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MINISTRY OF AGRICULTURE AND SETTLEMENT

AREA, PRODUCTION, YIELD USE OF FERTILIZERS AND MARKETED PRODUCTION OF MAJOR CROPS

RESULTS OF THE AGRICULTURAL SAMPLE SURVEY 1977/78 (1970 E. C.)
WITH PRELIMINARY FORECAST FOR 1978/79 (1971 E. C.)
VOL. I

STATISTICS SECTION
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C O N T E N T S

Page

Page

LIST OF TABLES

Page

PREFACE

This is a consecutive report on crop production survey, i.e. on area under major crops, yield and production, for the 1977/78 (1970 E.C.) production year. Such reports are published every year since 1974/75 (1967 E.C.).

The present report was prepared on the basis of the findings of the Agricultural Sample Survey 1977/78 (1970 E.C.) which was conducted between March and May 1978.

A sample of about 4,500 holdings were selected of which only 4,151 holdings were interviewed. Private peasant holdings were investigated on sampling basis in 10 regions, excluding Bale, Eritrea, Hararge and Tigrai. The data on area, production and yield of state farms were compiled from the documents produced by the State Farm Development Authority, whereas the data for cooperatives were assessed using indirect approaches.

The results of the Agricultural Sample Survey 1977/78 (1970 E.C.) are to be published in two volumes. This volume (volume I) deals with area, production, yield, use of fertilizers and marketed production of major crops and the next volume (volume II) shall focus on land utilization, cost of crop production and farm implements.

This first volume comprises of four chapters and five annexes. The first chapter deals with the area, production and yield of major crops. In chapter II results of use of fertilizers, crop damage and marketed production are presented. Chapter III is devoted to comparison of crop production data for 1976/77 (1969 E.C.) and 1977/78 (1970 E.C.), using statistical test. Chapter IV describes non-response rates and estimates of sampling errors.

This report contains more information than previous reports published in the last three years. The following topics are covered by the five Annexes attached:

(i) method of correction for crop production estimates obtained by interview,

(ii) comparison of area, production and yield of major crops for the whole country for the last four years, i.e. from 1974/75 (1967 E.C.) to 1977/78(1970 E.C.),

(iii) assessment of some components of Food Balance for 1977/78 (1970 E.C.) with preliminary forecast of food deficit in 1978/79 (1971 E.C.),

(iv) preliminary crop production forecast in 1978/79 (1971 E.C.),

(v) survey results by regions.

This report was written by Dr. Jan Kordos, FAO Statistician, and Ato Ghebre Selassie Mebrahtu, Statistician, Head of Agricultural Statistics Section. The coordinator of the survey was Ato Yohannes Hagos, Statistician, Agricultural Statistics Section. The data were processed manually by the supervisors of the Planning and Programming Department with assistance from the Operation and Information Centre of the Relief and Rehabilitation Commission.

We would like to extend our appreciation to all who have contributed towards the publication of this report. All comments that could improve the quality of our surveys are most welcome.

Betru Gebre Egziabher

Addis Ababa, August 1978

Head

Planning and Programming Department

Chapter I

AREA, PRODUCTION AND YLELD OF MAJOR CROPS

1.1. Introduction

Data on area, production and yield of major cereals, pulses and oil crops were collected by interview method during the Agricultural Sample Survey conducted in 1978. These major crops include: teff, barley, wheat, maize, sorghum, millet, horse beans, chick peas, haricot beans, field peas, lentils, flax, neug, vetch and rape seed. The above mentioned data were collected from private peasant holdings /on sampling basis/, cooperative and state farms/ by complete enumeration/.

The data on area and production of the major crops were collected by interviewing the holders. However, from our previous experience, it is well known that such data are usually underestimated. Therefore, it is necessary to find a correction coefficient to adjust the holder's estimate. To derive such correction coefficients for such data, one must use objective methods, i.e. field area measurements and crop-cutting experiments. Since the data for the Agricultural Sample Survey were collected by interview method only, we have to find some means of adjusting these data. In the last three crop production surveys (see [1], [2] and [4]) that were conducted in 1974/75, 1975/76 and 1976/77 (1967 E.C. 1968 E.C. and 1969 E.C.) both objective and interview methods were applied. Based on these two methods, correction coefficients for adjusting the holder's estimate were developed.

Area and production which were reported in local units were converted into metric equivalents (hectares or kilograms) (see [5]) and corrected according to accepted mehods. The methodology of the correction for crop production estimates obtained by interview is described in the Annex I. For area,

local units were converted into hectares and this convertion was calculated according to the last three years field area measurements and interview method (about 12 thousand fields were measured during that period). This convertion also includes correction for the underestimation reported by holders.

Correction of area and production was done at regional level, then the yield of each crop is the ratio of the production and area under crop in question, i.e.

$$\bar{y}_{ci} = \frac{P_{ci}}{a_{ci}}$$

Where P_{ci} stands for production of crop c, in region i, and

a_{ci} - area under crop c in region i.

To estimate the total production and area of each major crop for the whole country, the production and area of all regions for each major crop was summed up respectively, i.e.

$$P_c = \sum_{i=1}^{10} P_{ci} \quad ; \quad A_c = \sum_{i=1}^{10} a_{ci}$$

and the yield is the ratio of P_c and A_c, i.e $\bar{Y}_c = \frac{P_c}{A_c}$.

The data on area, production and yield of the major crops presented in this chapter are generalized for the whole country excluding the regions which were not covered, (i.e. Bale, Eritrea, Hararge and Tigrai.) However, attempts have made to assess relevant data for the whole country. In Annex II comparisons of area, production and yield of major crops for the last four years are presented. Results by region are given in the Annex V. Information on the precision of selected characteristices are given in Chapter IV of this report.

1.2. Area, production and yield of major crops for private peasant holdings/ main seasnn/

The survey covered 10 regions, excluding Bale, Eritrea , Hararge and Tigrai. Area under crop in question and production of this crop are estimated at regional level (for details see Annex V.). The estimates of the total area under crop in question as well as the total production of this crop at national level are the sum of the area and the production for all the regions respectively.

The estimate of the total area under major crops for the country is approximately 4.4 million hectares (excluding Bale, Eriteea, Hararge and Tigrai). Area under teff is 1.2 million hectares (26.7%) and the production on this area being 9.3 million quintals with mean yield of 7.9 quintals per hectare. The total area under barley is estimated to be 0.67 million hectares (15.3%) with total production of 4.9 million quintals and mean yield of 7.3 quintals per hectare (qt/ha). Whereas, the total area under wheat is estimated to be 0.4 million hectares (9.2%) with total production of 2.4 million quintals and mean yield of 8.4 qt/ha. The estimated area under maize is approximately 0.76 million hectares (17.3%) with total production of 7.6 millon quintals and mean yield of 10.0 qt/ha. Sorghum, one of the major cereal crop occupies an area of 0.4 million hectares (10.0%) with total production of 4.5 million quintals and mean yield of 10.2 qt/ha.

The above mentioned five major crops occupy approximately 79% of the total area under temporary crops with the total production of 29.7 million quintals (81.3% of production of all major croops). For details see table 1. The data presented in this table are the final estimates of area,

Table 1.

ESTIMATES OF AREA, PRODUCTION AND YIELD OF MAJOR CROPS IN 1970E.C. (1977/78) FOR PRIVATE HOLDINGS (MAIN SEASON)*

Crop	Total area		Production	Yield
	Thousand hectares	per cent	Thousend quintals	Quintals per ha
(1)	(2)	(3)	(4)	(5)
Teff	1,178.6	26.7	9,264.5	7.9
Barley	674.8	15.3	4,942.4	7.3
Wheat	402.3	9.2	3,368.8	8.4
Maize	763.1	17.3	7,635.6	10.0
Sorghum	443.9	10.0	4,519.0	10.2
African millet	157.4	3.6	1,544.3	9.8
Horse beans	264.3	6.0	2,625.9	9.9
Chick peas	109.3	2.5	828.3	7.6
Haricot beans	16.4	0.4	107.0	6.5
Field peas	102.7	2.3	713.8	7.0
Lentils	50.3	1.1	259.1	5.2
Flax	22.0	0.5	88.7	4.0
Neug	108.0	2.4	343.8	3.2
Rape seed	0.3	0.0	2.3	7.7
Vetch	35.7	0.8	212.5	6.0
Oats	17.2	0.4	120.0	7.0
Sesame	0.3	0.0	1.9	6.3
Others	66.0	1.5	x	x
Total	4412.6	100.0	36,577.9	8.4

1.3. Area, production and yield of major crops for state farms and cooperatives

The data on area, production and yield of major crops in state farms were compiled from the publications and documents produced by the State Farm Development Authority (see [7]). The major crops grown in the state farms are: maize, wheat, sorghum, teff, haricot beans, millet, chick peas and sun flower.

The total area under the mojor crops mentioned above is approximetely 25 thousand hectares with total production of 725 thousand quintals. Area under maize occupies 17.1 thousand hectares (68.7%) with total production of 582.1 thousand quintals and average yield of 34.0 qt/ha while the area under wheat is 4.2 thousand hectares (16.9%), with total production of 82.8 thousand quintals and mean yield of 19.7 qt/ha. For detail see table 2.

Area under major crops in cooperative is estimated to be approximately 44 thousand hectares. "Cooperative farms" are farms which are jointly operated by all members of a Peasant Association (for definition see [4, pp.44-46]). The data on area, production and yield of major crops for cooperative farms were estimated using indirect approaches based on the previous survey conducted during which cooperative farms that were in selected Peasant's Associations were investigated by complete enumeration. The main crops produced by cooperatives are teff (54.4%) , neug (16.6%), sorghum (6.4%), wheat (5.9%), barley (4.1%), maize (3.4%), millet (3,2%) etc. For detaile see table 3

Table 2.

ESTIMATES OF AREA, PRODUCTION AND YIELD OF MAJOR CROPS IN 1970 E.C. (1977/78) FOR STATE FARMS

Crop	Total area		Productiona	Yield
	Thousand hectares	Per cent	Thousand quintals	Quintals per ha
(1)	(2)	(3)	(4)	(5)
Teff	0.7	2.8	7.4	10.6
Wheat	4.2	16.9	82.8	19.7
Maize	17.1	68.7	582.1	34.0
Sorghum	1.5	6.0	36.0	24.0
African millet	0.2	0.4	1.4	13.9
Chick peas	0.1	0.8	1.2	6.1
Haricot beans	0.6	2.4	9.9	16.5
Sun flower	0.5	2.0	4.3	8.6
Total	24.9	100.0	725.1	29.1

Table 3.

ESTIMATES OF AREA, PRODUCTION AND YIELD OF MAJOR CROPS IN 1970 E.C.(1977/78) FOR COOPERATIVE FARMS

Crop	Total area		Production	Yield
	Thousand hectares	Per cent	Thousand quintals	Quintals per ha
(1)	(2)	(3)	(4)	(5)
Teff	24.0	54.4	189.6	7.9
Barley	1.8	4.1	12.8	7.1
Wheat	2.6	5.9	21.8	8.4
Maize	1.5	3.4	14.8	9.9
Sorghum	2.8	6.4	28.6	10.2
African millet	1.4	3.2	12.7	9.1
Horse beans	0.2	0.4	2.0	9.9
Chick peas	1.1	2.5	8.4	7.6
Haricot beans	0.1	0.2	0.8	7.9
Field peas	1.2	2.7	8.4	7.0
Lentils	0.1	0.2	0.5	4.9
Neug	7.3	16.6	24.1	3.3
TOTAL	44.1	100.0	324.5	7.4

1.4. Area, production and yield of major crops for private holdings for belg season

"Belg" season or small rainy season normally occurs from February to May. Short maturing crops are planted during this period and harvested in June or July. In the lowland, however, long maturing crops such as maize and sorghum are planted as early as January or February and harvested in June or July.

The main belg crop growing areas of Ethiopia are: Wello, Northern and Central Shoa, Arssi, Sidamo and Bale.

Barley, wheat, beans and teff are the major belg season crops grown in the highlands while maize and sorghum are the major belg season crops grown in the lowlands.

The total area under major crop during the belg season is estimated to be approximately 187 thousand hectares comprising about 3.5% of area under major crops and with the total production of about 1.52 million quintals. Barley occupies nearly 55% of total area under belg crops, followed by maize (29.0%), wheat (10.7%), horse beans (1,7%), teff (1.2%), chick peas (1.2%) and others with less than 1% area each. Details are given in table 4.

1.5. Assessment of area, production and yield of major crops for the whole country (all seasons)

The Agricultural Sample Survey covered 10 regions only. Bale, Eritrea, Hararge and Tigrai were ~~un~~ not covered. Very often users are interested in having estimates for the whole country; therefore, we have to look for some methods to assess the area, production and yield of major crops for the whole country.

The area and production of the major crops for the whole country were estimated last year (see [4]). We have used

Table 4. ESTIMATES OF AREA, PRODUCTION AND YIELD OF MAJOR CROPS IN 1970 E.C.(1977/78) FOR PRIVATE HOLDINGS (BELG SEASON)

Crop	Total area		Production	Yield
	Thousand hectares	Per cent	Thousand quintals	Quintals per ha
(1)	(2)	(3)	(4)	(5)
Teff	2.3	1.2	18.2	7.9
Barley	102.7	54.9	729.2	7.1
Wheat	20.1	10.7	168.8	8.4
Maize	54.2	29.0	536.6	9.9
Sorghum	0.6	0.3	6.1	10.1
Horse beans	3.2	1.7	31.7	9.9
Chick peas	2.2	1.2	16.7	7.6
Haricot beans	0.1	0.1	0.7	6.8
Field peas	0.4	0.2	2.8	7.0
Lentils	0.4	0.2	2.1	5.2
Vetch	1.0	0.5	6.0	6.0
TOTAL	187.2	100.0	1518.9	8.1

crops for the whole country in 1970 E.C. (1977/78).

The area under crop in question for the whole country for private peasant holdings was assessed as follows:

$$A_{70} = A_{69} \times \frac{A'_{70}}{A'_{69}}$$

where A_{69} and A_{70} stand for area under crop in question for the whole country in 1969 and 1970 respectively,

A_{69} and A_{70} - area under crop in question for the 10 investigated regions in 1969 and 1970 respectively.

Similar formula has been applied for the assessment of yield, i.e

$$\bar{Y}_{70} = \bar{Y}_{69} \times \frac{\bar{Y}'_{70}}{\bar{Y}'_{69}}$$

where $\bar{Y}_{69}$ and $\bar{Y}_{70}$ stand for the yield of the crop in question for the whole country in 1969 and 1970 respectively,

$\bar{Y}'_{69}$ and $\bar{Y}'_{70}$ stand for the yield of the crop in question for the 10 investigated regions in 1969 and 1970 respectively.

Production for the whole country was assessed as follows:

$$P_{70} = A_{70} \times \bar{Y}_{70}$$

where A_{70} and $\bar{Y}_{70}$ are as explained above.

Applying the above formulae, assessments of area, production and yield for the major crops for the whole country are given in table 5.

Table 5.

ESTIMATES OF AREA, PRODUCTION AND YIELD
OF MAJOR CROPS IN 1970 E.C (1977/78)
FOR PRIVATE HOLDINGS FOR THE WHOLE COUNTRY (Main season)

Crop	Total area		Production	Yield
	Thousand hectares	per cent	Thousand quintals	Quintals per ha
(1)	(2)	(3)	(4)	(5)
Teff	1,497.2	27.6	11,528.4	7.7
Barley	864.2	15.9	6,567.9	7.6
Wheat	460.5	8.5	3,960.3	8.6
Maize	859.3	15.9	8,850.8	10.3
Sorghum	702.5	13.0	6,041.5	8.6
African millet	202.5	3.7	2,106.0	10.4
Horse beans	278.3	5.1	2,699.5	9.7
Chick peas	153.8	2.8	1,045.8	6.8
Haricot beans	16.6	0.3	109.6	6.6
Field peas	127.4	2.4	904.4	7.1
Lentils	64.6	1.2	361.8	5.6
Flax	25.9	0.5	106.2	4.1
Neug	112.7	2.1	405.7	3.6
Rape seed	0.5	0.0	3.8	7.7
Vetch	37.7	0.7	222.4	5.9
Oats	17.2	0.3	120.4	7.0
Sesame	0.5	0.0	3.2	6.3
TOTAL	5,421.4	100.0	45,037.9	8.3

Table 6 . ESTIMATES OF AREA, PRODUCTION AND YIELD OF MAJOR CROPS IN 1970 E.C. (1977/78) FOR THE WHOLE COUNTRY

Crop	Total area		Production	Yield
	Thousand hectares	per cent	Thousand quintals	Quintals per ha
(1)	(2)	(3)	(4)	(5)
Teff	1521.9	27.7	11,743.6	7.7
Barley	866.0	15.8	7,309.9	8.4
Wheat	467.3	8.5	4,233.7	9.1
Maize	877.9	16.0	9,984.3	11.4
Sorghum	706.8	12.9	6,112.2	8.7
African millet	204.0	3.7	2,120.1	10.4
Horse beasn	278.5	5.1	2,733.2	9.8
Chick peas	155.1	2.8	1,072.1	6.9
Haricot beans	17.3	0.3	121.0	7.0
Field peas	128.6	2.3	915.7	7.1
Lentils	64.7	1.2	364.4	5.6
Flax	25.9	0.5	106.2	4.1
Neug	120.0	2.2	429.8	3.6
Rape seed	0.5	0.0	3.8	7.7
Vetch	37.7	0.7	228.4	6.1
Oats	17.2	0.3	120.4	7.0
Sesame	0.5	0.0	3.2	6.3
TOTAL	5,489.9	100,0	47,602.0	X

The assessment of area, production and yield for the whole country during the main season, for state farms, co-operatives and private holdings are given in table 2, 3 and 5 respectively. Table 4 shows the assessment of area, production and yield during the belg season for private holdings. The total area, production and yield of major crops for the whole country , for both seasons and for all types of holdings are given in table 6 (area under belg crop is not added).

