distributions in the Tah area for good, normal and poor years and aggregated across farms and years

crop	means (and standard deviations) based on farmers' estimates, kg/ha: GOOD years	NORMAL years	POOR years	ref. Table	AGGREGATE ACROSS FARMS AND YEARS 1/
wheat	2863 (870)	1524 (472)	662 (384)	Table 2	1533 (525)
barley	3148 (1023)	1787 (776)	791 (354)	Table 5	1760 (699)
lentil	1485 (413)	867 (316)	439 (290)	Table 8	862 (328)
melon	5083 (3629)	2708 (1958)	1125 (1236)	Table 9	2708 (2076)
sesame	163 (112)	90 (83)	50 (56)	Table 10	93 (80)

1/ the method of aggregation across farms and years was:

$$\bar{X}_A = \sum_{j=1}^{n} P_j \bar{X}_j \quad \text{and}$$

$$S_{xA} = \bar{X}_A - \sum_{j=1}^{n} P_j(\bar{X}_j - S_{xj}) = -\bar{X}_A + \sum_{j=1}^{n} P_j(\bar{X}_j + S_{xj}),$$

where:

$\bar{X}_A$ and S_{xA} are, respectively, the mean and standard deviation of the aggregate yield distribution;

$\bar{X}_j$ and S_{xj} are, respectively, the mean and standard deviation of the yield distribution for year type "j", and

P_j is the probability of year type "j" occuring,

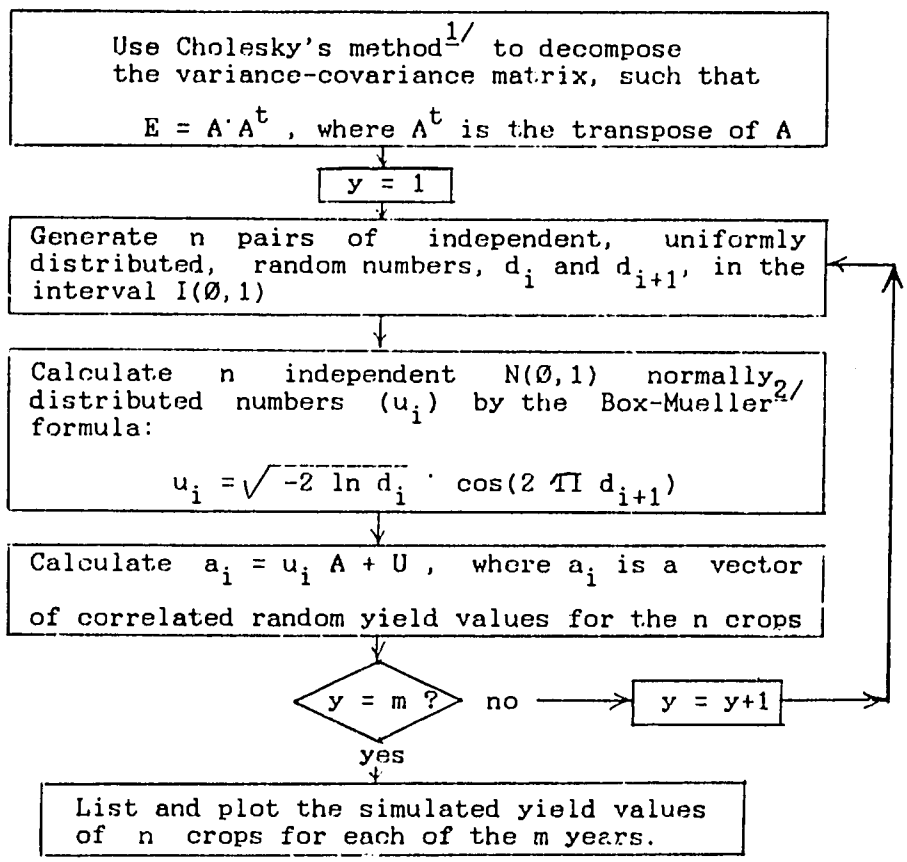
subject to $\sum_{j=1}^{n} P_j = 1.0$, and in the present application:

j = 1 for "good" years, $P_1 = 0.2$,

j = 2 for "normal" years, $P_2 = 0.5$,

j = 3 for "poor" years, and $P_3 = 0.3$

From the estimates of correlation coefficients between pairs of crops (Appendix B), and the aggregate standard deviations from Table 19, the empirical variance-covariance matrix in Taole 20 was estimated for the five main crops in the Tah area. Maerz (1986) has shown that yield distributions characterized in this format can be used to simulate correlated random yields of several crops simultaneously. Maerz's simulation procedure for n crops over m years (y), starting with the vector of n mean yields (U), and the empirical variance-covariance matrix (E), can be summarized as follows:



1/ see Engeln-Muellges and Reutter (1985, p.51)
2/ see Fruehwirth and Regler (1983, p.106)

TABLE 20. Correlation, variance and covariance among main crops in the Tah area, based on farmers' estimates, kg/ha

CORRELATION MATRIX[1/]:

	wheat	barley	lentil	melon	sesame
wheat	1	.76	.70	.59	.81
barley	.76	1	.92	.83	.64
lentil	.70	.92	1	.74	.68
melon	.59	.83	.74	1	.60
sesame	.81	.64	.68	.60	1

VARIANCE-COVARIANCE MATRIX[2/]:

	wheat	barley	lentil	melon	sesame
wheat	275,625	278,901	120,540	643,041	34,020
barley	278,901	488,601	210,930	1,204,433	35,789
lentil	120,540	210,930	107,584	503,887	17,843
melon	643,041	1,204,433	503,887	4,309,776	99,648
sesame	34,020	35,789	17,843	99,648	6,400

1/ unweighted correlation coefficients based on farmers' paired estimates, as summarized in Appendicies A and B and plotted in Figure 3.

2/ variance values on the main diagonal are the squares of the respective aggregate standard deviations from Table 19. The covariance values were derived according to the formula,

$$C_{xy} = g_{xy} S_x S_y ,$$

where:

g_{xy} = correlation coefficient for the two crops (upper table),

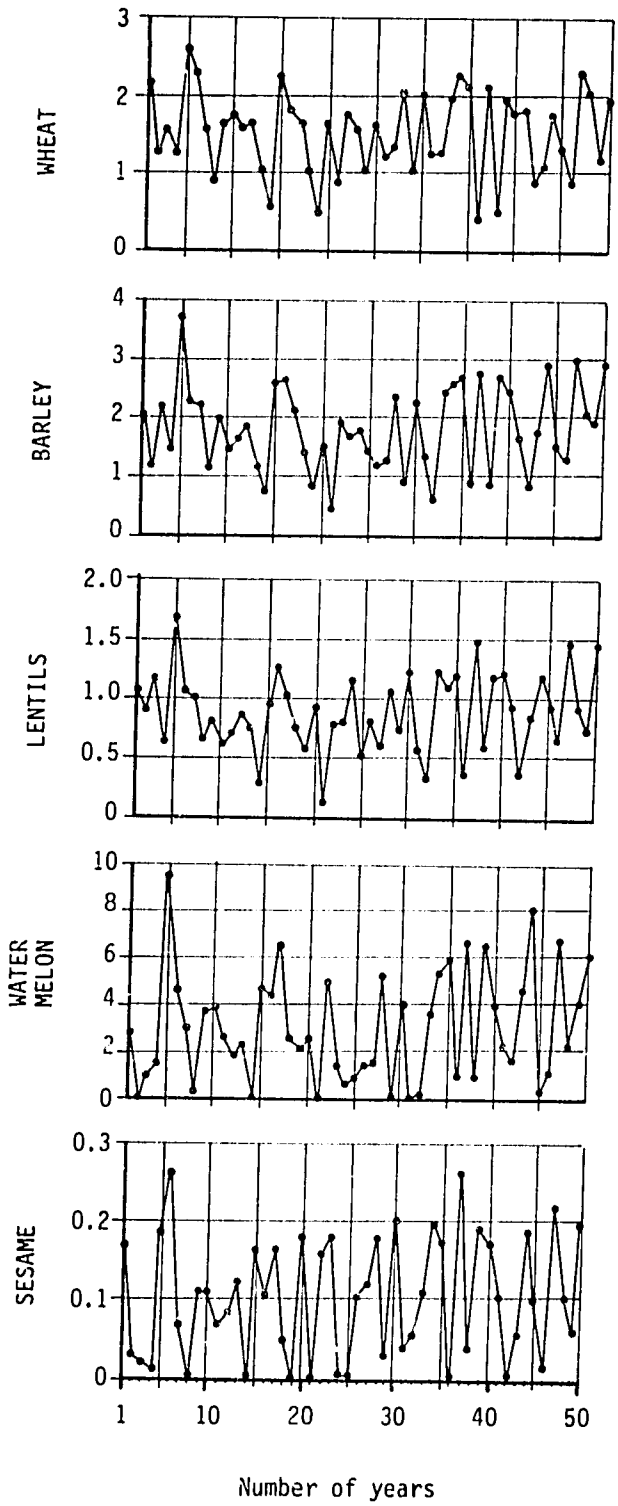
S_x and S_y are the estimated aggregate standard deviations across farms and years for crops x and y (Table 19)

