JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

REPUBLIC OF ZAMBIA
MINISTRY OF ENERGY AND WATER DEVELOPMENT

THE STUDY

ON

THE NATIONAL WATER RESOURCES MASTER PLAN

IN

THE REPUBLIC OF ZAMBIA

FINAL REPORT
SUPPORTING
(Volume-2)

OCTOBER, 1995

YACHIYO ENGINEERING CO., LTD.
(YEC)

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SUPPORTING REPORT [H]

AGRICULTURE, LIVESTOCK AND FISHERY

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THE STUDY ON NATIONAL WATER RESOURCES MASTER PLAN
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CHAPTER 1 PRESENT STATUS OF AGRICULTURE

1.1 Natural Conditions

1.1.1 Agro-Ecological Zone and Agro-Meteorology

(1) Agro-Ecological Zone

Zambian agriculture is greatly dependent on rainfall, and rainfed agriculture is widely practised across the whole country. Consequently, the agriculture is planned by the expected amount of rain. As discussed in Supporting Report Part-B "Meteorology", annual rainfall is as high as 1,200 mm to 1,400 mm in the north, and decreases to 700 mm to 800 mm towards the south of the country. As shown in Figure 1-1, agro-ecological zones are divided into three zones depending on the amount of annual rainfall.

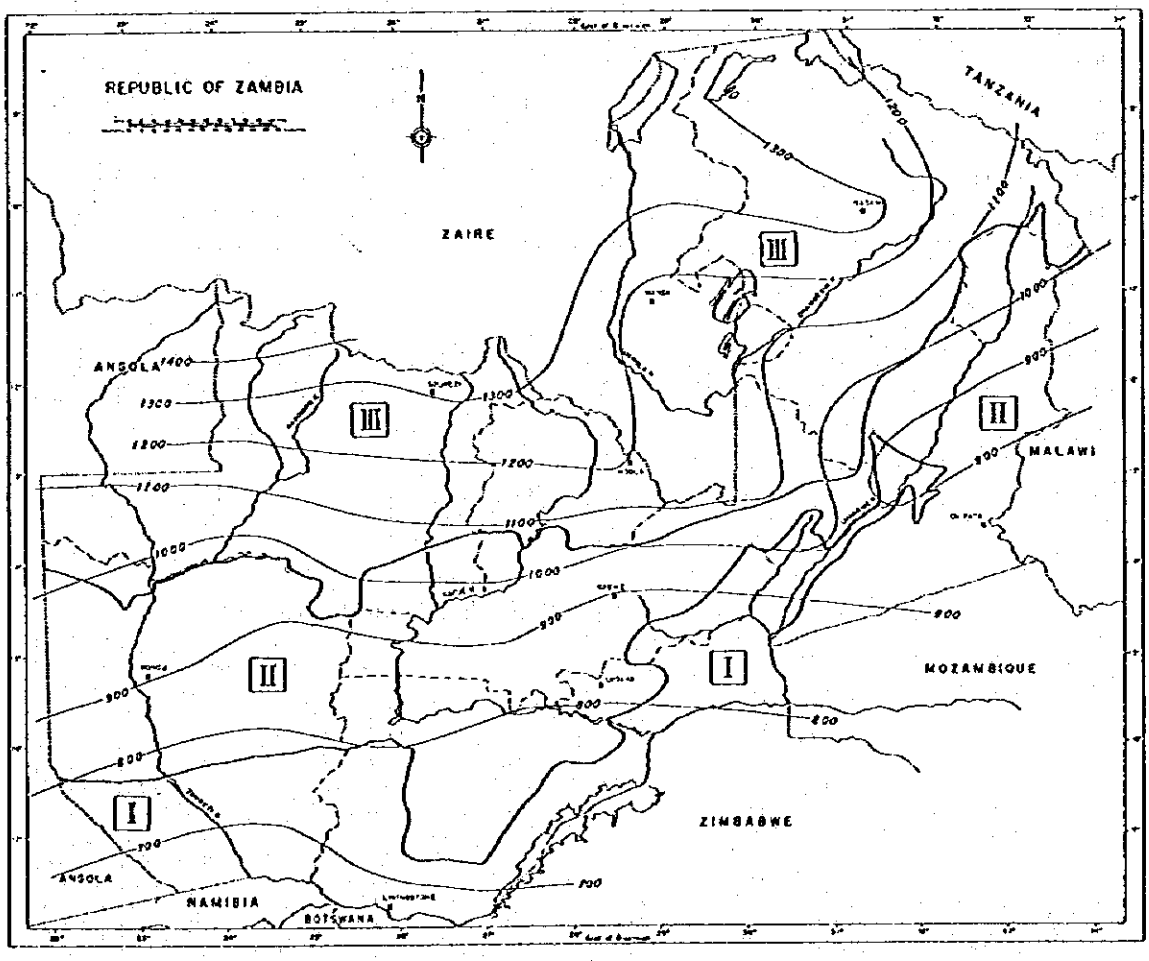


Figure 1-1 Agro-Ecological Zones and Isohyet in Zambia

Approximate divisions of agro-ecological zones in Zambia are defined as following regions mainly depending on the amount of annual rainfall:

Table 1-1 Agro-Ecological Zones

Agro-ecological Zones	Annual Rainfall (mm)	Approximate Extension of Zone
Zone-III	1,000 - 1,400	North-Western, Copperbelt, Luapula and Northern Province, and northern part of Central Province
Zone-II	800 - 1,000	Northern half of Western and Southern Provinces, Almost all of Central Province, western part of Lusaka Province, and Eastern Province except narrow band of Zone-I
Zone-I	700 - 800	Southern half of Western and Southern Provinces, Eastern half of Lusaka Province, and narrow band along the Luangwa River in Eastern Province

(2) Meteorological Characteristics of Agro-ecological Zones

Other than characterised by the amount of rainfall, agro-ecological zones are also characterised by temperature and evaporation amount. There is not much difference in mean temperature among zones, however, much differences are observed in maximum and minimum temperature. Maximum and minimum temperatures are generally observed in October and July respectively. Monthly mean temperature ranges from 15°C to 16°C in July to 24 °C to 25°C in October through Zambia. Annual mean temperature is around 21 °C through all zones. That is indicating that there is not much difference in mean temperature by zones. However, minimum and maximum temperature of Zone-I goes down and up in large range in the Agro-ecology Zone-I. Minimum temperature falls to 4°C in July, and maximum temperature goes up to 34°C in October at Sesheke in Agro-ecology Zone-I. Ranges of temperature of other zones are much less than Zone-I, as 8 °C to 31 °C as shown in Table 1-2.

Evaporation amount differs by zones, and it accounts about 2,300 mm in Zone-I and 1,900 mm in Zone-III in a year. In Zone-II and III, rainfall amount generally exceeds evaporation during rainy season, but rainfall is generally lower than evaporation in Zone-I.

Figure 1-2 shows the general features of meteorology in each agro-ecological zone by key station in the zone.

Table 1-2 General Meteorology of Agro-ecological Zones

Agro-Ecological Zone			Season and Month												Annual
Selected	Meteorological		Hot Dry Season			Rainy Season					Cool Dry Season				
Station	Factors	Unit	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	
III	Rainfall	(mm)	3.0	32.8	121.1	300.3	295.0	241.2	164.3	43.0	3.6	0.6	0.1	0.4	1,205.4
Ndola	Temp(Mean)	(°C)	22.2	23.8	23.3	22.2	22.0	22.0	22.1	21.1	19.0	16.6	16.5	18.9	20.8
	Temp(Max)	(°C)	30.7	31.4	29.6	27.2	26.7	27.0	27.6	27.7	26.8	25.2	25.2	27.6	27.7
	Temp(Min)	(°C)	13.7	16.2	17.1	17.2	17.1	16.5	16.5	14.5	11.1	8.1	7.8	10.2	13.8
	Evaporation	(mm)	226.3	230.5	177.5	129.8	118.4	109.0	130.6	133.8	141.1	135.2	154.2	189.5	1,875.9
II	Rainfall	(mm)	0.7	20.8	88.5	244.5	225.1	177.9	98.0	25.7	4.4	0.1	0.0	0.1	885.8
Kabwe	Temp(Mean)	(°C)	22.3	24.2	23.8	22.5	22.2	22.3	21.9	20.6	18.6	18.4	16.1	18.5	21.0
	Temp(Max)	(°C)	29.9	31.2	30.0	27.4	27.1	27.2	27.1	26.7	25.5	23.7	23.5	26.2	27.1
	Temp(Min)	(°C)	14.6	17.1	17.7	17.5	17.3	17.4	16.6	14.5	11.6	13.2	8.7	10.8	14.8
	Evaporation	(mm)	268.7	294.5	222.0	155.9	142.5	129.3	151.0	160.9	159.4	145.2	164.2	217.3	2,210.9
I	Rainfall	(mm)	4.0	32.6	69.6	144.8	149.3	150.7	89.5	25.2	1.7	0.4	0.0	0.2	668.0
Sesheke	Temp(Mean)	(°C)	22.4	25.7	25.7	24.9	24.7	24.4	24.0	22.0	18.5	15.4	15.1	18.0	21.7
	Temp(Max)	(°C)	33.2	34.2	32.7	31.0	30.7	30.2	30.7	30.0	28.3	26.1	26.2	29.3	30.2
	Temp(Min)	(°C)	11.6	17.2	18.7	18.9	18.8	18.5	17.4	14.2	8.8	5.4	4.3	6.7	13.4
	Evaporation	(mm)	245.6	308.9	257.3	177.4	148.8	138.4	177.5	167.0	141.2	155.2	156.2	197.9	2,271.4