The total area under major crops is assessed to be 5.5 million hectares, out of which 1.5 million hectares is under teff (27.7%), 0.87 million hectares under barley (15.8%), 0.47 million hectares under wheat (8.5%), 0.88 million hectares under maize (16.0%) and 0.71 million hectares under sorghum (12.9%).

The total production of major crops is assessed to be 47.6 million quintals. Out of which 45.0 million quintals (94.5%) is produced by private peasant holdings during the main season and 1.52 million quintals (3.2%) during the belg season. Therefore, 97.7% of the total production of major crops is produced by peasant holdings. The remaining: 1.5% of total production of major crops is produced by state farms and 0.8% by cooperative farms.

Chapter II

USE OF FERTILIZERS, CROP DAMAGE AND MARKETED PRODUCTION

2.1 Introduction

This chapter deals with the presentation and analysis of the type and amount of fertilizers used, complete and partial crop damage by reasons and the amount of production marketed.

This topic is a new modification on the previous publication that we have released . Users began demanding for more information about the peasants agriculture. They are interested to find out what modern technology the peasants are adapting. One of the modern technologies that peasant should adopt is the use of commercial and natural fertilizers. The amount and the extent of the use of commercial and natural fertilizers by peasants is one of the indicators of the adoption of modern technology. The amount of marketed produce available for urban population is also an indicator on the efficiency of the peasant agriculture to produce more and ability to transfer itself from self sufficiency to surplus.

Of course, there are a lot more indicators that could be investigated on the peasant agriculture; however, with limited manpower, organization and budget available we have confined ourselves to this study alone.

2.2 Use of commercial fertilizers on private peasant holdings

This information was collected by interviewing the holders. Since the holders were not able to identify the type of fertilizer by name, they were asked to tell the colour of the fertilizers they used. This was a very good way of simplifying the question because there were only two types of commercial fertilizers used and they have two distict colours.

The two commonly used commercial fertilizers are: Diammonium phosphate /DAP/ which has a black colour and Amonium Nitrate /Urea/ which has a white colour.

It is estimated that commercial fertilizers were applied on 308.4 thousand hectares of land under temporary crops comprising 7% of the total area under temporary crops in the ten investigated regions /excluding Bale, Eritrea, Hararge and Tigrai/. The amount of commercial fertilizers applied to this area is estimated to be 193.9 thousand quintals. It is interesting to note that there was no report on the use of commercial fertilizers on permanent crops by farmers.

The most commonly used commercial fertilizers in the private peasant holdings was DAP (i.e. 84.3% of all commercial fertilizers). The amount of fertilizers used is 4.2 kg per hectare in total area under temporary crops (3.5 kg/ha for DAP and 0.7 kg/ha for Urea). On area where commercial fertiliers were applied the amount of fertilizers applied was 62.2 kg/ha(61.3 kg/ha for DAP, and 72.4 kg/ha for Urea). Details are given in table 7.

The application of commercial fertilizers differs from crop to crop . The highest percentages of area on which commercial fertilizers were used are for: wheat and millet /about 18%/, followed by barley /10.3%/, teff /9.6%/, field peas /2.8%/, lentils /2.6%/, maize /2.0%/ and horse beans /1.7%/. Application of commercial fertilizers were not reported on chick peas, haricot beans, flax and neug. Details are given in table 8. Out of total amount of commercial fertilizers used the distribution by crop is as follows: 37.8% for teff 22.4 for barley, 20.9% for wheat, 10.0% for millet, 4.3% for maize, 1.9% for horse peas, 1.2% for field peas and 1.0% for lentils.

The amount of commercial fertilizers used by region are given in the Annex V.

It is possible to assess the use of commercial fertilizers for private peasant holdings for the whole country. It is assessed that amount of commercial fertilizers used for the whole country on area under temporary crops of the private peasant holdings is 217.0 thousand quintals (181.6 thousand quintal DAP and 35.4 thousand quintals Urea). The amount of commercial fertilizers applied per hectare is assessed to be 4.0kg/ha on temporary crops (3.4 kg/ha DAP and 0.6 kg/ha Urea).

2.3. Use of natural fertilizers

It is estimated that natural fertilizers were applied on 251.6 thousand hectares of land under temporary crops, which is 5.7% of the total area under these crops; and on 117.4 thousand hectares of land under permanent crops, which is 31.2% of the total area under permanent crops.

Natural fertilizers are commonly used on chat (73.3%), enset (45.3%), gesho (11.9%) (mostly permanent crops). Out of the temporary crops natural fertilizers are mainly used on: maize (9.4%), haricot beans (9.1%), horse beans (6.8%), sorghum (5.3%), teff (4.9%), barley (4.4%), wheat (4.0%), and for other crops 2% of total area under crop. For details see tables 8.

Table 7

USE OF COMMERCIAL AND NATURAL FERTILIZERS IN ETIOPIA*

Type of crop	Area under fertilizers				Amount of fertilizers used		
	Commercial			natural			
	Total	DAP	Urea		Total	DAP	Urea
	Thousand hectares				Thousand quintals		
Temporary crops	308.4	263.9	44.5	251.6	193.9	161.7	32.2
Permanent crops	-	-	-	117.4	-	-	-
TOTAL croplan	308.4	263.9	44.5	369.0	193.9	161.7	32.2
	Percentage				Kg/ha		
Temporary crops	7.0	6.0	1.0	5.7	4.2	3.5	0.7
Permanent crops	-	-	-	31.2	-	-	-
Total cropland	6.4	5.5	0.9	7.7	4.0	3.4	0.6

*Excluding Bale, Eritrea, Hararge and Tigrai.

Table 8

USE OF COMMERCIAL AND NATURAL FERTILIZERS BY CROP IN ETHIOPIA*

Crop	Percentage of area on which fertilizers were used				Commercial fertilizers per hectare of area under crop		
	Commercial			natural	Commercial		
	Total	DAP	UREA		Total	DAP	UREA
	Percentage				kg/ha		
Teff	9.6	7.9	1.7	4.9	6.4	5.2	1.2
Barley	10.3	8.5	1.8	4.4	6.3	5.0	1.3
Wheat	17.5	15.4	2.1	4.0	10.3	8.8	1.4
Maize	2.0	2.0	-	9.4	1.1	1.1	-
Sorghum	0.1	0.1	-	5.3	0.0	0.0	-
Millet	18.6	16.1	2.5	2.0	11.7	10.0	1.7
Horse beans	1.7	1.4	0.3	6.8	1.4	1.1	0.3
Chick peas	-	-	-	0.8	-	-	-
Haricot beans	-	-	-	9.1	-	-	-
Field peas	2.8	2.8	-	2.0	2.3	2.3	-
Lentils	2.6	2.2	0.4	2.0	4.0	2.2	1.8
Flax	-	-	-	2.4	-	-	-
Neug	-	-	-	2.3	-	-	-
Others	1.1	0.9	0.2	21.4	0.6	0.5	0.1
Total temporary crop	7.0	6.0	1.0	5.7	4.5	3.7	0.8
Enset	-	-	-	45.3	-	-	-
Coffee	-	-	-	6.1	-	-	-
Chat	-	-	-	73.3	-	-	-
Gesho	-	-	-	11.9	-	-	-
Total permanent crops	-	-	-	31.4	-	-	-

*Excluding Bale, Eritrea, Hararge and Tigrai

2.4. Crop damage by different factors.

As it can be seen from the next chapter, production this year decreased significantly compared last year. There were different factors which caused decrease of crop production. Meteorological factors, such as too much rain, shortage of rain, hail, frost or flood undoubtely account for a good deal of decrease in crop production, but they are not the only factors. Pest, plant diseases, depletiotion of fertility of the soil, changes in the amount of fertilizers used compared last year, damage by wild animals and many others exerted significant influance as well.

During the survey enumerators asked the holders whether production from the field in question was completely damaged or affected by some factors. The following factors were reported:

1) too much rain (MR - code for the factor),
2) shortage of rain (SR),
3) hail, frost or flood (HF),
4) pest, plant diseases (PD),
5) wild animals (WA),
6) depletion of the fertility of the soil (SD),
7) other reasons (OR), such as shortage of seeds, lack of fertilizers, bird damage, etc.

Complete crop damage

Holders reported that crop was completely damage on about 3.0% of total area under temporary crops, 128.1 thousand hectares). It is estimated that this damage decreased production of major crops about 1,145.1 thousand quintals, out of this 942.0 thousand quintals were cereals, 170.5 thousand quintals pulses, and 32.6 thousand quintals other crops.

Out of cereals the highest percentage of crop damage was

for millet (5.7%) followed by maize (5.5%), sorghun (3.5%), wheat (3.2%) teff (1.4%), and barley (0.9%).

The highest area damage out of pulses was reported for lentils (12.0%), followed by chick peas (5.8%), field peas (5.1%), haricot beans (3.8%), and horse beans (1.9%).

Out of the other crop, the highest percentage was reported for neug (5.7%), followed by vetch (4.9%) and flax (2.6%).

It is clear from these estimates that area sown and harvested are not the same, as can be seen from table 9.

Table 9

ESTIMATES OF AREA SOWN, HARVESTED AND PERCENTAGES OF AREA COMPLETELY DAMAGED BY CROPS*

Crop	Area		Percentage of completely damaged area
	Sown	Harvested	
	Thousand hectares		
Teff	1,178.6	1,162.7	1.4
Barley	674.8	668.5	0.9
Wheat	402.3	390.6	3.2
Maize	763.1	721.3	5.5
Sorghum	443.9	428.5	3.5
Millet	157.4	148.4	5.7
Horse beans	264.3	259.2	1.9
Chick peas	109.3	103.0	5.8
Haricot beans	16.4	15.8	3.8
Field peas	102.7	97.5	5.1
Lentils	50.3	44.3	12.0
Flax	22.0	21.4	2.6
Neug	108.0	101.8	5.7
Vetch	35.7	33.9	4.9
TOTAL	4,328.8	4,200.7	3.0

* Excluding Bale, Eritrea, Hararge and Tigrai.

Factors affecting crop production decrease

As may be seen from table 10, too much rain (MR) was reported most frequently as the reason for decrease in crop production. Nearly 20% of total area under temporary crops was affected by the unusual rain which fell in November 1977. Out of cereals, wheat (35.9%), followed by barley (28.9%), teff (20.2%), sorghum (12.1%), maize (5.7%) and millet (3.1%) were highly affected.

Out of pulses field peas was high affected (31.9%), followed by horse beans (27.9%), chick peas (21.4%), haricot beans (16.8%) and lentils (15.0%).

The second factor which decreased crop production significantly is hail, frost and flood (HF) and af ected 9.4% of total area under temeporary corps. These factors affected lentils mostly (31.2%) follwoed by vetch (25.4%), horse beans (15.6%). field peas (14.1%), wheat (12.4%), millet (11.7%) and others.

Pest and plant diseases is the third factor and affected 8.9% of total area under temprary crops. Sorghum (36.4%), haricot beans (23.2%), chick peas (18.7%), millet (13.4%) and teff (10.9%) were mainly affected.

Wild animals (WA) decreased productione on 6.3% of total area under temporary crops. Maize (15.3%), millet (9.6%) and sorghum (8.9%) were the main crops affected.

Shortage of rain (SR) was not a very important factor this year. But it affacted only 5.2% of total area under temporary crops mainly maize (11.4%) lentils (10.0%) flax (8.3%) and neug (7.6%).

Depletion of the fertility of the soil (SD) caused decrease of crop production on 2.0% of total area under temprory crops mainly reported for neug (5.3%), sorghum (3.4%) and millet (3.3%). For details see table 10.

Table 10.

PERCENTAGES OF AREA AFFECTED BY DIFFERENT FACTORS BY CROPS*

Crop	Crop production affected by:						
	MR	SR	HF	PD	WA	DF	OR
	Percentage of total area under crop						
Teff	20.2	3.9	10.4	10.9	4.7	1.8	4.8
Barley	28.9	2.7	9.4	4.5	2.9	1.6	7.3
Wheat	35.9	1.4	12.4	6.4	0.6	1.6	6.4
Maize	5.7	11.4	4.0	5.4	15.3	2.3	11.5
Sorghum	12.1	7.6	3.9	36.4	8.9	3.4	7.0
Millet	3.1	5.5	11.9	13.4	9.6	3.3	15.5
Horse beans	27.9	1.5	15.6	5.8	1.8	1.4	6.4
Chick peas	21.4	3.2	4.0	18.7	1.9	1.5	13.4
Haricot beans	16.8	5.5	-	23.2	7.5	-	3.8
Field peas	31.9	3.6	14.1	8.0	2.0	-	4.9
Lentils	15.0	10.0	31.2	4.9	2.1	0.9	18.6
Flax	17.5	8.3	7.1	8.0	2.6	-	5.0
Neug	7.2	7.6	10.4	2.2	4.9	5.3	11.6
Vetch	7.0	-	25.7	2.6	-	-	4.1
TOTAL	19.8	5.2	9.4	8.9	6.3	2.0	7.6

* Excluding Bale, Eritrea, Hararge and Tigrai.

2.5. Marketed produce

It is generally assumed that the peasant agriculure in Ethiopia is at subsistance level. However, very little study has been done so far to determine the degree of subsistance the peasant agriculture is.

One of the main indicators of the degree of subsistance in the peasant agriculture is the amount or percentage of their produce they sell to the market. In our agricultural survey we have attempted to determine the amount and percentage of produce farmers sell to the market.

We consider that this information is quite useful not only to indicate the degree of subsistance our agriculture is but also to determine the amount of food supply that will be available in the market. This information in return will guide policy makers to make certain decisions on import, price, etc.

The amount of crop production that was sold in the market is estimated to be approximately 4.1 million quintals which is 11.2% of the total production of major crops in the country, excluding Bale, Eritrea, Hararge and Tigrai.

The amount and percentage of crop production sold in the market vary from crop to crop. Approximately 3.3 million quintals of cereals are sold in the market which is 10.6% of cereals production. Among the cereals the most important is teff, nearly 26% of its production is sold. It is followed by; wheat, maize barley and sorghum. The rank of the percentage of produce sold in the market by crops is: millet (17.6%), wheat (17.1%) teff (11.4%), barley (10.1%), sorghum (8.5%) and maize (6.9%). Cereals consitute 81.2% of total production sold to the market, while pulses and other crop constitute 13.8% and 5.0% respectively. Details are given in table 11.

Table 11

MARKETED PRODUCE, PERCENTAGE OF SOLD PRODUCTION, AVERAGE PRICE REPORTED AND EARNING RECEIVED BY CROP*

Crop	Production sold		Amount received	
	Thousand Quintals	Per cent of total production	Birr per quintal	Thousand birr
/1/	/2/	/3/	/4/	/5/
CEREALS	3,310.1	10.6	28.1	93,002.4
Teff	1,058.0	11.4	36.5	38,614.0
Barley	496.7	10.1	24.7	12,248.6
Wheat	575.5	17.1	26.4	15,197.6
Maize	526.5	6.9	22.7	11,932.6
Sorghum	382.1	8.5	23.3	8,905.1
Millet	271.3	17.6	22.5	6,105.1
PULSES	562.9	12.4	25.4	14,272.0
Horse beans	270.3	10.3	23.4	6,316.0
Chick peas	119.8	14.5	21.5	2,580.0
Haricot beans	12.3	11.5	42.5	522.3
Field peas	120.2	16.8	29.6	3,552.9
Lentils	40.3	15.6	32.3	1,300.8
OTHERS	205.0	31.5	28.5	5,838.4
Linseed	29.4	33.2	29.8	874.8
Neug	152.4	44.3	30.7	4,682.8
Vetch	21.3	16.2	10.1	214.9
Sesame	0.4	75.0	62.5	25.0
Fenugreek	1.5	100.0	27.3	40.9
TOTAL	4,078.0	11.2	27.7	113,112.8

*Excluding Bale, Eritrea, Hararge and Tigrai.

Chapter III

COMPARISONS OF AREA, YIELD AND PRODUCTION OF MAJOR CROPS IN 1976/77 (1969 E.C.) AND 1977/78 (1970 E.C)

Introduction

Users of crop production data are usually interested in comparisons of the area under different crops, yield and production of these crops in consecutive years. It is very important to know whether area under crop in question, yield and production of this crop incresed or decreased compared to last year. Comparison of crop production data is very important and should be done correctly. We should remember that crop production data are usually collected on sampling basis and observed differences between two consecutive years are subject to sampling errors. It is necessary to apply some statistical test to verify whether observed differences are statisticlly significant or not.