Maerz contributed to this report by using his procedure to simulate 100 years of cross-correlated random crop yields based on the presented data from the Tah area. An example of the results is given in Figure 5, where crop yields for the first 50 years of the simulation run are plotted. Statistical evaluations of the 100 year results showed the mean and standard deviations of the individual crops, as well as the correlation coefficients between them, to be very close to the original empirical estimates. Also, no significant auto-correlation was present in any individual series of simulated crop yields.

In the cases of both melon and sesame crops, negative yield values occurred in the simulation. Since negative yields cannot occur in reality, these were plotted as zeros. In practice, moreover, one is not likely to find aggregate yields of water melons near zero; this is because melon planting time is late enough in the rainfall season that, in dry years, farmers decide not to plant melons but plant sesame or leave the land fallow.

If the yield variations suggested in Figure 5 are even only approximately representative of the Tah area, then serious caution must accompany any static economic analysis comparing alternative crop rotations: including the "present value" analysis offered earlier in this chapter. It is clear that an adequate analysis of conditions facing the introduction of medic pasture in this area must include both

Figure 5 Simulated crop yields (t/ha) for the Tah area, over a 50-year run



aspects: differential considerations of near and distant future costs and revenues, as well as the probabilistic nature of rainfed crop yields in the area. In addition, we must consider the very important aspect of price variations.

Fortunately, on a national scale, crop prices tend to be negatively correlated with crop yields and this has a dampening influence on farm incomes. These correlations may be estimated from historical price and yield series on a national level, and the resulting parameters used in an expanded simulation model for both crops and prices. Sheep prices should be included likewise.

In combination with whole-farm models, such data should allow probabilistic predictions of how different farm management plans compare over the near and long term. For example:

> "In the establishment year of a medic pasture, to be grown in rotation with wheat, we can expect this rotation to be less profitable than WLM, WLS, BLM, BLS, WL, WF and BF rotations in only a, b, c, d, e, f and g years out of 10, respectively."

Or: "At the beginning of a medic regeneration year, in rotation with wheat, this rotation is expected to be less profitable than WLM, WLS, BLM, BLS, WL, WF and BF in only h, i, j, k, l, m amd n years out of 10, respectively."

The above examples have been phrased in the negative only to avoid their being used out of context. The skepticism needed for scientific inquiry is in danger of being undermined by the real enthusiasm and true hospitality of farmers at Tah village.

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APPENDIX A. Paired crop yield estimates, by farmers in the survey, for good, normal and poor years: raw data in kg/ha

	Pair of Crops: wheat & lentil	
1G 1/	2100	1000
1N 2/	980	400
1P 3/	170	40
2G	3125	1680
2N	1500	980
2P	375	420
3G	2400	1680
3N	1200	980
3P	600	420
4G	2500	2250
4N	1250	1500
4P	1000	1050
5G	4375	1400
5N	2500	980
5P	1250	840
6G	2500	700
6N	1500	490
6P	875	280
7G	2970	1200
7N	1755	750
7P	135	115

	Pair of Crops: barley & lentil	
1G	3000	980
1N	1200	420
1P	500	70
2G	3300	1400
2N	2200	980
2P	1650	560
3G	3125	1400
3N	2125	700
3P	625	210
4G	3150	1960
4N	2100	1120
4P	1050	420
5G	2500	1400
5N	1500	700
5P	1000	280
6G	3300	1350
6N	2200	945
6P	1100	675
7G	3300	1350
7N	1100	675
7P	770	405
8G	2750	1400
8N	1320	700
8P	550	210
9G	2750	1120
9N	1650	700
9P	1100	280