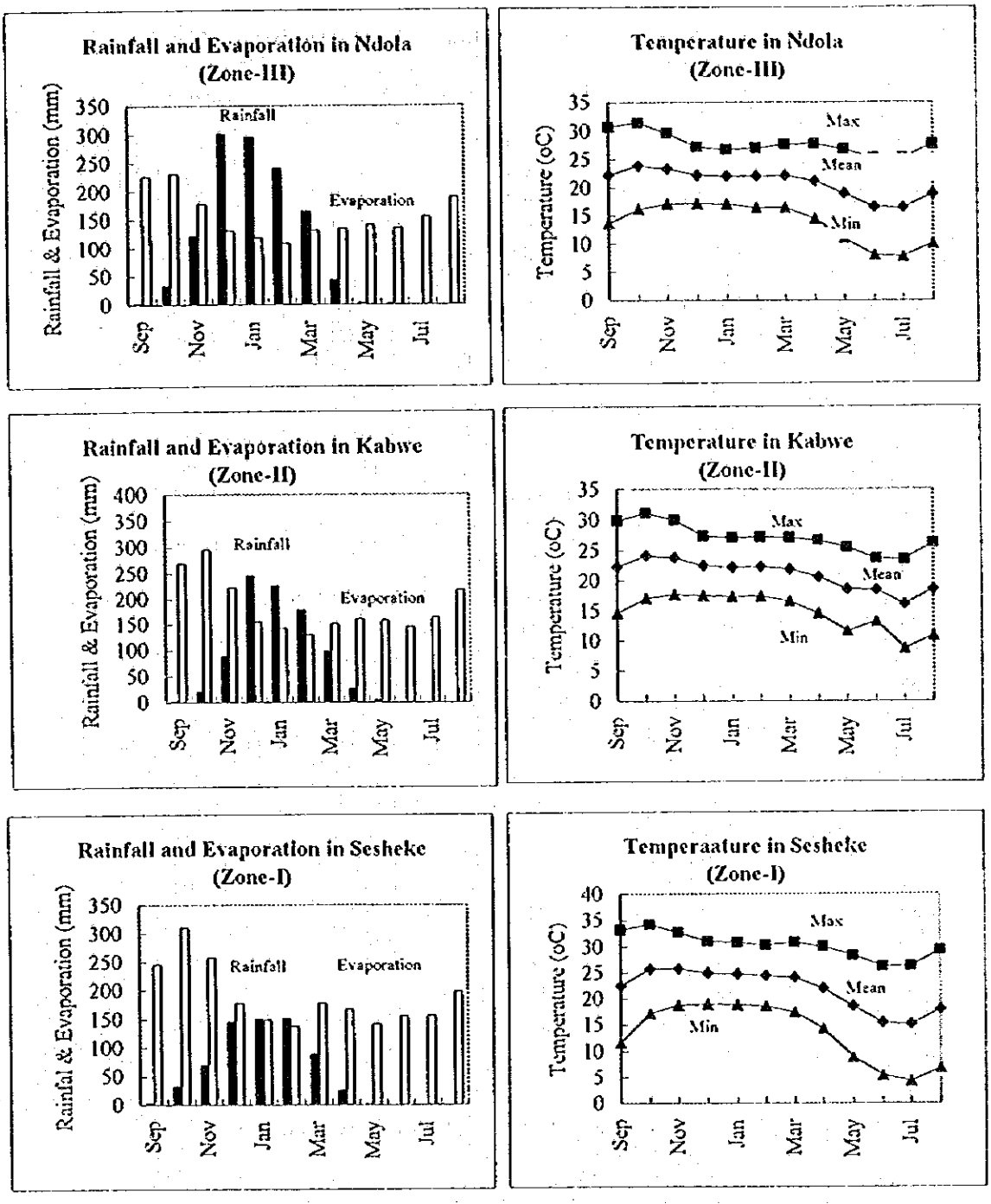


Figure 1-2 Rainfall, Evaporation and Temperature Patterns by Agro-ecological Zones

(3) Drought Characteristics by Agro-ecological Zones

Table 1-3 shows average annual rainfall by zone using 30 years of rainfall data from 1963/64 to 1992/93. As shown in the table, 1983/84 corresponds to the 1 in 10 year drought condition, while 1986/87 to 1 in 5 years. The 1991/92 drought corresponds to the 1 in 50 year drought over all Zambia, and Zone-II suffered a 1 in 100 year drought.