Crop productiona data for 1970 E.C. presented in chapter I of this report may be compared with relevant crop production data for 1969 E.C (see [3]). Comparison will be done as follows. In separate tables the following will be presented: estimates of relevant parameter in year 1969 E.C.(column 2) and in year 1970 E. C (column 3), the difference between thes estimates (column 4), percentage of this difference (column 5), and value of statistic T (column 6) . T-test (Student test) will be applied to verify whether observed differences in consecutive years are statistically significant or not.

3.2 Method of comparison

While coparing area under major crops, yield and production of theee crops in years 1969 E.C. and 1970 E.C., it is necessary to take into account the follwoing facts:

1. Primary sampling units, i.e. Farmers' Associations were the same in both years, and
2. Bale, Eritrea, Hararge and Tigrai were not covered in 1970 E.C.

For dynamic analysis we would like to stress that it is more efficient to have the same sample in both years.

Comparison will be done for the same population in both years, i.e. for private peasant holdings in the agriculturally important areas excluding Bale, Hararge, Eritrea and Tigrai.

To find out whether the observed differences between consecutive years are significant the test of the significance between two years is to be applied The following hypothesis will be verfied: relvant characteristics of crop production data are not signi ficantly different in years 1969 E.C. and 1970 E.C. or, in other words:

may we consider that the observed difference is due only to sampling fluctuations and that the true difference is zero (the null hypothesis)? To verify this hypothesis the following test will be applied:

$$T = \frac{d}{s(d)}$$

Where d stands for an estimate of the difference of characteristic X in years 1970 E.C. and 1969 E.C., i.e. $d = X_{70} - X_{69}$; s(d) - the standard error of the difference between the two years and is calculated from the following formula:

$$s(d) = \sqrt{s^2(X_{70}) + s^2(X_{69}) - 2r_{69,70}s(X_{70})s(X_{69})}$$

Where $s(X_{70})$ and $s(X_{69})$ are the standard errors of the characteristic X in years 1970 E.C. and 1969 E.C. respectively, $r_{69,70}$ - correlation coefficient between characterstic X in 1970 E.C. and 1969 E.C.

To verify the null hypothesis we select significance level P = 0.05: this would mean that we consider an event that can happen only 1 time in 20. Hence, if T is equal to or greater than 1.96 the hypothesis is to be rejected, which means that observed differences might be considered ad statistically significant according to accepted level of significance.

To apply the above described test it was necessary to calculate again the standard errors of the characteristics in question for both years for the population under study, i.e. for all private peasant holdings in the agriculturally important areas excluding Bale, Eritrea, Hararge and Tigrai.

3.3 Coparison of area under major crops

Comparisons of area under different crops in years 1969 E.C. and 1970 E.C. as well as results of applied test are given in table12. According to the applied test, the values ofthe T statistic are higher than 1.96 for barley, maize, haricot beans and for total area under temporary crops. According the applied test, differences between area under these crops were statistically significant in years 1969 E.C. and 1970 E.C. Area under barley and under maize increased while area under haricot beans decreased significantly. Total area under temporary crops also increased significantly.

5.4. Comparison of yield of major crops

Comparisons of yield for different crops in 1969 E.C. and 1970 E.C. as well as the results of the statistic are given in table 13. As may be seen from the table, values of the T statistic are higher than 1.96 for the following crops:barley (4.66), maize (3.53),wheat (2.19),horse beans (2.55),lentils (3.00) and neug (6.73). It means that yield of barley, wheat, maize, horse beans and lentils has decreased significantly, while the yield of neug has increased signficantly.

Table 12

COMPARISON OF AREA UNDER MAJOR CROPS IN 1976/77 (1969 E.C.) AND 1977/78 (1970 E.C.)[1)]

Crop	Estimate in: 1976/77	Estimate in: 1977/78	Difference (d) cl.3-cl.2	Statistics (T)
	Thousand hectares			
(1)	(2)	(3)	(4)	(5)
Teff	1207.4	1236.2	-28.8	0.64
Barley	581.0	674.8	93.8	2.28 *
Wheat	440.6	402.3	-38.3	1.41
Maize	582.5	763.1	+180.6	5.27 *
Sorghum	444.5	443.9	-0.6	0.02
Millet	134.7	131.4	-3.3	0.30
Horse beans	251.3	264.3	+13.0	0.70
Chick peas	121.3	109.3	-12.6	1.19
Haricot beans	42.5	16.4	-26.0	3.87 *
Field peas	111.6	102.7	-8.9	1.12
Lentils	51.9	50.3	-1.6	0.32
Neug	116.3	108.0	-8.3	0.91
Flax (linseed)	29.4	22.5	-6.9	1.23
Vetch	36.2	35.7	-0.5	0.19
TOTAL	4151.9	4412.6	260.7	2.76 *

1) Excluding Bale, Eritrea, Hararge and Tigrai.

* Difference statistically significant.

Table 13

COMPARISON OF YIELD OF MAJOR CROPS IN 1976/77 (1969 E.E.) AND 1977/78 (1970 E.C.) [1]

Crop	Estimate in: 1976/77	Estimate in: 1977/78	Difference (d)	Statistic T
	Quintals per hectare			
(1)	(2)	(3)	(4)	(5)
Teff	7.5	7.9	+0.4	1.03
Barley	10.4	7.3	-3.1	4.66*
Wheat	10.7	8.4	-2.3	2.19*
Maize	13.7	10.0	-3.7	3.53*
Sorghum	11.3	10.2	-1.1	1.43
Millet	8.6	9.8	+1.2	1.64
Horse beans	12.8	9.9	-2.9	2.55*
Chick peas	7.4	7.6	+0.2	0.25
Haricot beans	6.3	6.5	+0.2	0.21
Field peas	7.3	7.0	-0.3	0.05
Lentils	7.1	5.2	-1.9	3.00
Neug	2.1	3.2	+1.1	6.73*
Flax (linseed)	3.8	4.0	+0.2	0.51
Vetch	5.9	6.0	+0.1	0.28

1) Excluding Bale, Eritrea, Hararge and Tigrai

* Difference statistically significant.

3.5. Comparison of the production of major crops

Changes of crop production in 1969 E.C. and 1970 E.C. depend on changes of area under crop or yield or both. The estimates of total production of all major crops in 1969 E.C. was 40.1 million quintals, wheras in 1970 E.C. it was 36.6 million quintals, the decrease of the total crop production is estimated to be 3.5 million quintals (or 350 thousand metric tons), and according to the applied test, this difference is statistically significant (value of the statistic T is equal to 2.52). There are also significant differences within crops e.g. total production of barley, wheat and haricot beans decreased significantly, while production of millet and neug increased significantly.

There is no significant change in production of the following crops: teff, maize, sorghum, horse beans, chick peas, field peas, flax (linseed) and lentils. Details of the comparisons of crop production in both years as well as the values of the T statistics are given in table 14.

Table 14

COMPARISON OF PRODUCTION OF MAJOR CROPS IN 1976/77 (1969 E.E.) AND 1977/78 (1970 E.C.)[1)]

Crop	Estimate in: 1976/77	Estimate in: 1977/78	Difference (d) cl.3cl.2	Statistic T
	Thousand quintals			
(1)	(2)	(3)	(4)	(5)
Teff	9069.7	9264.5	+194.8	0.36
Barley	6035.1	4942.4	-1092.7	2.13*
Wheat	4719.9	3368.8	-1351.1	2.14*
Maize	7974.9	7635.6	-339.3	0.47
Sorhum	5023.9	4519.0	-604.9	0.93
Millet	1160.0	1544.3	+384.3	1.96*
Horse beans	3215.4	2625.9	-589.5	1.80
Chick peas	905.2	828.3	-76.9	0.58
Haricot beans	267.9	107.0	-160.9	2.36*
Field peas	808.9	713.8	-95.1	0.79
Lentils	369.0	259.1	-109.9	1.91
Neug	239.1	343.8	+104.7	2.38*
Flax(linseed)	111.0	88.7	-22.3	1.29
Vetch	213.7	212.5	-1.20	0.02
TOTAL	40,113.7	36577.9	-3535.8	2.52*

1)Excluding Bale, Eritrea, Harrarge and Tigrai

* Difference statistically not significant.

Chapter IV

NON-RESPONSE AND SAMPLING ERRORS

4.1. Sampling and non-sampling errors

Estimates of different parameters given in previous chapters of this report are subject to sampling and non-sampling errors. Sampling errors occur because we have investigted only a part out of the whole holdings. The results that we get by investigating a sample may differ from the results that we get by investigating the whole population. The difference between these results are known as sampling errors. It means that the feature of sampling errors refers to the discrepancies between the sample estimates and the population values that would be obtained from enumerating all units in the population: (e.g. all hldings in the same way in which the sample is enumerated). These discrepancies are unavoidable because sample estimates are based on data for only a sample of units. The employment of sampling method, however, enables estimates of the average magnitude of these discrepancies to be made. As a measure of these discrepancies in sampling theory a standard error is accepted. The standared error gives an idea of the frequency with which errors (differences between the sample estimate and thepopulation value) of a given magnitude may be expected to occour if repeated random samples of the same size are drawn from the population. Usually errors smaller than the standard error will occur with a frequency of about 68%, provided the estimate is approximately normally distributed.

The magnitude of sampling errors depends upon: sample size, sample design, method of selection, method of estimation and variability of the characteristic in question.

Non-sampling errors occur in all types of statistical investigation i.e. in sampling surveys as well as complete enumeration.
They may occur during survey preparation, interviewing, supervising, editing, processing, analyzing, etc. It is possible to minimize the magnitude of non-sampling errors by proper organization of the survey, adequate training and supervision of field staff and selecting efficient method of data collection. Sample surveys and censuses can give more accurate data than complete enumeration since investigating smaller number of units one can apply more accurate method of data collection and train more efficeint field staff and supervise enumerators adequately having the same amount of money.

In this chapter we have confined ourselves only to the presentation and analysis of non-response rates and sampling errors of some characteristics connected with area, yield and crop production.

4.2. NON-RESPONSE RATES

It is very well known that non-response, i.e. holdings for which data, for different reasons, were not collected, may have some impact on final results. If the number of non-response is confined to a small proportion of the whole sample, the results may not be biased significantly.

In our survey the non-response rate, i.e. number of holdings from which data were not collected tothe total number of selected holdings, is 9.3%. All non-respondants were classified by reasons of non-response r.The following reasons have been given:

(i) refusals,(ii) not at home, (iii)left the area, (iv) dead, (v) seriously sick, (vi)other reasons. Non-respondants have been also classified by the year the holdings were selected: holdings selected last year and surveyed in both years, were called "old holdings" holdings selected this year, were called "new holdings". It is expected that the non-response rates may be different for "old" and "new" hodings.

Non-response rates are 11.7% and 7.1% for "old" and "new" holdings respectively. The reason why non-response is higher for old holidngs than for new holdings can be explained by analyzing the non-response rates.

Refulals. In our survey where the interview method was used, the number of deliberate non-respose, i.e. refusals, is rather small. For all holdings it is 1.26%, where it is 1.2% for 'old' holdings and 1.3% for 'new' holdings. This shows that refusals' rate in not influenced significantly by the fact that we have interviewed old or new holdings.

Not-at-home. Enumerators were instructed to try to contact the selected holder at least three times for interviewing. If they failed, they reported it as 'not at home'. According to their reports, 2.64% of all selected holdings were not at home during the survey period, for 'old' holdings this rate is 2.95% and for 'new' holdings it is 2.35%.

Left area. Hodings might leave the area for different reasons, such as marriage, sale of holdings, joining to

new holdings, etc. During the survey 3.45% of all selected holdings reported as left the area, which is nearly 10% of all non-respondents. This rate is 5.28% for 'old' holdings, and 1.71% for 'new' holdings. This shows that 'old'holdings' left the area three times more frequent than 'new holdings'.From these figures it is estimeted that approximately 3.6% of the holdings changed areas last year. This is the main reason why non-response rate is higher for 'old' holdings than for 'new' ones.

Dead. Non-response for due to death was reported in 0.70% of all selected holdings; for 'old' holdings this rate was 0.94% and for 'new' holding it was 0.47%. This shows that the rate for 'old' holdings was two times higher than for new ones. This factor has also contricuted slightly to higher non-response rate for 'old'holdings.

Seriously sick. This reason was reported in only 0.35% of all the selected holdings: for old holdings this rate was 0.40% and 0.30% for 'new' holdings.

Other reasons. Non-response due to other reasons not mentioned above constitute only 0.92% of all the selected holdings, which was nearly the same for 'old' and for 'new' holdings.Q.94% for 'old' and 0.90% for 'new' holdings. For details see table 14.

From this simple analysis one may conclude that it could have been more iffieient to select new holdings by just judging from the lowest rate of non-response they could have hadn(7%). However, for efficient dynamic analysis, it is important to repeat certain % of the old holdings. In our case, for this purpose, we have kept 50% of the old holdings.

Table 14.

NON-RESPONSE RATES BY REASONS AND YEARS OF HOLDINGS' SELECTION

Non-response reason	Old holdings	New holdings	Total
	Percentage		
Refusals	1.21	1.32	1.27
Not-at-home	2.95	2.35	2.64
Left area	5.28	1.71	3.45
Dead	0.94	0.47	0.70
Seriously sick	0.40	0.30	0.35
Others	0.94	0.90	0.92
TOTAL	11.72	7.05	9.33

After analyzing the magnitute of the non-response, the next problem to tackle is, how to deal with it? The simplest way of dealing with non-response is to regard the non-responders as similar to the remaining of the sample. Treat the sample as if it was a sample of a smaller number of units and generalize the results on the whole population, (i.e. all holdings in relevant regions). This was the procedure that has been adopted in this report.

4.3. Methods of estimation of parameters and sampling errors

From data of this survey we have estimated totals, averages, ratios and percentages which are given in previous chapters. We have applied the following methods of estimation of parameters and sampling errors.

To estimate total of characteristic X (e.g. total area under crop, total production, total amount of fertilizers, etc.), we have applied the following ratio estimate:

$$\hat{X}_{Ti} = \hat{A}_{Ti}(69) \cdot \frac{\sum_{j=1}^{m_i} \hat{X}_{ij}}{\sum_{j=1}^{m_i} \hat{A}_{ij}} \qquad (1)$$

where $\hat{A}_{Ti}(69)$ is total area of private peasant holdings in i^{th} region estimated in 1969 E.C. [3], i.e. area of cropland, fallow land, pastoral land and other land. We have assumed that total area in a region was the same in both years, i.e. in 1969 E.C. and 1970 E.C.;

$\hat{A}_{ij}$ - estimate of total area in j^{th} selected Farmers' Association of i^{th} region;

$\hat{X}_{ij}$ - estimate of the total of characteristic X in j^{th} selected Farmers' Association and i^{th} region;

m_i - number of selected Farmers' Associations in region i.

Total for all investigated regions is

$$\hat{X}_T = \sum_{i=1}^{w} \hat{X}_{Ti} \qquad (2)$$

where w is the number of investigated regions (= 10).

Standard error for total expressed by formula (1) has been calculated as follows:

$$s(\hat{X}_{Ti}) = \frac{\hat{X}_{Ti}}{\sqrt{m_i}} \sqrt{C_{xi}^2 + C_{ai}^2 - 2 r_{xa} C_{ai} C_{xi}} \qquad (3)$$

where C_{xi}^2 and C_{ai}^2 are relative variances of characteristics X and A respectively,

r_{ax} - correlation coefficient between characteristic X and A (total area).

Standard error for all regions expressed by formula (2) was calculated as follows:

$$s(\hat{X}_T) = \sqrt{\sum_{i=1}^{w} s^2(\hat{X}_{Ti})} \qquad (4)$$

The mean yield is calculated as the ratio of two totals: total production and total area under crop in question, i.e.

$$\bar{y}_{ci} = \frac{\sum_{j=1}^{m_i} \hat{P}_{ij}(c)}{\sum_{j=1}^{m_i} \hat{A}'_{ij}(c)} \qquad (5)$$

where $\hat{P}_{ij}(c)$ stands for production of crop c in j^{th} Farmers' Association in region i;

$\hat{A}'_{ij}(c)$ - area under crop c in j^{th} Farmers' Association and region i.

Standard error of yield (5) for region i was calculated by the formula:

$$s(\bar{y}_{ci}) = \frac{\bar{y}_{ci}}{\sqrt{m_i}} \sqrt{C_{pi}^2 + C_{ai}^2 - 2 r_{pa} C_{pi} C_{ai}} \qquad (6)$$

where C^2_{pi} and $C^2_{a'i}$ are relative variances of production and area under crop respectively;

$r_{pa'}$ - correlation coefficient between production and area under crop in question.

Standard error of crop yield for the investigated regions was calculated as follows:

$$s(\bar{y}_c) = \sqrt{\sum_{i=1}^{w} W_i^2 \, s^2(\bar{y}_{ci})} \qquad (7)$$

where W_i stands for weight of the stratum i.

The standard error of an estimate can be expressed as a percentage of the population value of the estimated quantity. This form of expression is useful as the percentage standard error is unaffected by the units in which the estimate is expressed, and the percentage of standard error of the mean, of the total of sample, and the estimate of the population total are all equal. Such percentage of standard error is called a relative standard error.

Estimate of parameters, their standard errors and relative standard errors will be presented in next section of this chapter.

4.4. Selected estimates, their standard errors and relative standard errors

Presentation of the estimates is as follows: in column 2 estimates of parameters are given; in column 3 - standard errors of these estimates, and in column 4 relative standard errors (in percentages) are presented.