	Pair of Crops: sesame & lentil	
1G	70	980
1N	40	420
1P	20	70
2G	100	1350
2N	50	945
2P	20	675
3G	300	2250
3N	150	1500
3P	100	1050
4G	360	1400
4N	270	980
4P	180	840

	Pair of Crops: melon & lentil	
1G	10000	1400
1N	5000	980
1P	3000	560
2G	7000	1400
2N	5000	700
2P	2000	210
3G	13000	1680
3N	7000	980
3P	4000	420
4G	8000	1960
4N	3000	1120
4P	300	420
5G	2000	1400
5N	1000	700
5P	300	280
6G	3000	1400
6N	1500	700
6P	200	210
7G	3000	1120
7N	1500	700
7P	500	280
8G	5000	1680
8N	3000	980
8P	200	420
9G	2000	700
9N	1500	490
9P	1000	280

	Pair of Crops: melon & barley	
1G	3000	2000
1N	1500	1200
1P	500	500
2G	10000	3300
2N	5000	2200
2P	3000	1650

--continued--

	Pair of Crops: continued melon & barley	
3G	7000	3125
3N	5000	2125
3P	2000	625
4G	8000	3150
4N	3000	2100
4P	300	1050
5G	2000	2500
5N	1000	1500
5P	300	1000
6G	3000	2750
6N	1500	1320
6P	200	550
7G	3000	2750
7N	1500	1650
7P	500	1100

	melon & wheat	
1G	13000	3125
1N	7000	1500
1P	4000	375
2G	5000	2400
2N	3000	1200
2P	200	600
3G	3000	2600
3N	1500	1560
3P	1000	910
4G	2000	2500
4N	1500	1500
4P	1000	875

	sesame & wheat	
1G	300	2500
1N	150	1250
1P	100	1000
2G	50	1125
2N	25	625
2P	10	313
3G	250	2600
3N	150	1560
3P	50	910
4G	360	4375
4N	270	2500
4P	180	1250
5G	135	3250
5N	45	1950
5P	30	1040

1/, 2/ and 3/ indicate the good, normal and poor year estimates, respectively, for the first farmer in the series of pairs

APPENDIX A. Continued: Synthetic pairs[1/] of crop yield estimates for good, normal and poor years: data in kg/ha

	Pair of Crops: wheat & barley	
1G	2500	3150
1N	1250	2100
1P	1000	1050
2G	3125	3300
2N	1500	2200
2P	375	1650
3G	2400	3300
3N	1200	2200
3P	600	1100
4G	4375	2500
4N	2500	1500
4P	1250	1000
5G	2970	3125
5N	1755	2125
5P	135	625
6G	2500	3300
6N	1500	1100
6P	875	770
7G	2100	3000
7N	980	1200
7P	170	500

	Pair of Crops: barley & sesame	
1G	3150	300
1N	2100	150
1P	1050	100
2G	3300	360
2N	2200	270
2P	1650	180
3G	3125	100
3N	2125	50
3P	625	20
4G	3000	70
4N	1200	40
4P	500	20

	Pair of Crops: melon & sesame	
1G	8000	300
1N	3000	150
1P	300	100
2G	10000	360
2N	5000	270
2P	3000	180
3G	7000	70
3N	5000	40
3P	2000	20
4G	13000	250
4N	7000	150
4P	4000	50
5G	5000	50
5N	3000	25
5P	200	10
6G	3000	250
6N	1500	150
6P	1000	50

1/ Synthetic pairs were derived from reported pairs in the first page of Appendix A, as follows:

wheat & barley, from associations of ranked normal year values of lentils in wheat-lentil and barley-lentil pairs;

barley & sesame, from associations of ranked normal year values of lentils in barley-lentil and sesame-lentil pairs;

melon & sesame, from associations of ranked normal year values of lentils in melon-lentil and sesame-lentil pairs, and of wheat in melon-wheat and sesame-wheat pairs.