Table 1-3 Average Annual Rainfall and Probability by Zone

(Unit: mm/year)

	Year	Zone-I	Zone-II	Zone-III	Zambia
1	1963/64	541.7 1/8	781.1 1/3	1,210.2 1/2	985.1 1/3
2	1964/65	535.1 1/9	838.2 1/2	1,089.4 1/10	944.5 1/4
3	1965/66	716.2	781.9	1,241.9	1,015.8 1/2
4	1966/67	660.8	816.3	1,138.8	971.0
5	1967/68	740.2	789.4	1,258.4	1,038.2
6	1968/69	683.3 1/2	1,038.0	1,371.1	1,190.1
7	1969/70	537.9 1/8	772.8	1,170.8	968.8
8	1970/71	620.3	947.9	1,289.0	1,112.7
9	1971/72	880.2	816.7	1,181.8	1,018.2 1/2
10	1972/73	433.5 1/100	658.5 1/20	1,022.4 1/30	837.1 1/20
11	1973/74	1,043.9	1,107.5	1,284.9	1,198.0
12	1974/75	842.6	894.2	1,273.6	1,093.7
13	1975/76	665.1	968.2	1,359.6	1,156.3
14	1976/77	794.0	770.6	1,112.8	955.6
15	1977/78	1,055.6	1,244.7	1,382.3	1,311.7
16	1978/79	603.6	814.0	1,410.8	1,115.2
17	1979/80	703.9	938.6	1,321.2	1,109.9
18	1980/81	973.8	1,060.2	1,196.6	1,121.1
19	1981/82	553.5 1/8	714.9 1/6	1,046.0 1/20	865.6 1/10
20	1982/83	688.9 1/2	766.8	1,176.6	947.5
21	1983/84	540.0 1/8	706.5 1/10	1,099.9 1/8	865.3 1/10
22	1984/85	760.4	903.2	1,297.8	1,064.7
23	1985/86	754.6	1,016.4	1,241.3	1,092.5
24	1986/87	588.5 1/5	727.0 1/5	1,177.0 1/2.5	913.3 1/5
25	1987/88	784.1	822.1	1,118.3 1/5	945.8
26	1988/89	827.6	1,072.4	1,199.2	1,105.8
27	1989/90	711.9	867.1 1/2	1,160.7	983.0
28	1990/91	526.8 1/10	773.7 1/3	1,179.6 1/2.5	926.5 1/5
29	1991/92	641.2 1/2.5	590.1 1/100	1,033.1 1/20	793.5 1/50
30	1992/93	799.9	942.2	1,250.5	1,041.8
Average		707.0	864.7	1209.9	1022.9
S.D.		153.5	146.0	103.6	117.7
S.D./Ave.		22%	17%	9%	12%
Max.		1055.6	1244.7	1410.8	1311.7
Min.		433.5	590.1	1022.4	793.5

(Notes)

1) Zone rainfall is computed by average of annual rainfall where contained in each zone.
   Rainfall stations are as follows;
   Zone-1: Sesheke, Livingstone, Mfuwe (3 stations)
   Zone-2: Lusaka City A.P., Lusaka Int.A.P., Mt.Makulu, Kabwe Met. & Agro., Mumbwa, Mongu, Kalabo, Kaoma, Senanga, Kafue Polder, Magoye Agro., Choma, Chipata, Msekera Agro., Lundazi, Petakuke (17 stations)
   Zone-3: Ndola, Kafironda Agro., Serenje, Solwezi, Mwinilunga, Zambezi, Kabompo, Kasempa, Mansa, Kawambwa, Samfya, Kasama, Misamfu Agro., Mbala, Isoka, Mpika (16 stations)
2) Details of data and analysis are shown in Supporting Report I (Irrigation).

1.1.2 Land Use

Land use was investigated based on the Land Use Map (1975, Ministry of Lands) and on its land use categories, which are classified mainly by administratively defined land use. Land use categories used in This Study are shown in Table 1 - 5. According to the result of analysis, land use of Zambia can be summarised as below:

Table 1 - 4 Summary of Land Use in Zambia

Land Use related to Agriculture	Total Land	Agri. Land	Non-Agri Land	Non-agricultural Land				
				Reserved Forest	Non-reserved Forest	Total forest	Lake/ Swamp	Flood Plain
Area (1,000ha)	75,185	16,352	58,833	10,980	37,657	48,637	2,100	7,990
Ratio	100%	21.7%	78.3%	14.6%	50.1%	64.7%	2.8%	10.6%

(Note) Details are described in Table 1 - 6.

Detailed description of land use is shown in Table 1-6, and mapped in Appendix 4. Total agricultural land has been estimated at 16,352,000 ha., which corresponds to 22% of the total national land area of 75,185,000 ha. However, shifting cultivation land forms a large proportion of agricultural land, although shifting cultivation land is reducing in Copperbelt and Central Provinces by the settling schemes of the Government. Acreage of current shifting cultivation land is not surveyed. When shifting agricultural land is excluded, agricultural land goes down to 8,543,000 ha. Actual planted area of major crops was around 1,335,000 ha (see Table 1-37) in 1993, corresponding to about 16% of agricultural land (8,543,000ha). On the other hand, land use is also analysed based on vegetation by the satellite imagery interpretation. Therefore, there is some difference between two analyses. Major different points are summarised as below:

1) Agricultural Land

In the analysis of Land Use Map, agricultural lands are defined as the lands which are both for presently utilised or scheduled for future use for agricultural purposes. However, in the satellite imagery analysis, agricultural lands are defined as the land presently cultivated. Therefore, agricultural lands by the Land Use Map is much larger than the land by the satellite imagery analysis. The agricultural lands are classified into more categories by the cultivation methods or agricultural purposes in the analysis of Land Use Map. The agricultural land of satellite imagery is corresponding to the presently planted area.