Estimates of area under different crops, their standard errors and relative standard errors are given in table 15. One may see from this table that the total area under temporary crops of private holdings is estimated at 4.4 million hectares with

Table 15

ESTIMATES OF TOTAL AREA, THEIR STANDARD ERRORS AND RELATIVE STANDARD ERRORS BY CROP*

Crop	Estimate	Standard error	Relative standard error
	Thousand hectares		Per cent
(1)	(2)	(3)	(4)
Teff	1,178.6	97.8	8.3
Barley	674.8	90.7	13.4
Wheat	402.3	58.5	14.3
Maize	763.1	78.6	10.3
Sorghum	443.9	79.9	18.0
Millet	131.4	25.2	19.2
Horse beans	264.3	38.3	14.5
Field peas	102.7	17.3	16.9
Chick peas	109.3	22.0	20.1
Lentils	50.3	10.8	21.4
Neug	108.0	20.7	19.2
Total temporary crops	4,412.6	217.0	4.9

*Excluding Bale, Eritrea, Hararge and Tigrai.

standard error of o.2 million hectares and relative standard error is 4.9%. We should read this estimate as:

4.4 ±0.2 million hectares

It means that estimate of total area under temporary crops is equal to 4.4 million hectares but since estimation was done on sampling basis then it may fluctuate plus or minus from this estimated value and measure of this fluctuation is standard error.

Area under teff is estimated at 1.2 ±0.1 million hectares and this gives 8.3% of relative standard error. For comparison of precision of different estimates it is more convenient to use relative standard errors of these estimates. For other estimates of area the relative standard errors are as follows: barley - 13.4%, wheat - 14.3%, maize - 10.3%, sorghum - 18.0%, and the largest is for lentils, i.e. 21.4%.

Estimates of production by crops, their standard errors and relative standard errors are given in table 16. Teff has the highest precision with relative standard error of 9.3%. The precision of production estimates for other crops is as follows: maize - 15.3%, barley - 15.4%, wheat - 21.4%, and the largest is for lentils - 28.2%.

Total crop production of all major crops is estimated at 36.6 million quintals and the standard error of this estimate is 2.3 million quintals and this gives 6.1% of relative standard error.

Estimates of crop yield, their standard errors and relative standard errors are given in table 17. As one can see from this table, relative standard errors for yields are much smaller than for totals, i.e. total area or total production of different crops. Relative standard errors of yield estimates for different crops are as follows: teff - 5.3%, barley - 6.9%, wheat - 8.1%, maize - 10.9%, sorghum - 7.9%, millet - 8.2%, horse beans - 6.8%, etc. Estimates of standard errors and relative standard errors by region are given in the Annex V.

Table 16

ESTIMATES OF CROP PRODUCTION, THEIR STANDARD ERRORS AND RELATIVE STANDARD ERRORS BY CROP*

Crop	Estimate	Standard error	Relative standard error
	Thousand quintals		Per cent
(1)	(2)	(3)	(4)
Teff	9,264.5	861.0	9.3
Barley	4,942.4	760.6	15.4
Wheat	3,368.8	719.8	21.4
Maize	7,635.6	1,169.2	15.3
Sorghum	4,519.0	1,073.9	23.8
Millet	1,544.3	350.6	22.7
Horse beans	2,625.9	424.4	16.2
Field peas	713.8	192.4	27.0
Chick peas	828.3	217.8	26.3
Lentils	50.3	14.2	28.2
Neug	343.8	71.0	20.6
TOTAL PRODUCTION OF MAJOR CROPS	36,577.9	2,296.1	6.1

*Excluding Bale, Eritrea, Hararge and Tigrai

Table 17

ESTIMATES OF YIELD, THEIR STANDARD ERRORS AND RELATIVE STANDARD ERRORS BY CROP*

Crop	Estimate	Standard error	Relative standard error
	quintals per hectare		Per cent
(1)	(2)	(3)	(4)
Teff	7.9	0.4	5.3
Barley	7.3	0.5	6.9
Wheat	8.4	0.7	8.1
Maize	10.0	1.1	10.9
Sorghum	10.2	0.8	7.9
Millet	9.8	0.8	8.2
Horse beans	9.9	0.7	6.8
Field peas	7.0	0.8	11.7
Chick peas	7.6	0.9	11.9
Lentils	5.2	0.7	13.6
Neug	3.2	0.2	6.3

*Excluding Bale, Eritrea, Hararge and Tigrai

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ANNEX I

METHOD OF CORRECTION OF CROP PRODUCTION ESTIMATES OBTAINED BY INTERVIEW

The data for the agricultural sample survey conducted in 1977/78 (1970 E.C.) were collected by interview method only. From our previous experiences, it's well known that data collected by interviewing farmers are usually under-estimated. Therefore, to derive correction coefficients for such data, one must use objective methods (i.e. field area measurements and crop cutting experiments).

In the last two crop production surveys that were conducted in 1975/76 and 1976/77 (1968 E.C. and 1969 E.C.) both objective and interview methods were applied to collect the data. Based on these two methods, correction coefficients for adjusting crop production estimate collected by interview were developed. These correction coefficients are also used now for adjusting the data that were collected by interview method during the Agricultural sample survey that was conducted in 1977/78 (1970 E.C.)

Usually production estimates are given in local units, such as: Kuna, dawla, silicha, akomada, madiga, etc. More than ten different local units were reported on the average varying from one region to the other. The metric equivalent of these local units is published based on the second round survey that was conducted by CSO in 1968/69 under the total "Metric Equivelents of local Area and Production Units, Addis Abeba 1972" [5].

Any production estimates given in local units can be converted into kilograms using these equivalents. However, since crop production estimates given by farmers are under-estimated for one reason or another it is necessary to find the magnitude of this under-estimation using objective method.

Now we are going to develop correction coefficients for different local units by regions using the results of the two previous crop production surveys. We have conducted crop cutting experiments on about 1800 fields to obtain objective estimates of yield in the last two previous surveys. The same fields were measured to obtain objectiv area estimates.

Let's assume that crop production of i^{th} field under crop x in region r has been estimated, using objective methods, as follows:

$$P_{rxi}/0/ = a_{rxi}/0/ \cdot \bar{y}_{exi}/0/ \text{ kg} \qquad (1)$$

Where $a_{rxi}/0/$ stands for area on i^{th} field under crop x in region r according to area measurement,

$\bar{y}_{rxi}/0/$ - estimate of yield of crop x from i^{th} field in region r according to crop-cutting experiments.

For the same i^{th} field under crop x in region r, farmer's report crop production in local unit is:

$$P_{rxi}/u/ = u_{rxi} \text{ 1.u.} \qquad (2)$$

Where u_{rxi} stands for number of local units of crop production x obtained from i^{th} field in region r,

1.u. - name of local unit (e.g. kuna).

Crop production reported by farmer in local unit has been converted into kilograms according CSO calibration [5] as follows:

$$P_{rxi}/u/ = u_{rxu} \times g_{rxu}(c) \text{kg} \qquad (3)$$

Where $g_{rxu}(c) = V_{ru}(c)\, d_x$,

$V_{ru}(c)$ - Volume of local unit u (in litres) in region r,

d_x - density of crop x (given in [5]).

Let's assume that for crop x we had during the last two surveys n_{rux} fields on which crop-cutting experiments were conducted and farmers' reported crop production in the same local unit u. Using formuae(1) and (2) , we can estimate the ean production per local unit u according to objective measurments conducted on n_{rux} fields as follows:

$$\bar{\varepsilon}_{rxu}(o) \qquad \frac{\sum_{i=i}^{n_{rux}} p_{rxi}(o)}{\sum_{i=i}^{n_{rux}} u_{rxi}} \qquad (4)$$

Production of crop x per local unit u, as it is given in formula /3/ is $\varepsilon_{rxu}(c)$.
The ratio of $\bar{\varepsilon}_{rxu}(o)$ and $\varepsilon_{rxu}(c)$ gives us an estimate of the coefficicient of corrction of local unit u reported by farmers,

$$c_{rxu} = \frac{\bar{\varepsilon}_{rxu}(o)}{\varepsilon_{rxu}(c)} \qquad (5)$$

It is not possible to use "c_{rxu}" for correcting crop production without making further refinements. The main reason being;

a) for some region and local units the sample size is too small.

b) New local units which were not reported in the last two surveys might be reported in the agricultural sample survey conducted in 1977/78.

To make the refiniment we have to analyze the "c_{rxu}" of the different local units for the various crops by regions. After making such analysis we have discovered that there is a certain correlation between size of local unit, i.e. g_{rxu} and c_{rxu}. This finding is interesting and important. The value of g_{rxu} can be estimated from CSO bulletin while the correction coefficient can be calculated.

Different regressions models were tried and it was found that power curve has the best fitness for this purpose. The model that was used is $c = a\, g_u^b$ (a < 0).

We have obtained the following result:

$$c_u = 5.20\, g_u^{-0.24}, \quad r^2 = .34 \qquad (6)$$

Where g_u stands for weight of grain per local unit "u" according to CSO bulletin (as in formala (3)),
r^2 = coefficient of determination, 5.20 and - 0.24 are regression coefficients.

By applying this model, we can see that 39% of the change in c_u is explained by the change in g_u. The paranethers in equation (6) were estimated from about 90 units in different regions according to the results obtained from nearly 1800 crop cutting experiments. Much better fitness was obtained when the results were ordered and then the size of g_u and c_u is caluclated. To illustrate the correlation between c_u and g_u, we have divided g_u into four groups and the results are given in table I.1

Table I.1.

Average size of local unit $\bar{g}_u$, average correction coefficients and number of observations

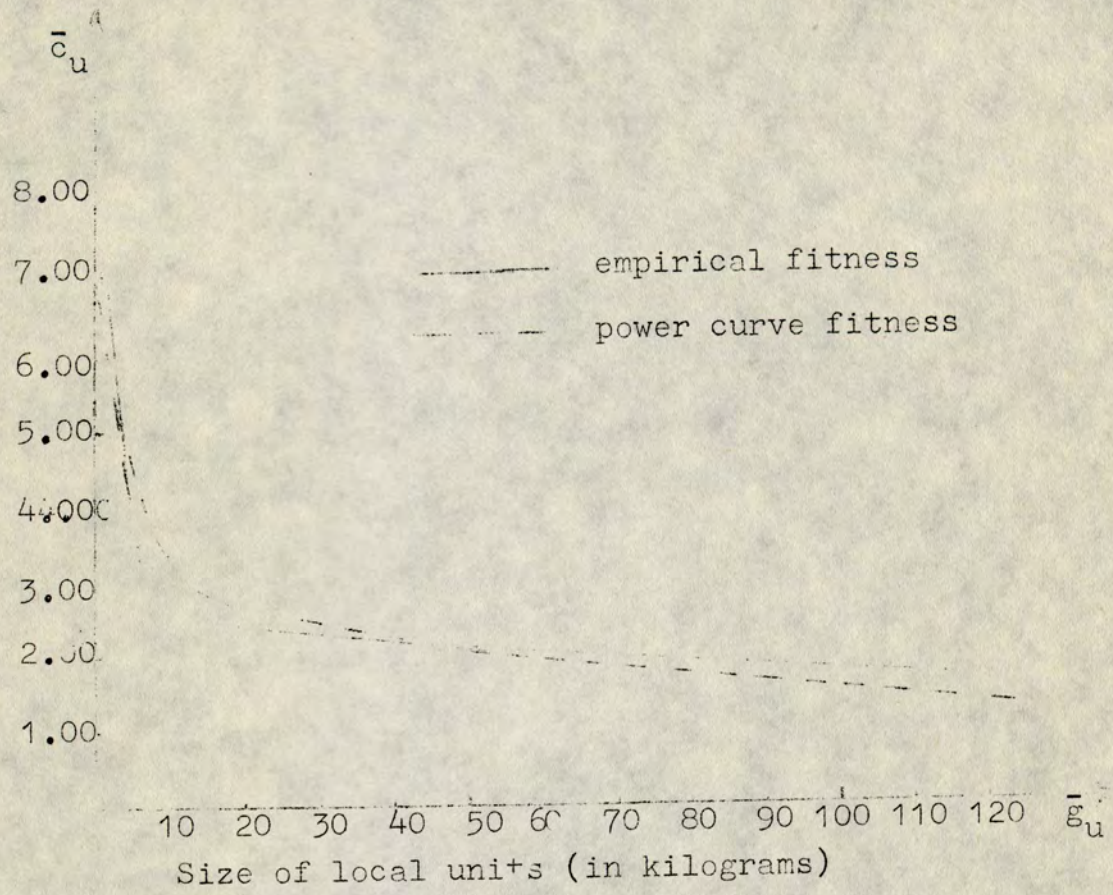
Local units ordered by g_u	Average size of local unit $\bar{g}_u$	Average correction coefficient $\bar{c}_u$	Number of observatins n_i
Under 5.0	1.90	6.62	63
5.0 - 25.0	10.67	2.66	882
25.0 -100.0	64.05	1.99	463
100.0 and above	119.06	1.70	388
TOTAL	57.52	1.91	1,796

If we apply power curve to the figures given in table I.1, we will obtain the following results:

$$\bar{c}_u = 7.08\ g_u^{-0.31}\ ,\ r^2 = 0.93$$

This shows that 93% of change in $\bar{c}_u$ is explained by change in $\bar{g}_u$. The relationship of the fitness of the power curve and the empirical data in table I.1 is illustrated in fig. 1.

Fig. 1 . Correlation between size of local units and correction coefficients of crop production



From the above analysis, it is possible to conclude that the correction coefficients for the local unit "u" can be estimated if the size of g_u is known. More over, we have found out that it also varies from region to region. Therefore, it is necessary to know the regional impact on c_u for estimating c_{ru}. Regional impact on c_u is estimated as follow:

First we have culculated the average correction coefficient for region r for all local unit reported, where

$$\bar{c}_r = \frac{\sum_{k=1}^{m_r} n_{rk}\ g_{ruk}(c)}{\sum_{k=1}^{m_r} n_{rk}\ g_{ruk}(c)} \qquad (7)$$

and n_{rk} is number of fields in region r which are reported in local unit k

m_r is the number of different local units in region r.

Averge size of localunits in region r is calculated by the following formual:

$$\bar{g}_r(c) = \frac{\sum_{k=1}^{m_r} n_{rk}\ \bar{g}_{ruk}(c)}{\sum_{k=1}^{n_r} n_{rk}} \qquad (8)$$

using $\bar{c}_r$ and $\bar{g}_r(c)$, for r = 1, 2, ..., 12, the power curve has been adjusted to

$$\bar{c}_r^{**} = 3.85\ \bar{g}_r(c)^{-0.17}, \qquad r^2 = 0.23 \qquad (9)$$

Regional impact on c_u has been estimate by

$$\bar{e}_r = \frac{\bar{c}_r}{c_r^{**}} \qquad (10)$$

using the above formula, we have obtained the following results for each region:

Arsi : 1.118; Bale: 1.031; Garo-Gofa:.940; Gojam: 1.115; Gondor: 0.883; Harar: 0.789; Illubabor: 1.086; Kefa: 1.351; Shoa: 0.887; Sidamo: 0.903; Welega: 0.717; Wollo: 1.351.

To estimate c_{ru} (adjusted correction coefficient) the following formula has been applied:

$$c^*_{ru} = \frac{n_{ru}}{n_r} c_{ru} + \frac{n_r - n_{ru}}{n_r} c^{**}_u e_r \qquad (11)$$

Where n_{ru} stands for number of observation (crop cutting experiment) for local unit u in region r, n_r = total number of observations in region r (i.e.total number of crop cutting experiments in 1975/76 and 1976/77)

C_{ru} = correction coefficient calculated according to formula (5),

e_r and c_u have been calculated according to formulae (10) and (6) respectively.

As it can be seen from formula (11), the first part of this formula is composed of the value of c_{rn} obtained from the surveys. If $n_{ru} = n_r$, then $c_{ru} = c_{ru}$, in which case the second part of the formula is ignored. If new local units were reported in 1977/78 which were not reported in 1975/76 and 1976/77 , then c^*_{ru} is calculated as follows:

$$c^*_{ru} = e_r * c^{**}_u \qquad (12)$$

This formula is useful for estimating correction coefficients for new local units which were not reported in the last two surveys. To get the estimate of c^*_{ru}, one has to calculate only c^*_u applying formula (6). The only unknown component is $\varepsilon_{ru}(c)$ which can be calculated from CSO Bulletin as follows:

$$\varepsilon_{ru}(c) = v_{ru}(c) \cdot d_x$$

Where $v_{ru}(c)$ and d_x are explained in formula (3) and are given in the CSO Bulletin.

Example 1

Suppose, we want to estimate the correction coefficient for the local unit Dawla in Arssi Region. Only 44 crop cutting experiments were conducted in this region in the years of 1975/76 and 1976/77 and production was reported in the local unit called "Daula". By applying formula (5), we find that c_{ur} = 2.206, and by applying formula (6) the value of c^{**}_u = 1,750 and the value of e_r = 1.118 by formula (10).