APPENDIX B. Summary of paired crop yield estimates for good, normal and poor years in the Tah area

Crop Pair	expected rainfed crop yields[1/] in kg/ha: good years	normal years	poor years	n[2/]	r[3/]	GN:NP[4/]
wheat	2853 (756)	1526 (497)	629 (429)			
& barley	3096 (287)	1775 (492)	956 (380)	7*	.76	1.55
wheat	2853 (756)	1526 (497)	629 (429)			
& lentil	1416 (511)	869 (368)	452 (370)	7	.70	1.45
wheat	2656 (323)	1440 (162)	690 (251)			
& melon	5750 (4992)	3250 (2598)	1550 (1676)	4	.59	1.63
wheat	2770 (1185)	1577 (708)	903 (352)			
& sesame	219 (126)	128 (98)	74 (68)	5	.81	1.67
barley	3019 (291)	1711 (452)	927 (361)			
& lentil	1373 (266)	771 (209)	346 (189)	9	.92	1.59
barley	2796 (450)	1728 (413)	925 (406)			
& melon	5143 (3132)	2643 (1725)	971 (1089)	7	.83	1.35
barley	3144 (123)	1906 (473)	956 (519)			
& sesame	208 (144)	128 (107)	80 (77)	4*	.64	1.38
lentil	1416 (360)	817 (204)	342 (118)			
& melon	5889 (3887)	3167 (2077)	1278 (1406)	9	.74	1.37
lentil	1495 (537)	961 (441)	659 (421)			
& sesame	208 (144)	128 (107)	80 (77)	4	.68	1.62
melon	7667 (3559)	4083 (1960)	1750 (1533)			
& sesame	213 (126)	131 (89)	68 (63)	6*	.60	1.42

1/ standard deviations in parentheses; raw data in Appendix A.
2/ number of farmers giving yield estimates for good, normal and poor years for both crops. * indicates synthetic pairs.
3/ unweighted correlation coefficient for paired estimates.
4/ ratio of line lengths between envelope means (Figure 3), good minus normal : normal minus poor.

APPENDIX C

THE QUESTIONNAIRES

SURVEY QUESTIONAIRE FOR TAH MEDIC ANALYSIS 1984-85

Questionaire No.___

Village_____ Date _____

Farmer _____ Interviewer_____

Total Farm Size: Rainfed Crops _____ ha No. of Sheep:Ewes_____

Trees _____ ha Fattening Lambs_____

RAINFED CROP ROTATIONS ON DIFFERENT FARM PLOTS

* *

	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5
Size of Plot:	_____du	_____du	_____du	_____du	_____du
ROTATIONS Year 1	_____	_____	_____	_____	_____
Year 2	_____	_____	_____	_____	_____
Year 3	_____	_____	_____	_____	_____

SOIL DESRCIPTION

Soil Colour *	W Y R B	W Y R B	W Y R B	W Y R B	W Y R B
Soil Depth (cm)	_____	_____	_____	_____	_____
Stoniness	_____%	_____%	_____%	_____%	_____%
Cracking **	__Y_N__	__Y_N__	__Y_N__	__Y_N__	__Y_N__

---

* soil colour codes: W = White, Y = Yellow, R = Red, B = Black

** soil cracking: Yes or No ?

MQ1

C U L T I V A T I O N

MAIN PLOT SIZE: ____ha

ROTATION ON Main PLOT: ========== ========== ==========

CULTIVATION COSTS

Tillage No.1 *	___	___	___
Cost (SL/ha)	_____	_____	_____
Tillage No.2 *	___	___	___
Cost (SL/ha)	_____	_____	_____
Tillage No.3 *	___	___	___
Cost (SL/ha)	_____	_____	_____
Tillage No.4 *	___	___	___
Cost (SL/Ha)	_____	_____	_____

AVAILABILITY** OF CULTIVATION EQUIPMENT, AND DEPTH OF CULTIVATION

		OWNED	HIRED	Min.(cm)	Max.(cm)
Feddan Plow	(F *)	_____	_____	_____	_____
Ducks-Ft Cultivator	(C)	_____	_____	_____	_____
Moldboard Plow	(M)	_____	_____	_____	_____
Disc Plow	(D)	_____	_____	_____	_____
Disc Harrow	(H)	_____	_____	_____	_____
Tahban	(T)	_____	_____	_____	_____
Roller	(R)	_____	_____	_____	_____
Other _____		_____	_____	_____	_____

** Availability: 1 = Always available when needed
2 = Not always available when needed
3 = Never available

MQ2

INPUT COSTS

CROP IN MAIN PLOT:

SEEDING COSTS			
Seed Price (SL/kg)	_____	_____	_____
Seed Rate (kg/ha)	_____	_____	_____
Weight of Shwal(kg)	_____	_____	_____
Cost of hand broad-casting (SL/ha)	_____	_____	_____
Cost of mechanized-seeding (SL/ha)	_____	_____	_____
WEED CONTROL			
Hand Weeding costs (SL/ha)	_____	_____	_____
Use of Herbicides			
Name of chemical	_____	_____	_____
Cost of Chem: (SL/ha)	_____	_____	_____
Application Cost: (SL/ha)	_____	_____	_____
FERTILIZER			
Amount of Phosphate(kg/ha)	_____	_____	_____
Nitrogen at Seeding Time			
kg 26% N /ha	_____	_____	_____
kg 33% N /ha	_____	_____	_____
kg 46% N /ha	_____	_____	_____
In Spring Time			
kg 26% N /ha	_____	_____	_____
kg 33% N /ha	_____	_____	_____
kg 46% N /ha	_____	_____	_____
Cost of Broadcasting (SL/ha)	_____	_____	_____
MANURE			
Year and Plot where used	_____	_____	_____

1. Has manure been used regularly? Each ___ years.
2. Applicaton rate is normally ____tons/ha

FERTILIZER PRICES

	26% N	33% N	46% N	Phosphate
Price(SL /50 kg bag)	_____	_____	_____	_____

Manure Price:_____SL /ton

MQ3

H A R V E S T C O S T S & Y I E L D D I S T R I B U T I O N S

CROPS IN MAIN PLOT:

	==========	==========	==========
HARVEST COSTS FOR NORMAL YIELDS*			
Mechanical Harvest cost (SL/ha)	_____	_____	_____
Hand Harvest Labour-days /ha	_____	_____	_____
Cost: SL/Labour-day	_____	_____	_____
Transport from field(rajad) No. of trella /ha	_____	_____	_____
Cost: SL /trella	_____	_____	_____
Threshing Cost: SL /trella	_____	_____	_____
Winnowing Cost: SL /trella	_____	_____	_____
Bagging and Bags Cost: SL / bag	_____	_____	_____
Sale Price of Crop: SL /kg	_____	_____	_____
YIELD DISTRIBUTIONS on MAIN PLOT:			
HIGHEST YIELDS /ha			
Multiple of seed rate	_____X	_____X	_____X
Shwals per ha	_____Sh	_____Sh	_____Sh
tons per ha	____ton	____ton	____ton
STRAW: tons /ha	____ton	____ton	____ton
* NORMAL YIELDS /ha			
Multiple of seed rate	_____X	_____X	_____X
Shwals per ha	_____Sh	_____Sh	_____Sh
tons per ha	____ton	____ton	____ton
STRAW: tons /ha	____ton	____ton	____ton
LOWEST YIELDS /ha			
Multiple of seed rate	_____X	_____X	_____X
Shwals per ha	_____SH	_____Sh	_____Sh
tons per ha	____ton	____ton	____ton
STRAW: tons /ha	____ton	____ton	____ton

CALENDAR OF SHEEP FEED USE / TAH MEDIC ANALYSIS (1984-85)

For: EWE FLOCK or FATTENING LAMBS (circle one)

	PRICE SL/kg	PER CENT OF DIET IN MONTH Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
CONCENTRATE FEEDS													
Barley Grain													
Wheat Ggain													
Cotton Seed Cake													
Cotton Seed Hull													
Wheat Bran													
Legume Grain													
Sugar Beet Pulp													
other _____													
_____													
HAND-FED ROUGHEGES													
Barley Straw													
Wheat Straw													
Lentil Straw													
Chickpea Straw													
Harvested Weeds													
other _____													
_____													
HAND-FED TOTALS	100 %												
	SL/ha												
GRAZING													
CEREAL CROP (B,W)													
green grazing													
mature grazing													
stubble grazing													
Weeds in Fallow													
Cotton Residues													
Common Grazing													
Steppe Grazing													
Sugar Beet Grzg													
other _____													
_____													
_____													
GRAZING TOTALS	100 %												
PROPORTIONS **********		***	***	***	***	***	***	***	***	***	***	***	***
Hand-Fed Roughage & Conc. %													
Grazing of all kinds	%												
TOTAL DIET	100 %	100	100	100	100	100	100	100	100	100	100	100	100

MQ5

INTEREST IN THE NEW CROP / TAH MEDIC ANALYSIS (1984-85)

Would YOU be willing to try a Medic pasture crop on your own farm?

If "YES", how many hectares? _____ha

How would you use a Medic pasture?