Agricultural Land by the Land Use Map: 16,352,281 ha
Agricultural Land by the Satellite Imagery: 1,150,655 ha

2) Forest Area

In the Land Use Map analysis, forest area is classified into two categories as the reserved and non-reserved forests. Acreage of the reserved and the non-reserved forests are 10,980,000 ha and 37,657,000 ha respectively. Total forest area amounts to 48,637,000 ha by the Land Use Map. On the other hand, the forest area amounts to 10,570,000 ha depending on vegetation by satellite imagery. It means that the reserved forest covers almost dense forests in the Country.

Table 1-5 Land Use Categories applied for Agricultural Analysis in This Study

Land Use Categories used in the Study		Land Use Categories in the Map 1975		Planted Crops
1	Agricultural Lands			
1.1	Shifting (Chitemene) Axe and Hoe Cultivation	1	Large Circle Chitemene	Cassava,Maize,Millet,Groundnuts,Beans
		2	Small Circle Chitemene	Maize,Millet,Cassava,Beans,Sorghum,Groundnuts
		3	Block Circle Chitemene	Maize,Sorghum (Cassava)
		4	Mwinilunga/semi-permanent	Cassava (Maize)
		5	Isoka Large Chitemene/Cattle	Maize,Millet,Beans,Groundnuts,Cassava,Cattle
1.2	Semi-permanent Hoe Cultivation	6	Luangwa	Maize (Millet,Sorghum)
		7	Subsidiary garden	Cassava,Maize,Vegetables
1.3	Fishing and Semi-permanent Hoe Cultivation	8	Fishing/Cassava lake/Swamp	Cassava,Maize (Groundnuts),Fishing
		8a	Banagweulu	- ditto -
		8b	Lower Luapula	- ditto -
		8c	Lake Mweru	- ditto -
		8d	Mweru Wantipa	- ditto -
		8e	Lake Tanganyika	- ditto -
		9	Lukanga Swamp	Various crops,Fishing
1.4	Semi-permanent Hoe and Ox Plough Cultivation	10	Luvale	Cassava,Maize (Cattle)
		11	Kaoma	Maize,Cassava,Groundnuts,Millet (Cattle)
		12	Barotse	Maize,Cassava,Millet,Cattle
		13	Sesheke	Maize,Sorghum,Cattle
		14	Gwembe	Sorghum,Millet,Maize,Cattle,Goats
		15	Mambwe	Maize,Beans,Groundnuts,Millet,Cassava (Cattle)
		16	Ikumbi	Maize,Beans,Millet,Groundnuts,Cassava (Cattle)
		17	Nyika	Maize,Millet,Beans,Groundnuts (Cattle)
		18	Zambezi Escarpment	Maize,Sorghum,Groundnuts,Cattle
1.5	Semi-commercial Ox and Tractor Plough Cultivation	19	Maize/Cattle mixed farming	Maize,Groundnuts (Cotton),Cattle
		19a	Southern Plateau	do
		19b	Central Plateau	do
		19c	Eastern Plateau	do
		20	Namwala mixed farming	Maize,Groundnuts (Cassava),Cattle
1.6	Private Commercial farms and Ranches	21	Cattle ranches	
		22	Beef cattle/Maize farms	with Dairy cattle,with Vegetables,with Poultry
		23	Beef cattle/Maize/Tobacco(V)	
		24	Maize farms	with Vegetables
		25	Maize/Tobacco(V)farms	with Vegetables
		26	Peri-urban farms	Vegetables,Citrus.Dairy,Layers on local market
1.7	Governmental Agricultural Projects	27	Scheme with a defined area	
		28	Outgrowers scheme	Confined to special crops,Pineapples,Tobacco
		29	Tobacco tenant scheme	
		30	Farming scheme	Bananas,Coffee,Maize, Suger,Tea,Vegetables
		31	Ranches and Dairy farms	State ranch etc.
		32	Research Station	
		33	Training farm Agri.College	
		34	Proposed Scheme area	
2	Urban Area	35	Urban area	
3	Forest Area			
3.1	Reserved Forests	36	Forest Reserve	
		37	Protected Forest area	
3.2	Afforestation	39	Afforestation	Eucalyptus grandis, Pinus khasya
3.3	National Park	40	National Park	
3.4	Non-reserved Forests	45	Woody area	
4	Hills/Escarpments	41	Hills/Escarpments	with no or marginal potential for cropping
5	Lakes	42	Lake	
6	Swamps	43	Swamp and sudd	
7	Floodplains	44	Area liable to flood	Floodplains,dambos,watershed plains etc.