The total number of observations in Arssi region is 72 (i.e n_r = 72). Therefore, to calculate c^*_{ur} (adjusted correction coefficient), we can apply formula (11) as follows, given the value of the other unknowns:

$$c^*_{ur} = \frac{44}{72} \times 2.206 + \frac{72-44}{72} \times 1.118 \cdot 1.750 = 2.109$$

Thus, the correction coefficient for the local unit "Dawla" in Arssi region is 2.109 . Note that this formula applies for the local units and regions in which the sample size is very small.

Example 2

Suppose now we want to estimate the correction coefficient of the local unit "Silicha" which was not reported in the last two surveys in Arssi region. Formula (11) is used to estimate c^*_{ur}. We know that the value of $e_r = 1.118$ from previous calculation. The value of c^{**}_u can be estimated using formula (5) as follows:

$$Cu^{**} = 5.20. \; g_{ru}^{-0.24}$$

here $g_{ru} = v_{ru} \cdot d_x$. For silicha in Arssi region $v_{rcu} = 54.69$. The value of d_x varies from crop to crop. In our example, we are interested in calculating the correction coeffieient of silicha for maize. In this case $d_x = 0.851$. Thus, $g^*_{rux} = 54.69 \times 0.851 = 46.54$. Substituting the value g^*_{rux} in the above formula, we have:

$$c^{**} = 5.20 \times 46.54^{-0.24} = 2.056$$

Therefore the correction coefficient of a silicha for maize in Arssi region is:

$$c^*_{ur} = 1.118 \times 2.056 = \underline{2.299} \; .$$

ANNEX II

COMPARISONS OF AREA, PRODUCTION AND YIELD OF MAJOR CROPS IN ETHIOPIA IN 1974/75 (1967 E.C.) - 1977/78 (1970 E.C.)

These assessments of area, production and yield of major crops for last four years covered the whole country and all types of holdings, i.e. private peasant holdings, cooperatives and state farms /known as commercial farms before the nationalization/ . Some results were estimated according to the last four agricultural surveys /mainly for private peasant holdings/ and some were assessed according to some accepted methods, i.e. for Eritrea in 1968 E.C., for Eritrea and Tigrai in 1969 E.C., and for Bale, Eritrea, Hararge and Tigrai in 1970 E.C. State farms were covered completely.

Production was assessed for both seasons, i.e. for main season and for belg season (second season), while area was calculated once . Yield was calculated by dividing total production by area under crop in questio during main season.

Table II.1

AREA UNDER MAJOR CROPS IN ETHIOPIA
IN1974/75, 1975/76, 1976/77 AND 1977/78

Crop	Estimate of area in year:			
	1974/75	1975/76	1976/77	1977/78
	Thousand hectares			
(1)	(2)	(3)	(4)	(5)
Teff	1,452.5	1,722.1	1,550.0	1,521.9
Barley	809.0	600.9	745.6	866.0
Wheat	703.3	501.1	507.1	467.3
Maize	774.3	739.3	680.1	877.9
Sorghum	697.5	718.9	707.0	706.8
African millet	174.0	316.5	174.4	204.0
Horse beans	320.0	258.7	264.8	278.5
Chick peas	177.3	197.7	173.0	155.1
Haricot beans	71.5	43.3	43.8	17.3
Field peas	108.0	107.3	139.7	128.6
Lentils	116.0	56.2	66.8	64.7
Flax	50.0	82.2	42.7	25.9
Neug	95.0	226.3	129.6	120.0
Vetch	39.8	38.0	38.3	37.7
Others	14.2	13.7	33.7	18.2
TOTAL	5,602.4	5,622.2	5,296.6	5,489.9

Table I.2

PRODUCTION OF MAJOR CROPS IN ETHIOPIA IN YEARS 1974/75 (1967 E.C.) - 1977/78 (1970 E.C.)

Crop	Crop production in:			
	1974/75 (1967 E.C.)	1975/76 (1968 E.C)	1976/77 (1969 E.C)	1977/78 (1970 E.C
(1)	(2)	(3)	(4)	(5)
	Thousand metric tons			
CEREALS	4,182.2	4,150.9	4,548.1	4,150.4
Teff	1,019.1	1,186.7	1,123.5	1,174.4
Barley	682.7	626.4	947.7	731.0
Wheat	623.7	515.8	592.0	423.4
Maize	1,041.8	1,405.9	1,015.3	998.4
Sorghum	649.6	804.9	670.9	611.2
Millet	165.3	311.2	198.7	212.0
PULSES	573.6	507.8	633.4	520.6
Horse beans	280.1	288.3	330.3	273.3
Chick peas	141.0	102.9	114.4	107.2
Haricot beans	50.0	33.4	29.1	12.1
Field peas	52.4	40.5	108.2	91.6
Lentils	50.1	42.7	51.4	36.4
OTHERS	65.9	129.6	68.9	76.4
Linseed	17.9	28.6	17.3	10.6
Neug	23.8	75.3	29.2	43.0
Vetch	24.2	25.7	22.4	22.8
TOTAL	4,821.7	5,488.3	5,250.4	4,747.4

Table I.3

YIELS OF MAJOR CROPS IN ETHIOPIA IN YEARS 1974/75, 1975/76, 1976/77, AND 1977/78

Crop	Yield in year:			
	1974/75	1975/76	1976/77	1977/78
	Quintals per hectare			
(1)	(2)	(3)	(4)	(5)
Teff	7.0	6.9	7.3	7.7
Barley	8.4	10.4	12.8	8.4
Wheat	8.9	10.3	11.7	9.1
Maize	13.5	19.0	14.9	11.4
Sorghum	9.3	11.3	9.5	8.7
African millet	9.5	9.8	11.4	10.4
Horse beans	8.8	11.1	12.5	9.8
Chick peas	8.0	5.2	6.6	6.9
Haricot beans	7.0	7.7	6.6	7.0
Field peas	4.9	3.8	7.7	7.1
Lentils	4.3	7.6	7.7	5.6
Flax(linseed)	3.6	3.5	4.1	4.1
Neug	2.5	3.3	2.3	3.6
Vetch	6.1	6.9	5.8	6.1

ANNEX III

ASSESSMENT OF SOME COMPONENTS OF FOOD BALANCE SHEET FOR 1977/78 (1970 E.C.) AND PRELIMINARY FORCAST FOR 1971 E.C. (1978/79)

1. Introduction

In the previous chapters of this report we have estimated the production of major crops for 1970 E.C. However, it is not enough to know just how much is produced; it is also equally important to know how much food a country needs, how much supply of the major crops is available on the market, etc. Shortly speaking, food balance sheet (FBS) should be prepared. It is not easy to prepare a food balance sheet properly because there are no reliable data on all the components which are needed for the food balance sheet. The only reliable data we have are on two components only. These are crop production of major crops and marketed surplus.

To quantify the other components of FBS, such as self-consumption of rural population, seed losses, consumption of urban population, we have to rely on some rough approaches and assumptions. Moreover, policy makers require such information to make policy decision on importation, price, etc. and cannot wait until we get reliable data. Therefore, to satisfy these needs, one has to resume to very rough approaches and try to assess the components needed. On the other hand, policy makers should also be aware of these limitations and care should be taken in interpreting and using such data. They should also encourage conducting statistical surveys in order to estimate the required components properly in the near future .

2. Methodology

With the limited statistical data available, it is very difficult to prepare a precise food requirement for the country. Taking this limitation into consideration one has to use a simple model with very few variables but ample enough to give some indications on the situation of food supply.

To satisfy our needs, we have confined ourselves to the supply of food from major crops. These major crops are listed in chapter I of this report. Here, the basic assumption is that the major food requirement of our people is satisfied by the major crops.

The most impotant variables that are considered in this model are: rural and urban population, total production of major crops, consumption of urban popuation self-consumption of rural popualation, seed requirement and losses (in storage, handling etc). Symbolically, the model could be presented as follows:

$$R = P - (C_r + S + L) \qquad (1)$$

Where R is surplus or deficit; P - crop production;

C_r - self-consumption of rural population;

S - seed requirement;

L - losses.

Consumption of major crops by urban popualation can be expressed as follows:

$$C_u = R + I \qquad (2)$$

Where I is amount of major crops which should be imported to satisfy the food requirement of urban population.

We have tried to assess the /different components in models (1)and (2) and the results are presented in the following sections.

3. Assessment of self-consumption of rural population, seed requirement and losses

Consumption of rural population, seed requirement and crop losses should be estimated from special statistical survey. As we have already mentioned, there are no relevant statistical data. However, we can have rough essessment of the consumption of rural population seed requirements and crop losses using indirect method

From the Agricultural Sample Survey whose results have been presented in the first three chapters of this report we can estimate production of major crops (P_{mc}) and marketed surplus (M_{cs}), i.e. crop production which farmers sold. It is reasonable to assume that rural population is self sufficient This assumption, however, does not hold in case of draught or other disasters connected with famine as in the case of Wello. For this reasone we have assumed that rural population of Wello is not self sufficient.

Total production of major crops in 1970 E.C. is assessed to be 4,760.2 thousand tons, out of this 105.0 thousand tons(produced by state farms and cooperatives meaning that private peasant holdings have produced 4,655.2 thousand tons (4,760.2 -105.0 = 4,655.2)according to our survey result, it is estimated see chapte 2 of this report that private holdings sell 11.2% of the production of major crops(521.4 thousand tons). According to our assumption, self consumption of rural population /excluding Wello/ including seed requirenent and losses is estimated to be 4,133.8 thousand tons. The mean consumption of rural population per person is:

$$C_{av} = \frac{4,133.8}{26.0} = 159 \text{ kg/person}$$

Assuming that the population of rural population in the whole country is 28.6 million self consumption of rural population, including losses and seed requirements, is assessed to be 4,547.4 thousand tons.

If we assume that losses of major crops are estimate to be 5.0% of the total production available to farmers and the seeding rate on the average is 60 kg per hectare (which amounts to 227.4 tousand tons of losses and 324.0 thousand tons of seeds than the consumption of major crops in the rural areas per person is approximately 140kg.

4. Assessment of the consumption of major crop by urban population

Consumption of major crops by urban population is not known from any statistical survey.

It is possible to calculate the food requirement for major crops using calory requirement and convert them into kilograms. We have assumed that consumption of major crop for urban population is higher than selfconsumption of rural population, and is accepted as 150 kg/person. Since the number of urban population in Ethiopia is estimated to be 4.54 million, the total requirement of major crops for this population is 681.0 thousand tons.

5. Assessments of the requirement of food from major crops in 1970 E.C. and expected deficit

According to our assessments given in sections 3 and 4, the food requirement from major crops for Ethiopia in 1970 E.C. is estemated to be 5,228.4 thousand tons, while the available production of these crops was assessed to be 4,760.2 thousand tons. Having these figures the estimate of the deficit is 468.2 thousand tons (5,228.5 -4,760.2 = 468.2).

5. Preliminary forcast of food supply from major crops in 1971 E.C. (1978/79)

The preliminary forecast of production from major crops is given in Annex I'. Having this forecast made, we have also to forecast whether there will be surplus or deficit of food supply from the major crops.

To determine this we have to account for the rural and urban population growth in the coming year. It is generally accepted that the rural population growth and urban popualtion growth in Ethippia is estimated to be at the rate of 2% and 6.6% respectively. Taking these popualation growth rates into account, the total food requirement for 1971 E.C. is 5353.4 thousand tons. It is forecasted, however that the expected production of the major crops is 5083.4 thousand tons. Therefore the expected shortage of grain in 1971 E.C. is 270.0 thousand tons (5353.4-5083.4)

ANNEX IV

PRELIMINARY CROP PRODUCTION FORECAST FOR ETHIOPIA IN 1978/79 (1971 E.C.)

1. Introduction

Preliminary crop production forecast presented in this report was prepared by applying time series analysis regarding area under major crops and yield of major crops for the last four years. (1974/75, 1975/76 1976/77 and 1977/78.)

We have already published two crop production forecasts for years 1976/77 (1969 E.C.) and 1977/78 (1970 E.C.) respctively (see [4]). The forecasts were collected by conducting surveys. Selected weredas visited by specially staff who conducted interview with weredas officials and farmers. They asked about expected changes in crop production and area under major crops compared to last year. Based on the interview results, the enumerators prepared reports on expected changes in crop production and area under major crops for each crop separately. It is expected that similar crop production forecast will conducted for 1978/79 (1971 E.C.)

The preliminary crop production forecast for 1978/79 (1971 E.C.) should be considered as a very general indicator of the next crop production. In this study, we have taken the tendencies that have occcured in the last four years. More reliable forecast will be available by the end of this year.

2. Different methods of crop production forecast

We would like to draw the attention of our users that there are three main methods of crop forecasting. Forecasts can be provided by reporters, they can be based on meteorological data such as rainfall obtained prior to the date of the forecast, or they can be based on observation and physical measurements of the growing crops, alone or in conjunction with meteorological data.

Meteorogical data do not directly provide forecast of yields. If they are to be used as a basis of such forecasts, reliable data on both the yields and the meteorological events must be collected over a number of years and crop-weather relations should be evaluated The same is true if observations and measurements on the growing crop are to be used.These evaluations require the application of the methods of statistical analysis known as regression analysis.

In our case, we have reliable data on the yield of major crops for four years only. It is possible to use rainfall and evaluate crop-weather relations using regression analysis. It must not be assumed that it will be possible to derive a formula which will give sastisfactory results, even if accurate and extensive data are available. In the first place, the yield of a given crop is influanced by meteorological and other events up to and sometimes after harvest, and this may introduce too much degree of uncertainty into the yield predicted some months before harvest to make the prediction of any value. In the second place, although meteorigical factors undoubtedly account for a good deal of the variation in crop yields, they are not by any means the only factors. Changes in variety, insects pests, plant diseases, depletion of the fertility of the soil, changes in the type of land under crop, changes in the amount of fertilizers, any many other factors often somewhat complex affect yield and it may therefore be impossible to determine them from a set of data extending over a limited number of years.

In Ethiopia there are reliable data on both yield and meteorogical events for four years and therefore yield-weather relations can be evaluated having in mind the limitation expressed above.

We would like to stress again that time series for yields is rather short, but we have tried to use it for forecast evaluations to give preliminary crop production forecast for Ethiopia as whole.

3. Crop Production Forecast Model

Crop production is the product of area under crop in question and its mean yield. Each component was calculated separately as follows:

area under crop: $A/t/ = at^b$,

where t standa for time,

a, and b are coefficients of the regression model.

mean yield:

$$\bar{Y}/t/ = ct^d,$$

where t stands for time, and c and d are coefficients of rdgression model.

The mean yield, can also be predicted from the following model which includes rainfall /R/ and time, i.e.

$$\bar{Y}/t, R/ = c't^{d'}R^{e}$$

The product of these two components, i.e. $A/t/$ and $\bar{Y}/t/$ gives forecast of crop production in question:

$$P/t/ = A/t/ \times \bar{Y}/t/$$

4. Preliminary crop production forecast in 1971 E.C. with comparison for 1970 E.C. estimates

By applying the models described in the previous section, and using data on area under major crops and yields of these crops given in Annex II of this report for last four years, we have obtained crop production forecast for the country as a whole. The results for area, yield and production are presented in tables Iv.1, IV.2 and IV.3 respectively.

Table IV.1

PRELIMINARY FORECAST OF THE AREA UNDER MAJOR CROPS IN 1971 E.C. (1978/79) AND ASSESSMENT FOR 1970E.C. (1977/78)

Crop	Assessment for 1970 E.C.	Forecast for 1971 E.C.	Change	
			cl.3-cl.4	$\frac{cl.4}{cl.2} \times 100$
	Thousand hectares			Per cent
(1)	(2)	(3)	(4)	(5)
Teff	1521.9	1584.6	+62.7	+4.1
Barley	866.0	774.6	-91.4	-10.6
Wheat	467.3	426.8	-40.5	-8.7
Maize	877.9	787.7	-90.2	-10.3
Sorghun	706.8	712.2	+5.4	+0.8
African millet	204.0	215.9	-11.9	+5.8
Horse beans	278.5	255.8	-22.7	-8.2
Chick peas	155.1	162.7	7.6	+4.9
Haricot beans	17.3	31.7	+14.4	+83.2
Field peas	128.6	137.8	+9.2	+7.2
Lentils	64.7	52.4	-12.3	-19.0
Flax	25.9	32.0	+6.1	+23.6
Neug	120.0	150.8	+30.8	+25.7
Vetch	37.7	37.3	-0.4	-1.1
TOTAL	5,471.7	5,362.3	=109.4	-2.0

Table IV.2

PRELIMINARY FORECAST OF YIELD OF MAJOR CROPS IN 1971 E.C.(1978/79) AND ASSESSMENT FOR 1970 E.C. (1977/78)

Crop	Assessment for 1970 E.C	Forcast for 1971 E.C	Change cl.3-cl.2	Change cl.4/cl.2 100
	Quintals per hectare			Per cent
(1)	(2)	(3)	(4)	(5)
Teff	7.7	7.6	-0.1	-1.3
Barley	8.4	10.7	+2.3	+27.4
Wheat	9.1	10.6	+1.5	+16.5
Maize	11.4	13.4	+2.0	+17.5
Sorghum	8.7	9.3	+0.6	+6.9
Millet	10.4	11.1	+0.7	+6.7
Horse beans	9.8	11.7	+1.9	+19.4
Chick peas	6.9	6.1	-0.8	-11.6
Haricot beans	7.0	6.9	-0.1	-1.4
Field peas	7.1	7.5	+0.4	+5.6
Lentils	5.6	7.5	+1.9	+33.9
Flax	4.1	4.2	+0.1	+2.4
Neug	3.6	3.3	-0.3	-8.3
Vetch	6.1	6.3	+0.2	+3.3

Table IV.3

PRELIMINARY FORECAST OF THE PRODUCTION OF MAJOR CROPS IN 1971 E.C. (1978/79) AND ASSESSMENT FOR 1970 E.C. (1977/78)

Crop	Assessment for 1970 E.C (1977/7)	Forecast for 1971 E.C. (1978/79)	Change	
			cl.3-cl.2	$\frac{\text{cl.4}}{\text{cl.2}} 100$
	Thousand metric tons			Per cent
(1)	(2)	(3)	(4)	(5)
CEREALS	4,150.4	4,434.9	+284.5	6.8
Teff	1,174.4	1,205.9	+ 31.5	2.7
Barley	731.0	825.7	+ 94.7	13.0
Wheat	423.4	451.1	+ 28.0	6.6
Maize	998.4	1,051.6	+53.2	5.3
Sorghum	611.2	660.9	+ 49.7	8.1
Millet	212.0	239.7	+ 27.7	13.1
PULSES	520.6	562.8	+ 42.2	8.1
Horse beans	273.3	298.8	+ 25.5	9.3
Chick peas	107.2	99.3	- 7.9	-7.4
Haricot beans	12.1	21.4	+ 9.3	+76.9
Field peas	91.6	103.8	+ 12.2	13.3
Lentils	36.4	39.5	+ 3.1	8.5
OTHERS	65.9	85.8	+ 19.9	30.2
Neug	43.0	49.0	+ 6.0	13.9
Flax(linseed)	10.6	13.3	+ 2.7	25.5
Vetch	22.8	23.5	+ 0.7	3.1
TOTAL	4,747.4	5,083.5	+336.1	+7.1

According to the crop production forecast results, it is expected that the total production of major crops will increase about 7%, while area under major crops may decrease slightly.