Ewes _____

Ewes and Lambs _____

Fattening Lambs _____

If "NO", what problems do you see for this crop?

What crop(or crops) would Medic replace?

On which plot would you first grow Medic?

دراسة حول زراعة النفل في قرية
التح والقرى المجاورة ١٩٨٤-٨٥
رقم الاستمارة ( )

اسم القرية : _____ التاريخ : _____

اسم المزارع : _____ اسم الباحث : _____

المساحة الاجمالية للمشجر : ____ هكتار عدد رؤوس الغنم : ____ راس

المساحة الاجمالية للمحاصيل البعلية : ____ هكتار عدد رؤوس الخراف للتسمين : ____ راس

الدورة الزراعية للمحاصيل البعلية في خمس قطع من المزرعة

	القطعة الاولى	القطعة الثانية	القطعة الثالثة	القطعة الرابعة	القطعة الخامسة
مساحة القطعة	____دونم	____دونم	____دونم	____دونم	____دونم
الدورة الزراعية					
السنة الاولى	____	____	____	____	____
السنة الثانية	____	____	____	____	____
السنة الثالثة	____	____	____	____	____
وصف التربة					
لون التربة*	WYRB	WYRB	WYRB	WYRB	WYRB
عمق التربة (سم)	____	____	____	____	____
نسبة الحجر في القطعة	____%	____%	____%	____%	____%
قابلية التشقق**	- YN -	- YN -	- YN -	- YN -	- YN -

* لون التربة W : بيضاء Y : صفراء R : حمراء B : سوداء

** Y : قابلة للتشقق N : غير قابلة للتشقق

الفـــلاحـــات

حجم القطعة الرئيسية من الارض _____ دونم

الدورة الزراعية في هذه القطعة _____ _____ _____

تكاليف الفلاحـة

الفلاحـة الاولـى*	_____	_____	_____
التكاليف لس/هكتار	_____	_____	_____
الفلاحـة الثانيـة*	_____	_____	_____
التكاليف لس/هكتار	_____	_____	_____
الفلاحـة الثالثـة*	_____	_____	_____
التكاليف لس/هكتار	_____	_____	_____
الفلاحـة الرابعـة*	_____	_____	_____
التكاليف لس/هكتار	_____	_____	_____

توفـــر** معـدات الفلاحـة و عمـق الفلاحـات

		ملـك	اجـار	اقل عمق (سم)	اكثر عمق (سم)
الفـدان*	(F)	_____	_____	_____	_____
الكالتيفاتور	(C)	_____	_____	_____	_____
السكـة	(M)	_____	_____	_____	_____
ديسك للاجـر	(D)	_____	_____	_____	_____
ديسك التنعيم	(H)	_____	_____	_____	_____
طبـان	(T)	_____	_____		
ديسك الدحـل	(R)	_____	_____		

** امكانية التوفـر ١) متوفر دائما
٢) ممكن توفره
٣) غير متوفـر

البذار والادوية والسماد

محاصيل القطعة الرئيسية :	_____	_____	_____
سعر البذار لس/كغ	_____	_____	_____
نسبة البذار كغ/هكتار	_____	_____	_____
وزن الشوال (كغ)	_____	_____	_____
كلفة اضافة البذار يدويا لس/هكتار	_____	_____	_____
كلفة اضافة البذار ميكانيكيا لس/هكتار	_____	_____	_____
مكافحة الاعشاب			
كلفة المكافحة اليدوية لس/هكتار	_____	_____	_____
المكافحة الكيماوية اسم المبيد	_____	_____	_____
ثمن المبيد لس/هكتار	_____	_____	_____
كلفة رش المبيد لس/هكتار	_____	_____	_____
الاسمدة			
كمية السماد الفوسفوري كغ/هكتار	_____	_____	_____
كمية السماد الازوتي وقت البذار			
كغ N ٢٦ %	_____	_____	_____
كغ N ٣٣ %	_____	_____	_____
كغ N ٤٦ %	_____	_____	_____
كمية السماد الازوتي في الربيع			
كغ N ٢٦ %	_____	_____	_____
كغ N ٣٣ %	_____	_____	_____
كغ N ٤٦ %	_____	_____	_____
كلفة اضافة السماد لس/هكتار	_____	_____	_____
السماد البلدي السنة التي اضيف فيها والمحصول الذي اضيف عليه	_____	_____	_____