Table 1 - 6 District-wise Land Use in Zambia

(Unit ha)

District	Total Area	Agricultural Land	Non Agricultural Land	Agricultural Land: Shifting Axe Hoe Cultivation	Agricultural Land: Semi-permanent Ox-Tracker Cultivation	Agricultural Land: Fishing' Semi-permanent Hoe Cultivation	Agricultural Land: Semi-permanent Hoe/Ox Cultivation	Agricultural Land: Semi-Commercial Ox-Tracker Cultivation	Agricultural Land: Private Commercial Farms' Ranches	Agricultural Land: Government Agricultural Projects	Non-Agricultural Land: Urban Area	Non-Agricultural Land: Reserved Forest	Non-Agricultural Land: Afforestation	Non-Agricultural Land: National Park	Non-Agricultural Land: Non-reserved Forests	Non-Agricultural Land: Hills' Escarpments	Non-Agricultural Land: Lakes'	Non-Agricultural Land: Swamps	Non-Agricultural Land: Hoodplains	Forest Area: Reserved Forest, Afforestation, National Park	Forest Area: Non-Reserved Forest, Hills and Escarpment	Forest Area: Total	Readily Available Agricultural Land (excl. 11)
Land Use Code				11	12	13	14	15	16	17	2	33	32	33	34	4	5	6	7	31,32,33	34,4		12+13+17
11 Lusaka Urban	11,105	26,756	17,349	0	12,217	0	0	0	14,539	0	12,488	1,262	241	0	3,355	0	0	0	0	1,506	3,355	4,861	26,756
12 Lusaka Rural	1,379,391	293,119	1,085,272	0	0	0	0	51,273	227,632	12,211	1,383	28,839	0	0	663,398	710,181	5,295	25,113	17,730	28,839	1,103,582	1,132,421	291,119
13 Luangwa	355,930	18,791	367,139	0	18,791	0	0	0	0	0	383	231	0	0	106,887	18,791	1,351	99	236,381	231	125,678	125,909	18,791
21 Ndola Urban	99,333	15,850	83,483	1,981	6,121	0	0	0	5,223	2,522	3,189	19,071	1,683	0	20,383	1,801	246	110	0	53,751	22,183	35,938	13,869
22 Ndola Rural	2,312,316	290,272	2,052,071	261,633	2,286	0	0	0	1,172	18,881	1,019	278,271	2,355	0	1,116,070	53,556	811	6,353	262,536	280,656	1,500,626	1,781,282	25,639
23 Chililabombwe	100,986	1,331	96,655	1,969	689	0	0	0	1,673	0	1,990	30,091	0	0	51,136	1,133	161	318	5,512	30,091	58,280	88,371	2,362
24 Chingola	175,150	75,571	99,579	1,381	8,350	0	0	0	18,681	11,153	116	25,907	0	0	67,317	0	586	0	5,323	25,907	67,317	93,251	31,183
25 Mufulira	128,015	22,052	105,963	0	9,306	0	0	0	1,329	11,417	5,153	35,390	169	0	63,526	547	878	0	0	35,859	63,073	99,932	22,052
26 Kabushi	113,509	20,010	93,469	5,010	2,035	0	0	0	8,298	1,697	2,527	69,231	9,707	0	11,771	0	233	0	0	78,938	11,771	90,709	15,030
27 Kitwe	75,071	16,086	58,985	0	11,111	0	0	0	33,043	21,932	8,279	11,851	273	0	7,899	0	180	0	0	12,627	7,899	20,526	16,086
28 Luanshya	83,269	30,238	53,031	861	15,711	0	0	0	7,855	5,811	1,436	19,655	3,871	0	26,636	1,829	269	112	0	23,529	28,465	51,994	29,377
31 Kabwe Urban	152,991	113,063	39,928	0	8,951	0	0	9,830	76,885	18,397	3,261	11,791	495	0	12,267	0	11	0	8,370	14,986	12,263	27,253	111,063
32 Kabwe Rural	2,553,611	516,081	2,037,560	99,167	0	12,689	0	206,095	168,723	29,107	2,235	211,118	198	0	1,055,129	159,585	11,237	323,183	474,075	211,316	1,215,011	1,426,330	866,611
33 Mumbwa	2,153,630	362,555	1,795,085	11,116	0	0	0	138,131	0	210,008	1,665	111,799	0	816,729	573,661	35,070	6,139	33,077	186,591	958,528	698,731	1,567,309	348,139
34 Mkushi	2,216,901	752,363	1,101,193	558,560	0	0	0	16,300	101,276	76,628	1,167	143,138	0	0	801,935	190,113	7,586	116	16,812	133,138	1,295,078	1,138,216	193,201