Teff will increase by 2.7% only while increase of the production of barley will be 13.%. The increase of production of wheat, maize and sorghum is expected from 5% to 8%. Production of cereals will increase by 6.8%, while the production of pulses will increase 8.1%.

Compared to the last four year, the crop production of 1970 E.C. (1977/78) was the lowest and this was due to the damage caused by the unusual rain of October, November 1977 which has decreased yield significantly.

ANNEX V

THE SURVEY RESULTS BY REGION

1. Arssi.
2. Gamo Gofa.
3. Gojam.
4. Gondar.
5. Illubabor.
6. Kefa.
7. Shoa.
8. Sidamo.
9. Wollega.
10. Wollo.

Table 1.1

COMPARISON OF AREA OF MAJOR CROPS IN YEARS 1976/77 (1969. E.C.) AND 1977/78 (1970 E.C.) IN ARSSI REGION

Crop	Estimate in: 1976/77	Estimate in: 1977/78	Change cl.3-cl.2	Change cl.4/cl.2 x100
	Thousand Hectares			Per cent
(1)	(2)	(3)	(4)	(5)
CEREALS	364.1	399.4	+35.3	+9.7
Teff	24.1	25.2	+1.1	+4.6
Barley	135.6	154.7	+19.1	+14.1
Wheat	142.9	153.8	+10.9	+7.6
Maize	43.2	41.9	-1.3	-3.0
Sorghum	18.3	23.8	+5.5	+30.1
Millet	-	-	-	-
PULSES	61.7	60.8	-0.9	-1.5
Horse beans	24.6	37.3	+12.7	+51.6
Chick peas	0.5	1.0	+0.5	+100.0
Haricot beans	10.9	1.2	-9.7	-89.0
Field peas	17.4	15.8	-1.6	-9.2
Lentils	8.3	5.5	-2.8	-33.7
OTHERS	6.1	5.2	-0.9	-14.8
Neug	0.5	0.2	-0.3	-60.0
Flax(linseed)	4.0	3.8	-0.2	-5.0
Rape seed	0.1	-	-0.1	-100.0
Vetch	0.8	-	-0.8	-100.0
Fenugreek	0.7	1.2	+1.2	-
TOTAL	431.9	464.5	+32.6	+7.5

Table 1.2

COMPARISON OF AREA OF MAJOR CROPS IN YEARS 1976/77 (1969 E.E.) AND 1977/78 (1970 E.C.) IN GAMO GOFA REGION

Crop	Estimate area		Change	
	1976/77	1977/78	cl.3-cl.2	cl.4 / cl.2 *100
	Thousand hectares			Percent
(1)	(2)	(3)	(4)	(5)
CEREALS	66.2	79.1	+12.9	+19.5
teff	11.8	13.0	+1.2	+10.2
barley	21.1	30.5	+9.4	+44.5
Wheat	1.4	1.5	+0.1	+7.1
Maize	20.5	27.4	+6.9	+33.7
Sorghum	11.4	6.7	-4.7	-41.2
Millet	-	-	-	-
PULSES	4.7	4.1	-0.6	-12.8
Horse beans	1.2	1.5	+0.3	+25.0
Field peas	3.5	2.5	-1.0	-28.6
Lentils	-	0.1	+0.1	-
OTHERS	9.4	13.4	+4.0	+42.6
TOTAL	80.3	96.6	+16.3	+20.3

Table 1.3

COMPARISON OF AREA OF MAJOR CROPS IN YEARS 1976/77 (1969 E.E.) AND 1977/78 (1970 E.C.) IN GOJAM REGION

Crop	Estimate in:		Change	
	1976/77	1977/78	cl.3-cl.2	$\frac{cl.4}{cl.2}100$
	Thousand hectares			Per cent
(1)	(2)	(3)	(4)	(5)
CEREALS	473.7	486.1	+12.4	+2.6
Teff	249.3	254.2	+4.9	+2.0
Barley	93.9	89.0	-4.9	-5.2
Wheat	21.6	28.3	+6.7	+31.0
Maize	33.8	47.1	+13.3	+39.3
Sorhum	27.9	9.2	-18.7	-67.0
Millet	47.2	46.5	~~+11.4~~ 0.7	~~+23.5~~ 1.5
PULSES	58.7	52.9	-5.8	-9.9
Horse beans	35.5	29.8	-5.7	-16.1
Chick peas	9.6	5.8	-3.8	-39.6
Haricot beans	-	-	-	-
Field peas	12.6	16.3	+3.7	+29.4
Lentils	1.0	1.0	0.0	0.0
OTHERS	56.1	63.7	+7.6	+13.6
Neug	39.8	40.3	+0.5	+1.3
Flax(linseed)	13.3	10.5	-2.8	-21.1
Rape seed	0.3	0.1	-0.2	-66.7
Vetch	1.2	5.2	+4.0	+333.3
Others	1.5	7.6	+6.1	+406.7
TOTAL	588.5	602.7	+14.2	+2.1

Table 1.4

COMPARISON OF AREA OF MAJOR CROPS IN YEARS 1976/77 (1969 E.E.) AND 1977/78 (1970 E.C.) IN GONDAR REGION

Crop	Estimate in: 1976/77	Estimate in: 1977/78	Change cl.3-cl.2	Change cl.4/cl.2 x100
	Thousand hectares			Per cent
(1)	(2)	(3)	(4)	(5)
CEREALS	460.8	479.3	+18.5	+4.0
Teff	216.6	201.3	-15.3	-7.1
barley	85.2	119.7	+34.5	+40.5
Wheat	32.9	26.0	-6.9	-21.0
Maize	9.4	26.5	+17.1	+181.9
Sorghum	66.9	54.0	-12.9	-19.3
Millet	49.8	51.8	+2.0	+4.0
PULSES	125.3	133.7	+8.4	+6.7
Horse beans	36.8	54.6	+17.8	+48.4
Chick peas	51.1	53.4	+2.3	+4.5
Haricot beans	-	0.5	+0.5	-
Field peas	27.2	15.3	-11.9	-43.8
Lentils	10.2	9.9	-0.3	-2.9
OTHERS	66.5	~~55.7~~ 60.3	~~-10.8~~ 6.2	~~-16.2~~ -9.3
Neug	42.6	39.9	-2.7	-6.3
Flax(linseed)	2.0	2.1	+0.1	+5.0
Vetch	21.9	18.3	-3.6	-16.4
TOTAL	652.6	668.7	+16.1	+2.5

Table 1.5

COMPARISON OF AREA OF MAJOR CROPS IN YEARS 1976/77 (1969 E.E.) AND 1977/78 (1970 E.C.) IN ILLUBABOR REGION

Crop	Estimate in:		Change	
	1976/77	1977/78	cl.3-cl.2	$\frac{cl.4}{cl.2} \times 100$
	Thousand hectares			Per cent
(1)	(2)	(3)	(4)	(5)
CEREALS	123.9	127.3	+3.4	+2.7
Teff	53.9	45.4	-8.5	-15.8
Barley	4.4	3.3	-1.1	-25.0
Wheat	4.8	2.1	-2.7	-56.3
Maize	47.5	55.2	+7.7	+16.2
Sorghum	10.1	15.7	+5.6	+55.4
Millet	3.2	5.6	+2.4	+75.0
PULSES	8.4	6.1	-2.3	-27.4
Horse beans	1.3	1.8	+0.5	+38.5
Chick peas	-	-	-	-
Haricot beans	0.1	-	-0.1	-100.0
Field peas	7.0	4.3	-2.7	-38.6
OTHERS	0.4	2.2	+1.8	+450.0
Neug	0.0	0.0	-	-
Flax(linseed)	0.4	-	-0.4	-100.0
Others	0.0	2.2	-2.2	-100.0
TOTAL	132.7	135.6	+2.9	+2.2

Table 1.6

COMPARISON OF AREA OF MAJOR CROPS IN YEARS 1976/77 (1969 E.E.) AND 1977/78 (1970 E.C.) IN KEFA REGION

Crop	Estimate in: 1976/77	1977/78	Change cl.3-cl.2	cl.4 / cl.2 ·100
	Thousand hectares			Per cent
(1)	(2)	(3)	(4)	(5)
CEREALS	247.0	312.8	+65.8	+26.6
Teff	87.8	104.8	+17.0	+19.4
Barley	19.0	21.0	+3.0	+10.5
Wheat	10.9	7.0	-3.9	-35.8
Maize	98.5	144.9	+46.4	+47.1
Sorghum	29.8	28.0	-1.8	-6.0
Millet	1.0	7.1	+6.1	+610.0
PULSES	28.2	16.4	-11.8	-41.8
Horse beans	17.6	7.5	-10.1	-57.4
Chick peas	0.4	-	-0.4	-100.0
Field peas	10.2	8.9	-1.3	-12.7
OTHERS	2.4	1.2	-1.2	-50.0
Neug	1.5	1.2	-0.3	-20.0
Flax(linseed)	0.1	0.0	-0.1	-100.0
Rape seed	0.8	0.0	-0.8	-100.0
TOTAL	277.6	330.4	52.8	+19.0

Table 1.7

COMPARISON OF AREA OF MAJOR CROPS IN YEARS 1976/77 (1969 E.E.) AND 1977/78 (1970 E.C.) IN SHOA REGION

Crop	Estimate		Change	
	1976/77	1977/78	cl.3-cl.2	cl.4/cl.2 x100
	Thousand hectares			Per cent
(1)	(2)	(3)	(4)	(5)
CEREALS	947.9	998.9	+51.0	+5.4
Teff	314.6	306.5	-18.8	-6.0
Barley	151.8	191.5	+39.7	+26.2
Wheat	180.8	160.1	-20.7	-11.4
Maize	179.5	188.3	+18.8	+10.5
Sorhum	117.7	149.8	+32.1	+27.3
Millet	3.5	3.4	-0.1	-2.9
PULSES	241.4	216.5	-24.9	-10.3
Horse beans	101.2	100.3	-0.9	-0.9
Chick peas	54.5	44.7	-9.8	-18.0
Haricot beans	26.4	12.3	-14.1	-53.4
Field peas	28.9	29.1	+0.2	+0.7
Lentils	30.4	30.1	-0.3	-1.0
OTHERS	25.6	38.2	+12.6	+49.2
Neug	8.9	3.5	-5.4	-60.7
Flax(linseed)	10.1	5.3	-4.8	-47.5
Oats	-	17.2	+17.2	-
Vetch	6.6	12.2	+5.6	+84.8
TOTAL	1,214.9	1253.6	+38.7	+3.2

Table 1.8

COMPARISON OF AREA OF MAJOR CROPS IN YEARS 1976/77 (1969 E.E.) AND 1977/78 (1970 E.C.) IN SIDAMO REGION

Crop	Estimate in: 1976/77	Estimate in: 1977/78	Change cl.3-cl.2	Change cl.4÷100 cl.2
	Thousand hectares			per cent
(1)	(2)	(3)	(4)	(5)
CEREALS	130.0	146.2	+16.2	+12.4
Teff	22.7	11.4	-11.3	-49.7
Barley	38.8	46.8	+8.0	+20.6
Wheat	20.9	0.5	-20.4	-97.6
Maize	34.1	85.1	+51.0	+149.5
Sorghum	13.5	2.4	-11.1	-82.2
PULSES	11.9	6.9	-5.0	-42.0 -50.4
Horse beans	2.5	3.2	+0.7	+28.0
Chick peas	6.1	-	-6.1	-100.0
Haricot beans	5.2	2.4		
Field peas	0.5	1.3	+0.8	+160.0
Lentils	0.1	-	-0.1	-100.0
OTHERS	10.8	1.3	-9.5	-87.9
Rape seed	0.2		-0.2	-100.0
Others	10.6	1.3	-9.3	-87.7
TOTAL	152.7	153.4	+0.7	+0.5

Table 1.9

COMPARISON OF AREA OF MAJOR CROPS IN YEARS 1976/77 (1969 E.E.) AND 1977/78 (1970 E.C.) IN WELLEGA REGION

Crop	Estimate in: 1976/77	1977/78	Change cl.3-cl.2	$\frac{cl.4}{cl.2} \cdot 100$
	Thousand quintals			Per cent
(1)	(2)	(3)	(4)	(5)
CEREALS	411.4	431.9	+20.5	+5.0
Teff	180.2	158.6	-21.6	-12.0
Barley	26.3	13.9	-12.4	-47.1
Wheat	6.7	2.4	-4.3	-64.2
Maize	108.7	139.5	+30.8	+28.3
Sorghum	60.4	74.8	+14.4	-23.8
Millet	29.1	42.7	+13.6	+46.7
PULSES	14.8	9.9	-4.9	-33.1
Horse beans	9.0	5.9	-3.1	-34.4
Chick peas	2.1	0.5	-1.6	-76.2
Haricot beans	-	-	-	-
Field peas	3.5	3.5	+0.0	0.0
Lentils	0.2	-	-0.2	-100.0
OTHERS	24.8	23.3	- 1.5	-6.0
Neug	23.0	23.0	0 .0	0.0
Flax(linseed)	1.8	0.3	-1.5	-83.3
Rape seed	0.1	-	-0.1	-100.0
TOTAL	451.1	465.1	+14.0	+3.1

Table 1.10

COMPARISON OF AREA OF MAJOR CROPS IN YEARS 1976/77 (1969 E.E.) AND 1977/78 (1970 E.C.) IN WOLLO REGION

Crop	Estimate in: 1976/77	1977/78	Change cl.3-cl.2	Change cl.4/cl.2 ×100
	Thousand hectares			Per cent
(1)	(2)	(3)	(4)	(5)
CEREALS	170.5	170.2	-0.3	-0.2
Teff	46.4	58.2	+11.8	+25.4
Barley	4.9	4.4	-0.5	-10.2
Wheat	22.5	20.6	-1.9	-8.4
Maize	7.3	7.2	-0.1	-1.4
Sorghum	88.5	79.5	-9.0	-10.2
Millet	0.9	0.3	-0.6	-66.7
PULSES	26.4	35.7	+9.3	+35.2
Horse beans	22.9	22.4	-0.5	-2.2
Chick peas	0.6	3.9	+3.3	+550.0
Haricot beans	0.1	—	-0.1	-100.0
Field peas	0.8	5.7	+4.9	+612.5
Lentils	2.0	3.7	+1.7	+85.0
OTHERS	9.5	1.9	-7.6	+1.0
Neug	-	0.3	-0.3	-100.0
Flax(linseed)	0.9	-	-0.9	-100.0
Vetch	7.8		-7.8	-100.0
Others	0.8	1.3	+0.5	+62.5
TOTAL	206.4	207.8	+1.4	+0.7

Table 2.1

COMPARISON OF PRODUCTION OF MAJOR CROPS IN YEARS 1976/77 (1969 E.E) AND 1977/78 (1970 E.C.) IN ARSSI REGION

Crop	Estimate in: 1976/77	1977/78	Change cl.3-cl.2	Change $\frac{cl.4}{cl.2}$ 100
	Thousand quintals			Per cent
(1)	(2)	(3)	(4)	(5)
CERALS	5087.3	5024.1	-63.2	-1.2
Teff	325.0	332.4	+7.4	+2.3
Barley	1895.7	1748.2	-147.5	-7.8
Wheat	1922.0	1910.7	-11.3	-0,6
Maize	691.0	660.0	-31.2	-4.5
Sorghum	253.6	372.8	+119.2	+47.0
Millet	-	-	-	-
PULSES	646.8	588.1	-58.7	-9.1
Horse beans	452.4	460.6	+8.2	+1.8
Chick peas	2.2	10.5	+8.3	+377.3
Haricot beans	43.3	0.8	-42.5	-98.2
Field peas	116.9	97.6	-19.3	-16.5
Lentils	32.0	18.6	-13.4	-41.9
OTHERS	18.6	34.9	+16.3	+87.6
Neug	1.0	1.0	0	0
Flax(linseed)	9.4	32.7	+23.3	247.9
Rape seed	0.4	-	-0.4	-100.0
Vetch	4.2	-	-4.2	-100.0
Fenugreek	-	1.2	+1.2	-
TOTAL	5752.7	5647.1	-105.6	-1.8