١) هل يضاف السماد بشكل دوري؟ كل _____ سنة

٢) نسبة الاضافة عادة _____ طن / هكتار

اسعار الاسمدة الازوتي	٢٦%	٣٣%	٤٦%	الفوسفاتي
سعر كس السماد (ل.س/٥٠ كغ)	_____	_____	_____	_____

سعر السماد البلدي _____ لس / طن

تكاليف الحصاد وتوزع المردود

محاصيل القطعة الرئيسية :	_____	_____	_____
تكاليف الحصاد للسنين المتوسطة الانتاج*			
الحصاد الالي لس/هكتار	_____	_____	_____
الحصاد اليدوي			
عدد العمال/عدد الايام / هكتار	_____	_____	_____
كلفة العامل لس/يوم	_____	_____	_____
تكاليف النقل من الحقل			
عدد التريلات/هكتار	_____	_____	_____
كلفة التريلا لس/تريلا	_____	_____	_____
تكاليف الدراس لس/تريلا	_____	_____	_____
تكاليف التذرية لس/تريلا	_____	_____	_____
الاكياس والتعبئة			
ثمن الكيس الفارغ	_____	_____	_____
ثمن مبيع المحصول لس/كغ	_____	_____	_____

توزيع المردود في القطعة الرئيسية

الحد الاعلى للمردود/هكتار			
امثال نسبة البذار	____عدد امثال	____عدد امثال	____عدد امثال
شوال / هكتار	_____ شوال	_____ شوال	_____ شوال
طن / هكتار	_____ طن	_____ طن	_____ طن
انتاج التبن طن/هكتار	_____ طن	_____ طن	_____ طن
الحد المتوسط للمردود/هكتار			
امثال نسبة البذار	____عدد امثال	____عدد امثال	____عدد امثال
شوال/هكتار	_____ شوال	_____ شوال	_____ شوال
طن / هكتار	_____ طن	_____ طن	_____ طن
انتاج التبن طن/هكتار	_____ طن	_____ طن	_____ طن
الحد الادنى للمردود/هكتار			
امثال نسبة البذار	____عدد امثال	____عدد امثال	____عدد امثال
شوال / هكتار	_____ شوال	_____ شوال	_____ شوال
طن / هكتار	_____ طن	_____ طن	_____ طن
انتاج التبن طن/هكتار	_____ طن	_____ طن	_____ طن

جدول يبين النسب المئوية لاستعمال الاعلاف المختلفة على مدار السنة
للاغنام او لخراف التسمين ١٩٨٤-٨٥

	الاسعار ل.س/كغ	ت٣	ت٢	ك١	ك٢	شباط	اذار	نيسان	ايار	حزيران	تموز	اب	ايلول
الاسعار المركزة													
شعير	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ
حنطة	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ
كسبة القطن	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ
قشرة بذور القطن	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ
نخالة	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ
حبوب بقولية	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ
تفل شوندر	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ
مواد اخرى	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ
اعلاف مالئة													
تبن شعير	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ
تبن حنطة	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ
تبن عدس	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ
تبن حمص	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ
نواتج التعشيب	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ
مواد اخرى	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ
مجموع كميات الاطعام %	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ
	١٠٠%												
الرعي	الاسعار ل.س/هكتار												
محاصيل حبوب	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ
محصول اخضر	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ
محصول ناضج	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ
مخلفات حصاد	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ
الاعشاب في البور	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ
مخلفات القطن	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ
رعي حول القرية	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ
رعي في البادية	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ
رعي مخلفات الشوندر	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ
رعي محاصيل اخرى	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ
النسب بين الرعي والاطعام	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ
الاطعام	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ
الرعي	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ	ــــ
مجموع الاستهلاك	١٠٠%	١٠٠%	١٠٠%	١٠٠%	١٠٠%	١٠٠%	١٠٠%	١٠٠%	١٠٠%	١٠٠%	١٠٠%	١٠٠%	١٠٠%

هـــل تعرف التفـــل؟

كـــلا

نعـــــم

هل ترغب بتجربته في ارضـــك _____

كم المساحة التي تود تجريبهـــا _____ دونم

ما هو المحصول الذي سيحل التفل محله فـــي ارضـــك _____

على اية قطعة من ارضك تود زراعته

كيف ستستعمل علف التفل؟

اغنام وخراف تسمين _____

خراف تسميـــن _____