35 Serenje	2,357,206	666,119	1,690,353	616,765	0	10,198	0	0	0	0	1,059	112,082	101	225,010	512,012	562,695	2,121	18,061	257,313	337,193	1,074,737	1,411,930	19,681
41 Solwezi	3,012,192	401,616	2,610,576	315,411	0	0	0	0	0	86,202	655	888,643	0	0	1,333,670	17,818	951	8,963	163,843	888,643	1,351,488	2,240,131	86,202
42 Mwinilunga	2,089,419	216,586	1,842,863	216,586	0	0	0	0	0	0	2,575	369,335	0	168,612	872,768	274,356	71	8,209	116,813	538,017	1,117,124	1,655,141	0
43 Zambezi	1,874,616	309,915	1,564,701	0	0	0	233,867	0	0	76,048	2,470	120,093	0	0	1,153,382	0	5,709	2,161	280,886	120,093	1,153,382	1,273,475	309,915
51 Kabompo	1,453,502	109,022	1,344,480	12,002	0	0	97,020	0	0	0	1,820	108,179	0	0	1,052,231	96,120	302	10	85,818	108,179	1,148,351	1,256,530	97,020
45 Mufumbwe	1,907,817	35,118	1,872,669	25,917	0	0	9,201	0	0	0	162	112,256	0	229,288	1,015,918	0	1,145	752	212,818	611,514	1,015,918	1,657,432	9,201
46 Kasempa	2,190,452	129,270	2,061,182	128,111	0	0	0	0	0	1,156	578	519,102	0	237,912	981,860	139,360	1,258	1,112	176,670	757,011	1,121,220	1,881,263	1,156
51 Mongu	1,007,986	321,268	685,818	0	0	0	321,268	0	0	0	560	61,125	0	0	311,693	0	3,923	10,925	261,592	61,125	311,693	372,818	321,268
52 Lukulu	1,563,916	156,769	1,407,147	0	0	0	156,769	0	0	0	366	99,306	0	0	965,593	0	6,180	312	335,330	99,306	965,593	1,064,899	156,769
53 Kalabo	1,323,011	167,920	1,155,121	0	0	0	167,920	0	0	0	423	17,768	0	117,091	617,559	0	1,690	13,189	752,113	161,859	617,559	782,418	167,920
54 Kaoma	2,302,365	261,849	2,037,516	5,728	0	0	259,121	0	0	0	588	111,362	0	0	1,608,695	0	1,199	272	315,310	111,362	1,608,685	1,720,147	259,121
55 Senanga	3,185,707	371,863	2,813,844	0	0	0	284,090	0	0	87,773	0	160,019	0	122,712	2,014,983	0	9,965	9,111	197,021	282,761	2,014,983	2,297,744	371,863
56 Sesheke	2,952,233	180,228	2,772,005	0	0	0	180,228	0	0	0	519	136,032	0	336,153	2,061,163	0	8,891	3,132	225,815	472,185	2,061,163	2,533,648	180,228
61 Livingstone	103,131	41,418	62,683	0	0	0	803	0	36,121	4,524	1,555	16,008	0	2,181	26,867	9,851	613	235	2,013	18,489	36,718	55,207	41,418
62 Namwala	2,152,792	106,398	2,046,394	0	0	0	0	103,893	0	591	991	53,660	0	121,708	1,081,528	81,852	13,567	37,233	621,856	179,368	1,163,380	1,342,748	106,398
63 Mazabuka	662,465	289,630	372,835	0	0	0	11,356	92,516	113,913	11,845	1,661	60,391	0	0	17,196	112,611	2,568	58,475	119,927	60,391	129,807	190,201	289,630
64 Monze	490,118	325,453	164,695	0	0	0	22,729	196,501	74,421	31,802	683	66,803	0	12,521	8,818	0	4,311	1,420	67,019	79,321	8,818	88,172	325,453
65 Choma	700,252	497,427	293,325	0	0	0	13,512	226,381	131,831	35,633	1,797	52,118	0	0	191,226	11,851	0	0	0	52,118	233,080	291,528	103,927
66 Kalomo	3,112,473	659,857	2,482,616	0	0	0	105,177	321,691	181,256	51,730	1,085	317,768	0	11,855	1,320,663	391,508	1,835	6,021	368,871	392,627	1,712,171	2,104,798	659,857
67 Siavonga	260,858	39,680	221,178	0	0	0	39,502	0	0	178	0	14,566	0	0	55,817	139,682	11,018	100	0	14,566	195,491	210,060	39,680
68 Gwembe	526,231	13,188	482,743	0	0	0	43,488	0	0	0	0	19,496	0	0	91,690	272,519	98,602	101	0	19,496	364,280	383,735	13,188
69 Sinazongwe	480,010	50,596	429,414	0	0	0	50,220	0	0	376	61	32,760	0	0	1,706	278,752	109,161	1,671	0	33,760	280,458	314,218	50,596