Table 2.2

COMPARISON OF PRODUCTION OF MAJOR CROPS IN YEARS 1976/77 (1969 E.E.) AND 1977/78 (1970 E.C.) IN GAMO GOFA REGION

Crop	Estimate in: 1976/77	Estimate in: 1977/78	Change: cl.3-cl.2	Change: $\frac{cl.4}{cl.2}$ 100
	Thousand quintals			Per cent
(1)	(2)	(3)	(4)	(5)
CEREALS	430.0	405.0	-25.0	-5.8
Teff	52.6	57.4	+4.8	+9.1
Barley	129.8	72.6	-57.2	-44.1
Wheat	12.6	3.9	-8.7	-69.0
Maize	174.9	229.1	+54.2	+31.0
Sorghum	60.1	42.0	-18.1	-30.1
PULSES	53.2	8.8	-44.4	-83.5
Horse beans	18.9	4.0	-14.9	-78.8
Chick peas	-	-	-	-
Fiels peas	34.3	4.7	-29.6	-86.3
Lentils		0.1	+0.1	-
TOTAL	483.2	413.8	-69.5	-14.4

Table 2.3

COMPARISON OF PRODUCTION OF MAJOR CROPS IN YEARS 1976/77 (1969 E.E.) AND 1977/78 (1970 E.C.) IN GOJAM REGION

Crop	Estimate in: 1976/77	Estimate in: 1977/78	Change cl.3-cl.2	Change cl.4/cl.2 x100
	Thousand quintals			Per cent
(1)	(2)	(3)	(4)	(5)
CERALS	3619.6	3629.0	+9.4	+0.3
Teff	1708.6	1999.5	+290.9	+17.0
Barley	801.9	454.2	-347.7	-43.4
Wheat	257.9	224.5	-33.4	-13.0
Maize	233.2	359.8	+126.6	+54.3
Sorghum	227.7	88.2	-139.5	-61.3
Millet	390.3	502.8	+112.5	+28.8
PULSES	551.6	375.9	-175.7	-31.8
Horse beans	434.5	273.4	-161.1	-74.2
Chick peas	80.2	20.7	-59.5	-74.2
Haricot beans	-	-	-	-
Field peas	36.5	70.0	+33.5	+91.8
Lentils	4.0	11.8	+7.8	+195.0
OTHERS	97.1	167.5	+70.4	+72.5
Neug	69.7	111.6	+41.9	+60.1
Flax(linseed)	21.0	28.5	+7.5	+35.7
Rape seed	0.8	2.3	+1.5	+187.5
Vetch	5.6	25.1	+19.5	+348.2
TOTAL	4268.3	4172.4	-95.9	-2.2

Table 2.4.

COMPARISON OF PRODUCTION OF MAJOR CROPS IN YEARS 1976/77 (1969 E.E.) AND 1977/78 (1970 E.C.) IN GONDAR REGION

Crop	Estimate in:		Change	
	1976/77	1977/78	cl.3-cl.2	$\frac{\text{cl.4}}{\text{cl.2}} 100$
	Thousand quintals			Per cent
(1)	(2)	(3)	(4)	(5)
CERALS	3,454.2	5468.4	+1,114.2	+32.3
Teff	1,328.3	1929.7	+599.8	+45.2
Barley	1,068.4	1094.7	+26.3	+2.5
Wheat	303.3	125.7	-177.6	-58.6
Maize	44.9	183.7	+138.8	+309.1
Sorghum	335.8	546.7	+210.9	+62.8
Millet	373.5	688.5	+315.0	+84.3
PULSES	973.5	1310.8	+337.3	+34.6
Horse beans	357.8	417.9	+60.2	+16.8
Chick peas	352.1	587.2	+235.1	+66.8
Haricot beand	-	1.3	+1.3	-
Feild peas	190.7	215.3	+24.6	+22.9
Lentils	73.0	89.1	+16.1	+22.1
OTHERS	193.3	247.9	+54.6	+28.2
Neug	76.7	108.2	+31.5	+41.1
Flax(linseed)	8.0	8.1	+0.1	+1.3
Vetch	108. 6	131.6	+23.0	+21.2
TOTAL	4621.0	6127.1	+1506.1	+32.6

Table 2.5

COMPARISON OF PRODUCTION OF MAJOR CROPS IN YEARS 1976/77 (1969 E.E.) AND 1977/78 (1970 E.C.) IN ILLUBABOR REGION

Crop	Estimate in: 1976/77	Estimate in: 1977/78	Change cl.3-cl.2	Change cl.4/cl.2 ·100
	Thousand quintals			Per cent
(1)	(2)	(3)	(4)	(5)
CEREALS	838.5	967.2	+128.7	+15.4
Teff	268.5	266.9	-16.0	-0.6
Barley	25.2	11.8	-13.4	-53.2
Wheat	30.6	4.8	-25.8	-84.3
Maize	358.2	479.5	+121.3	+33.9
Sorghum	113.6	148.1	+34.5	+30.4
Millet	42.4	56.1	13.7	+32.3
PULSES	53.8	10.8	-43.0	-79.9
Horse beans	15.0	2.3	-12.7	-84.7
Chick peas	-	-	-	-
Haricot beans	0.4	-	-0.4	-100.0
Field peas	38.4	8.5	-29.9	-77.9
OTHERS	0.7	-	-	-
Flax(linseed)	0.7	-	-0.7	-100.0
TOTAL	893.0	1104.0	+211.0	+23.6

Table 2.6

COMPARISON OF PRODUCTION OF MAJOR CROPS IN YEARS 1976/77 (1969 E.E.) AND 1977/78 (1970 E.C.) IN KEEA REGION

Crop	Estimate in: 1976/77	Estimate in: 1977/78	Change cl.3-cl.2	Change cl.4/cl.2 100
	Thousand quintald/hectare			Per cen
(1)	(2)	(3)	(4)	(5)
CERALS	2211.5	4205.8	+239.3	+10.8
Teff	604.6	807.5	+202.9	+33.6
Barely	96.7	158.9	+63.2	+64.3
Wheat	35.5	80.6	+45.1	+127.0
Maize	1053.0	1199.1	+146.2	+13.9
Sorghum	404.7	170.5	-234.2	-57.9
Millet	17.0	34.2	+17.2	+101.2
PULSES	476.8	140.3	-336.5	-70.6
Horse beans	423.8	47.6	-376.2	-88.8
Chic peas	0.7	-	-0.7	-100.0
Field peas	52.3	92.7	-40.4	+77.2
OTHERS	16.6	6.1	-10.5	+63.3
Neug	11.3	6.1	-5.2	-46.0
Flax(linseed)	0.4	-	-0.4	-100.0
Rape seed	4.9	-	-4.9	-100.0
TOTAL	2704.9	2597.2	-107.7	-4.0

Table 2.7

COMPARISON OF PRODUCTION OF MAJOR CROPS IN YEARS 1976/77 (1969 E.E.) AND 1977/78 (1970 E.C.) IN SHOA REGION

Crop	Estimate in:		Change	
	1976/77	1977/78	cl.3-cl.2	$\frac{cl.4}{cl.2}100$
	Thousand quintals			Per cent
(1)	(2)	(3)	(4)	(5)
CEREALS	10,312.8	8,888.3	-1,424.5	-13.8
Teff	2,771.1	2,318.5	-542.6	-16.6
Barley	1,393.5	1,139.2	-254.3	-18.0
Wheat	1,657.9	812.5	-845.4	-51.0
Maize	2,529.2	2,824.0	+294.8	-11.7
Sorghum	1,918.5	1,776.3	-142.2	-7.4
Millet	42.6	17.8	-24.8	-58.2
PULSES	2,204.9	1,648.1	-556.8	-25.3
Horse beans	1,104.1	1,098.8	-5.3	-0.5
Chick peas	364.1	201.3	-162.8	-44.7
Haricot beans	170.3	76.8	-93.5	-54.9
Field peas	316.2	163.8	-152.4	-48.2
Lentils	250.2	107.4	-142.8	-57.1
OTHERS	143.9	209.8	+65.9	+45.8
Neug	38.8	15.8	-23.0	-59.3
Flax(linseed)	72.6	18.8	-54.4	-74.9
Oats	-	120.0	+120.0	-
Vetch	32.5	55.8	+23.3	+71.7
TOTAL	12,661.6	10,746.2	-1,915.4	-15.1

Table 2.8

COMPARISON OF PRODUCTION OF MAJOR CROPS IN YEARS 1976/77 (1969 E.E.) AND 1977/78 (1970 E.C.) IN SIDAMO REGION

Crop	Estimate in:		Change	
	1976/77	1977/78	cl.3-cl.2	$\frac{cl.4}{cl.2}100$
	Thousand quintals			Per cent
(1)	(2)	(3)	(4)	(5)
CEREALS	1730.5	1191.7	-538.8	-31.1
Teff	203.5	105.5	-98.0	-48.1
Barley	393.0	159.1	-233.9	-59.5
Wheat	255.2	6.9	-248.3	-97.3
Maize	610.4	900.7	+290.3	+47.5
Sorghum	268.4	19.5	-248.9	-92.7
PULSES	225.1	59.8	-165.3	-73.4
Horse beans	61.2	17.6	-43.6	-71.2
Chick peas	104.3	-	-104.3	-100.0
Haricot beans	54.3	28.1	-26.2	-48.2
Field peas	3.9	14.1	+10.2	+261.5
Lentils	1.4		-1.4	-100.0
OTHERS	0.8		-0.8	-100.0
Rape seed	0.8		-0.8	-100.0
TOTAL	1956.4	1251.5	-704.9	-36.0

Table 2.9

COMPARISON OF PRODUCTION OF MAJOR CROPS IN YEARS 1976/77 (1969 E.E.) AND 1977/78 (1970 E.C.) IN WELLEGA REGION

Crop	Estimate in:		Change	
	1976/77	1977/78	cl.3-cl.2	$\frac{cl.4}{cl.2}100$
	Thousand quintals			Per cent
(1)	(2)	(3)	(4)	(5)
CEREALS	4562.2	2298.6	-2263.6	-49.6
Teff	1368.1	798.2	-569.9	-41.7
Barley	187.3	73.2	-114.1	-60.9
Wheat	30.7	12.6	-18.1	-59.0
Maize	2183.8	723.6	-146.2	-66.9
Sorghum	508.6	449.9	-58.7	-11.5
Millet	283.2	241.1	-42.6	-15.0
PULSES	86.8	45.7	-41.1	-47.4
Horse beans	64.4	26.9	-37.5	-58.2
Chick peas	7.3	0.9	-6.4	-87.8
Field peas	14.8	17.9	+3.1	+20.9
Lentils	0.3	-	-3.3	-100.0
OTHERS	45.6	101.9	+56.3	+123.5
Neug	41.6	100.7	+59.1	+142.1
Flax(linseed)	3.7	1.2	-2.5	-67.6
Rape seed	0.3	-	-0.3	-100.0
Total	4694.6	2446.2	-2248.4	-47.9

Table 2.10

COMPARISON OF PRODUCTION OF MAJOR CROPS IN YEARS 1976/77 (1969 E.E.) AND 1977/78 (1970 E.C.) IN WOLLO REGION *

crop	Estimate in: 1976/77	1977/78	Change cl.3-cl.2	Change $\frac{cl.4}{cl.2}100$
	Thousand quintals			Per cent
(1)	(2)	(3)	(4)	(5)
CEREALS	1677.2	1851.4	+174.2	+10.4
Teff	439.4	649.5	-210.1	47.8
Barley	43.6	30.5	-13.1	-30.0
Wheat	244.8	186.6	-58.2	-23.8
Maize	96.1	76.1	-20.0	-20.8
Sorghum	932.8	904.9	-27.9	-3.0
Millet	10.5	3.8	-6.7	-63.8
PULSES	318.0	345.8	+27.8	+8.7
Horse beans	298.4	276.8	-21.6	-0.1
Chick peas	4.5	7.7	+3.2	+71.1
Haricot beans	0.4	-	-0.4	-100.0
Field peas	4.9	29.2	+24.3	+495.9
Lentils	9.8	32.1	+22.3	+227.6
OTHERS	74.7	0.9	-73.8	-98.8
Neug	-	0.4	-0.4	-100.0
Flax(linseed)	2.1		-2.1	-100.0
Sesame		0.5	-0.5	-100.0
Vetch	72.6		-72.6	-100.0
TOTAL	2069.9	2198.1	+128.2	+6.2

* Excluding Western Wollo.

Table 3.1-10

ESTIMATES OF AREA UNDER TEMPORARY CROPS THIER STANDARD ERRORS AND RELATIVE ERRORS BY REGION

Region	Estimate	Standard error	Relative standard error
	Thousand hectares		Per cent
(1)	(2)	(3)	(4)
Arssi	464.5	36.7	7.9
Gamo Gofa	96.6	31.0	32.1
Gojam	602.7	102.5	17.0
Gondar	669.5	97.1	14.5
Illubabor	135.6	22.9	16.9
Keffa	355.6	67,9	19.1
Shoa	1,268.0	119.2	9.4
Sidamo	153.4	35.6	23.2
Wellega	474.2	52.2	11.0
Wello	207.8	38.9	18.7
TOTAL	4,427.9	217.0	4.9

Table 4.1-10

ESTIMATES OF AREA UNDER TEFF THEIR STANDARD ERRORS AND RELATIVE STANDARD ERRORS BY REGION

Region	Estimate	Standard error	Relative standard error
	Thousand hectares		Per cent
(1)	(2)	(3)	(4)
Arssi	25.2	10.0	39.8
Gamo gofa	13.0	7.3	56.2
Gojam	254.2	56.2	22.1
Gondar	201.3	37.4	18.6
Illubabor	45.4	10.2	22.5
Keffa	104.8	35.3	33.7
Shoa	295.8	49.4	16.7
Sidamo	11.4	6.1	53.2
Wellega	158.6	25.4	16.0
Wello	58.2	13.6	23.4
TOTAL	1,167.9	97.8	8.3

Table 5.1-10

ESTIMATES OF AREA OF BARLEY, THEIR STANDARD ERRORS AND RELATIVE STANDARD ERRORS BY REGION

Region	Estimate	Standard error	Relative standard error
	Thousand hectares		Per cent
(1)	(2)	(3)	(4)
Arssi	154.7	36.2	23.4
Gamo Gofa	30.5	21.6	70.7
Gojam	89.0	19.0	21.3
Gondar	119.7	52.0	43.4
Illubabor	3.3	1.5	44.4
Keffa	21.0	12.9	61.4
Shoa	191.5	53.8	28.1
Sidamo	46.8	17.5	37.4
Wellega	13.9	3.9	27.9
Wello	4.4	2.1	47.5
TOTAL	674.8	90.7	13.4

Table 6.1-10

ESTIMATES OF AREA UNDER WHEAT, THEIR STANDARD ERRORS AND RELATIVE STANDARD ERRORS BY REGION

Region	Estimate	Standard error	Relative standard error
	Thousand hectares		Per cent
(1)	(2)	(3)	(4)
Arssi	153.8	38.3	24.9
Gamo Gofa	1.5	1.0	65.0
Gojam	28.3	20.6	72.6
Gondar	26.0	14.3	55.1
Illubabor	2.1	1.6	78.0
Keffa	7.0	5.5	79.0
Shoa	160.1	35.2	22.0
Sidamo	0.5	0.3	67.5
Wellega	2.4	1.3	54.0
Wello	20.6	6.8	33.0
TOTAL	402.3	58.5	14.5

Table 7.1-10

ESTIMATES OF AREA UNDER MAIZE, THEIR STANDARD ERRORS AND RELATIVE STANDARD ERRORS BY REGION

Region	Estimate	Standard error	Relative standard error
	Thousand hectares		Per cent
(1)	(2)	(3)	(4)
Arssi	41.9	18.4	44.0
Gamo Gofa	27.9	15.7	57.3
Gojam	47.1	13.7	29.1
Gondar	26.5	14.7	55.5
Illubabor	55.2	14.9	26.9
Keffa	144.9	38.1	26.3
Shoa	188.3	47.5	15.3
Sidamo	85.1	26.5	31.1
Wellega	139.5	21.3	15.3
Wello	7.2	3.5	48.6
TOTAL	763. 1	78.6	10.3

Table 8.1-10

ESTIMATES OF AREA OF SORGHUM, THEIR STANDARD ERRORS AND RELATIVE STANDARD ERRORS BY REGION

Region	Estimate	Standard error	Relative standard error
	Thousand hectares		Per cent
(1)	(2)	(3)	(4)
Arssi	23.8	11.5	48.3
Gamo Gofa	6.7	2.5	36.9
Gojam	9.2	5.1	55.4
Gondar	54.0	29.9	55.4
Illubabor	15.7	6.3	40.0
Keffa	28.0	12.6	45.7
Shoa	149.8	62.5	41.7
Sidamo	2.4	1.9	79.4
Wellega	74.8	17.4	23.3
Wello	79.5	30.2	38.0
TOTAL	443.9	79.9	18.0

Table 9.1-10

ESTIMATES OF AREA UNDER HORSE BEANS, THEIR STANDA ERRORS AND RELATIVE STANDARD ERRORS BY REGION

Region	Estimate	Standard error	Relative standard error
	Thousand hectares		Per cent
(1)	(2)	(3)	(4)
Arssi	37.3	9.0	24.2
Gamo Gofa	1.5	1.1	73.0
Gojam	29.8	16.5	55.4
Gondar	54.6	23.5	43.0
Illubabor	1.8	1.4	75.5
Keffa	7.5	4.1	54.0
Shoa	100.3	21.6	21.5
Sidamo	3.2	2.4	84.4
Wellega	5.9	2.2	37.9
Wello	22.4	8.2	36.8
TOTAL	264.3	38.3	14.5

Table 10.1-10

ESTIMATES OF AREA UNDER FIELD PEAS, THEIR STANDARD ERRORS AND RELATIVE STANDARD ERRORS BY REGION

Region	Estimate	Standard error	Relative standard error
	Thousand hectares		Per cent
(1)	(2)	(3)	(4)
Arssi	15.8	7.4	47.1
Gamo Gofa	2.5	1.6	64.7
Gojam	16.3	7.2	44.0
Gondar	15.3	8.8	57.6
Illubabor	4.3	2.6	59.9
Keffa	8.9	4.6	51.3
Shoa	29.1	8.7	29.8
Sidamo	1.3	0.9	65.8
Wellega	3.5	1.9	54.5
Wello	5.7	2.5	43.4
TOTAL	102.7	17.3	16.9

Table 11.1-10

ESTIMATES OF AREA NDAR NEUG, THEIR STANDARD ERRORS AND RELATIVE STANDARD ERRORS BY REGION

Region	Estimate	Standard error	Relative standard error
	Thousand hectares		Per cent
(1)	(2)	(3)	(4)
Arssi	0.2	0.2	100.0
Gojam	40.3	10.4	25.7
Gondar	39.9	16.6	41.5
Keffa	1.2	0.7	61.0
Shoa	3.5	2.0	58.3
Wellgea	23.0	8.3	35.9
Wello	0.3	0.3	95.0
TOTAL	108.0	20.7	19.2

Table 12.1-10

ESTIMATES OF TEFF PRODUCTION, THEIR STANDARD ERRORS AND RELATIVE STANDARD ERRORS BY REGION

Region	Estimate	Standard error	Relative standard error
	Thousand quintals		Per cent
(1)	(2)	(3)	(4)
Arssi	332.4	123.2	37.1
Gamo Gofa	57.4	30.5	53.2
G ojam	1,999. 5	479.9	24.0
Gondar	1,929.9	401.3	20.8
Illubabor	266.9	88.1	33.0
Kefa	807,5	271.3	17.2
Shoa	2,318.5	389.8	62.3
Sidamo	105.5	65.7	62.3
Wellega	798.2	229.1	28.7
Wello	649.5	191.6	29.5
TOTAL	9,264.5	861.0	9.3

Table 13.1-10

ESTIMATES OF PRODUCTION OF BARLEY, THEIR STANDARD ERRORS AND RELATIVE STANDARD ERRORS BY REGION

Region	Estimate	Standard error	RElative standard error
	Thousand quintals		Per cent
(1)	(2)	(3)	(4)
Arssi	1,748.2	503.5	28.8
Gamo Gofa	72.6	35.7	49.2
Gojam	454.2	115.8	25.5
Gondar	1,094.7	453.2	41.4
Illubabor	11.8	5.9	49.7
Keffa	158.9	109.8	69.1
Shoa	1,139.2	297.3	26.1
Sidamo	159.1	56,6	35.6
Wellega	73.2	30.7	42.0
Wello	30.5	15.3	50.0
TOTAL	4,942.4	760.6	15.4

Table 14.1-10

ESTIMATES OF PRODUCTION OF WHEAT, THEIR STANDARD ERRORS AND RELATIVE STANDARD ERRORS BY REGION

Region	Estimate	Standard error	Relative standard error
	Thousand quintals		Per cent
(1)	(2)	(3)	(4)
Arssi	1,910.7	670.7	35.1
Gamo Gofa	3.9	3.1	79.9
Gojam	224.5	149.7	66.7
Gondar	125.7	64.2	51.1
Illubabor	4.8	4.1	85.2
Keffa	80.6	69.5	86.2
Shoa	812.7	176.4	21.7
Sidamo	6.9	4.8	69.2
Wellega	12.6	7.2	57.0
Wello	186.6	75.8	40.6
TOTAL	3,368.8	719.8	21.4

Table 15.1-10

ESTIMATES OF PRODUCTION OF MAIZE, THEIR STANDARD ERRORS AND RELATIVE STANDARD ERRORS BY REGION

Region	Estimate	Standard error	Relative standard error
	Thousand quintals		Per cent
(1)	(2)	(3)	(4)
Arssi	660.0	268.0	40.6
Gamo Gofa	229.1	145.0	63.3
Gojam	359.8	133.9	37.2
Gondar	183.7	105.6	57.5
Illubabor	479.5	184.1	38.4
Keffa	1,199.1	364.5	30.4
Shoa	2,824.0	965.8	34.2
Sidamo	900.7	353.1	39.2
Wellega	723.6	137.5	19.0
Wello	76.1	44.4	58.4
TOTAL	7,635.6	1,169.2	15.3

Table 16.1-10

ESTIMATES OF PRODUCTION OF SORGHUM, THEIR STANDARD ERRORS AND RELATIVE STANDARD ERRORS BY REGION

Region	Estimate	Standard error	Relative standard error
	Thousand quintals		Per cent
(1)	(2)	(3)	(4)
Ars i	372.8	187.5	50.3
Gamo Gofa	42.1	19.9	47.3
Gojam	88.2	49.0	55.5
Gondar	546,7	324.2	59.3
Illubabor	148.1	79.7	53.8
Keffa	170.5	73.1	42.9
Shoa	1,776.3	913.0	51.4
Sidamo	19.5	14.5	74.3
Wellega	449.9	99.0	22.0
Wello	904.9	393.6	43.5
TOTAL	4,519.0	1073.9	23.8

Table 17.1-10

ESTIMATES OF PRODUCTION OF HORSE BEANS, THEIR STANDARD ERRORS AND RELATIVE STANDARD ERRORS BY REGION

Region	Estimate	Standard error	Relative Standard error
	Thousand quintals		Per cent
(1)	(2)	(3)	(4)
Arssi	460.6	117.5	25.5
Gamo Gofa	4.0	3.1	77.4
Gojam	273.4	191.4	70.0
Gondar	417.9	177.2	42.4
Illubabor	2.3	1.9	84.0
Keffa	47.6	28.4	59.7
Shoa	1,098.8	292.3	26.6
Sidamo	17.6	11.8	66.9
Wellega	26.9	13.0	48.3
Wello	276.8	108.5	39.2
TOTAL	2,625.9	424.4	16.2

Table 18.1-10

ESTIMATES OF PRODUCTION OF FIELD PEAS, THEIR STANDARD ERRORS AND RELATIVE STANDARD ERRORS BY REGION

Region	Estimate	Standard error	Relative standard error
	Thousand quintals		Per cent
(1)	(2)	(3)	(4)
Arssi	97.6	42.9	43.9
Gamo Gofa	4.7	2.8	59.8
Gojam	70.0	33.7	48.1
Gondar	215.3	167.1	77.6
Illubabor	8.5	5.0	59.1
Keffa	92.7	58.4	63.0
Shoa	163.8	48.5	29.6
Sidamo	14.1	9.7	68.7
Wellega	17.9	9.8	54.7
Wello	29.2	11.7	40.1
TOTAL	713.8	192.4	27.0

Table 19.1-10

ESTIMATES OF PRODUCTION OF NEUG, THEIR STANDARD ERRORS AND RELATIVE STANDARD ERRORS BY REGION

Region	Estimate	Standard error	Relative standard error
	Thousand quintals		Per cent
(1)	(2)	(3)	(4)
Arssi	1.0	1.0	100.0
Gamo Gofa	-	-	-
Gojam	111.6	30.6	27.4
Gondar	108.2	49.6	45.8
Illubabor	-	-	-
Keffa	6.1	3.8	62.0
Shoa	15.8	9.4	59.3
Sidamo	--	-	-
Wellega	100.7	39.3	39.0
Wello	0.4	0.4	95.0
TOTAL	343.8	71.0	20.6

Table 20.1-10

ESTIMATES OF YIELD OF TEFF, THEIR STANDARD ERRORS AND RELATIVE STANDARD ERRORS BY REGION

Region	Estimate	Standard error	Relative standard error
	Quintals per hectare		Per cent
(1)	(2)	(3)	(4)
Arssi	13.2	3.0	22.7
Gamo Gofa	4.4	1.6	35.7
Gojam	7.9	1.0	12.8
Gondar	9.6	1.4	14.2
Illubabor	5.9	1.3	21.6
Keffa	7.7	1.1	13.9
Shoa	7.8	0.4	5.7
Sidamo	9.3	2.0	21.9
Wellega	5.0	1.4	27.0
Wello	11.2	1.4	12.7
TOTAL	7.9	0.4	5.3

Table 21.1-10

ESTIMATES OF YIELD OF BARLEY, THEIR STANDARD ERRORS AND RELATIVE STANDARD ERRORS BY REGION

Region	Estimate	Standard error	Relative standard error
	Quintals per hectare		Per cent
(1)	(2)	(3)	(4)
Arssi	11.3	1.9	16.5
Gamo Gofa	2.4	1.3	54.1
Gojam	5.1	0.6	11.7
Gondar	9.1	1.3	14.2
Illubabor	3.4	0.8	22.9
Keffa	3.4	0.5	13.7
Shoa	5.9	0.6	9.6
Sidamo	3.4	0.8	24.8
Wellega	5.3	1.6	29.2
Wello	6.9	0.7	10.0
TOTAL	7.3	0.5	6.9

Table 22.1-10

ESTIMATES OF YIELD OF WHEAT, THEIR STANDARD ERRORS AND RELATIVE STANDARD ERRORS BY REGION

Region	Estimate	Standard error	Relative standard error
	Quintals per hectare		Per cent
(1)	(2)	(3)	(4)
Arssi	12.4	1.6	13.2
Gamo Gofa	2.6	1.1	40.6
Gojam	7.9	1.1	13.4
Gondar	4.8	0.7	13.5
Illubabor	2.3	1.8	77.5
Keffa	11.5	1.8	16.0
Shoa	5.1	0.6	11.9
Sidamo	13.8	1.1	7.9
Wellega	5.3	0.9	17.7
Wello	9.1	1.6	17.2
TOTAL	8.4	0.7	8.1

Table 23.1-10

ESTIMATES OF YIELD OF MAIZE, THEIR STANDARD ERRORS AND RELATIVE STANDARD ERRORS BY REGION

Region	Estimate	Standard error	Relative standard error
	Quintals/hectare		Per cent
(1)	(2)	(3)	(4)
Arssi	15.8	4.1	26.1
Gamo Gofa	8.4	1.9	22.5
Gojam	7.6	1.1	13.9
Gʷondar	6.9	1.3	18.8
Illubabor	8.7	2.1	24.6
Keffa	8.3	1.6	19.2
Shoa	14.2	3.6	25.4
Sidamo	10.6	2.8	26.3
Wellega	5.2	0.7	12.7
Wello	10.6	2.8	26.1
TOTAL	10.0	1.1	10.9

Table 24.1-10

ESTIMATES OF YEILD OF SORGHUM, THEIR STANDARD ERRORS AND RELATIVE STANDARD ERRORS BY REGION

Region	Estimate	Standard error	Relative standard error
	Quintals/hectare		Per cent
(1)	(2)	(3)	(4)
Arssi	15.7	1.7	10.8
Gamo Gofa	6.3	2.4	38.8
Gojam	9.6	1.6	16.5
Gondar	10.1	1.8	17.5
Illubabor	9.4	1.9	20.0
Keffa	6.1	1.0	17.1
Shoa	11.9	2.1	17.6
Sidamo	8.1	0.8	10.4
Wellega	6.0	1.0	17.0
Wello	11.4	1.3	11.4
TOTAL	10.2	0.8	7.9

Table 25.1-10

ESTIMATES OF YIELD OF HORSE BEANS, THEIR STANDARD ERRORS AND RELATIVE STANDATD ERRORS BY REGION

Region	Estimate	Standard error	Relative standard error
	Quintals/hectare		Per cent
(1)	(2)	(3)	(4)
Arssi	12.4	1.4	11.3
Gamo Gofa	2.7	0.4	13.7
Gojam	9.2	1.9	20.1
Gondar	7.7	1.9	24.1
Illubabor	1.3	1.3	98.1
Keffa	6.4	1.5	24.0
Shoa	11.0	1.2	10.8
Sidamo	5.5	1.8	32.2
Wellega	4.6	1.3	28.4
Wello	12.4	1.6	12.8
TOTAL	9.9	0.7	6.8

Table 26.1-10

ESTIMATES OF YIELD OF FIELD PEAS, THEIR STANDARD ERRORDS AND RELATIVE STANDARD ERRORS BY REGION

Region	Estimate	Standard error	Relative Standard error
	Quintals/hectare		Per cent
(1)	(2)	(3)	(4)
Arssi	6.2	1.6	26.0
Gamo Gofa	1.9	1.2	61.2
Gojam	4.3	0.4	9.0
Gondar	14.1	4.7	33.3
Illubabor	2.0	1.2	58.9
Keffa	10.4	2.6	24.8
Shoa	5.6	0.8	14.5
Sidamo	10.8	5.8	53.8
Wellega	5.1	0.8	15.3
Wello	5.1	1.2	23.3
TOTAL	7.0	0.8	11.7

Table 27.1-10

ESTIMATES OF YIELD OF NEUG, THEIR STANDARD ERRORS AND RELATIVE STANDARD ERRORS BY REGION

Region	Estimate	Standard error	Relative standard error
	Quintals/hectare		Per cent
(1)	(2)	(3)	(4)
Arssi	4.1	0.5	12.4
Gojam	2.8	0.3	11.0
Gondar	3.1	0.4	11.5
Keffa	5.1	1.5	29.8
Shoa	4.5	1.2	25.5
Wellega	4.4	0.6	13.3
Wello	1.3	0.3	25.5
TOTAL	3.3	0.2	6.3

Table 28.1-10

USE OF COMMERCIAL AND NATURAL FERTILIZERS FOR TEMPORARY CROPS BY REGION IN 1977/78*

Region	Percentage of area on which fertilizers were used				Commercial fertilizers per hectare of area under crop		
	Commercial			natural			
	Total	DAP	UREA		Total	DAP	UREA
	Percentage				kg/ha		
Arssi	21.4	18.7	2.7	4.7	13.6	11.6	2.0
Gamo Gofa	-	-	-	8.7	-	-	-
Gojam	10.5	7.7	2.8	4.9	6.9	5.0	1.9
Gondar	0.7	0.4	0.3	-	0.4	0.2	0.2
Illubabor	0.8	0.8	-	0.9	0.8	0.8	-
Kefa	1.5	1.5	-	5.2	2.2	2.2	-
Shoa	7.0	6.2	0.8	5.0	4.4	3.7	0.7
Sidamo	5.3	5.3	-	13.3	3.1	3.1	-
Wellega	8.8	8.1	0.7	12.3	3.2	2.8	0.4
Wello	-	-	-	5.9	-	-	-
Total temporary crops	7.0	6.0	1.0	5.2	4.2	3.5	0.7

*Excluding Bale, Eritrea, Hararge and Tigrai.

Table 29.1-14

USE OF COMMERCIAL FERTILIZERS BY REGION IN 1977/78 (1970 E.C.)

Region	Amount of fertilizers used			Commercial fertilizers per hectare of area under temporary crops		
	Total	DAP	UREA	Total	DAP	UREA
	Thousand quintals			kg/ha		
Arssi	61.1	53.9	9.2	13.6	11.6	2.0
Bale*	8.8	8.8	-	6.6	6.6	-
Eritrea*	2.5	2.0	0.5	1.0	0.8	0.2
Gamo GofA	-	-	-	-	-	-
Gojam	41.4	30.2	11.2	6.9	5.0	1.9
Gondar	2.7	1.5	1.2	0.4	0.2	0.2
Hararge*	10.0	7.3	2.7	4.1	3.0	1.1
Illubabor	1.1	1.1	-	0.8	0.8	-
Kefa	7.8	7.8	-	2.2	2.2	-
Shoa	55.8	46.9	8.9	4.4	3.7	0.7
Sidamo	6.9	6.9	-	3.1	3.1	-
Tigrai*	1.8	1.8	-	0.5	0.5	-
Wellega	15.1	13.4	1.7	3.2	2.8	0.4
Wello	-	-	-	-	-	-
Total temporary crop	217.0	181.6	35.4	4.0	3.4	0.6

*According to EPID dispatches.