71 Mansa	1,599,736	470,355	1,128,984	0	455,017	13,956	0	0	0	1,382	2,132	93,011	0	0	881,202	125,171	1,562	22,573	0	93,011	1,006,373	1,099,384	470,755
72 Nchelenge	791,438	107,109	687,329	51,089	0	56,020	0	0	0	0	1,389	31,696	0	51,313	133,331	88,176	292,333	51,533	20,511	96,039	225,510	321,549	56,020
73 Kawambwa	910,837	218,882	691,955	186,123	0	26,435	0	0	0	36,324	2,131	118,462	0	86,153	260,010	86,098	6,932	26,379	35,487	204,915	346,108	551,023	62,759
74 Mwense	667,211	199,529	467,683	188,312	0	11,217	0	0	0	0	1,583	123,161	0	0	283,912	13,317	3,077	12,123	26,418	123,161	297,329	420,489	11,217
75 Samfya	987,222	226,424	760,798	169,553	0	56,869	0	0	0	0	1,547	2,677	0	0	253,980	336,185	169,160	150,021	42,628	2,677	393,165	395,842	56,869
81 Kasama	2,015,750	1,109,168	936,582	1,103,691	0	0	0	0	0	5,477	1,362	179,625	299	0	398,758	66,186	1,882	6,982	278,188	179,923	465,241	645,165	5,477
82 Kaputa	1,238,831	110,326	1,098,508	111,270	0	29,056	0	0	0	0	709	26,229	0	136,516	826,689	211,166	203,525	38,953	21,721	162,745	670,855	833,600	29,056
83 Mbala	1,869,524	870,317	999,207	736,375	0	13,910	85,156	0	0	34,876	1,990	185,769	0	39,395	291,888	253,170	151,155	18,933	60,607	225,169	538,358	763,527	133,942
84 Mperoloso	1,193,791	759,991	433,303	736,210	0	0	0	0	0	23,781	1,391	6,856	0	0	182,621	93,934	681	12,072	135,745	6,856	276,555	283,411	23,781
85 Luwingu	883,133	162,868	420,265	433,922	0	25,133	0	0	0	1,810	111	90,901	0	51,761	115,292	0	2,668	9,028	150,171	142,665	115,292	257,957	26,916
86 Chilubi	526,922	56,517	470,405	9,637	0	46,880	0	0	0	0	219	0	0	0	329,091	0	62,283	15,120	33,729	0	329,091	329,091	46,880
87 Isoka	1,376,750	588,912	787,838	335,587	20,682	0	232,673	0	0	0	309	80,125	0	0	70,231	330,292	0	1,986	301,862	80,125	400,526	480,651	253,355
88 Chinsali	1,511,511	855,333	689,181	810,781	0	0	0	5,920	8,629	1,031	91,111	0	0	131,232	209,881	616	3,383	248,921	91,111	311,116	335,227	11,519	
89 Mpika	3,050,470	604,283	3,446,189	596,167	0	0	0	0	0	8,116	2,809	462,529	0	198,009	1,999,911	0	611	67,527	111,793	960,538	1,999,911	2,960,449	8,116
91 Chipata	1,218,913	373,025	845,918	0	30,936	0	0	282,006	8,031	52,069	2,532	110,809	0	13,695	232,593	339,425	251	0	32,610	156,501	672,018	830,522	373,025
92 Chama	1,760,311	210,551	1,569,760	56,239	129,813	0	0	23,871	0	592	106	333,318	0	0	846,516	381,596	181	573	4,149	333,318	1,231,112	1,564,369	154,312
93 Lundazi	1,368,723	380,602	988,121	0	33,807	0	0	332,851	0	13,941	200	126,878	0	295,232	376,613	176,959	0	0	12,239	422,110	553,572	975,682	380,602
94 Chadiza	250,156	130,711	119,112	0	0	0	0	81,716	1,956	41,042	0	28,820	0	0	31,041	59,575	0	0	0	28,820	90,622	119,442	130,711
95 Katete	381,156	255,211	125,945	0	8,323	0	0	200,054	1,681	45,153	198	24,122	0	0	39,317	61,312	0	0	3,963	24,122	100,629	124,751	255,211
96 Petauke	1,912,339	387,224	1,525,115	0	59,550	0	0	321,329	0	5,945	1,118	194,191	0	105,396	509,360	707,118	689	565	6,318	299,587	1,216,568	1,516,095	387,224
10 Lusaka	2,209,426	339,666	1,869,760	0	31,008	0	0	54,273	242,171	12,211	17,251	30,332	241	0	323,610	358,975	9,659	25,512	253,118	30,576	1,532,615	1,563,191	339,666
20 Copperbelt	3,321,679	504,440	2,617,239	278,838	55,612	0	0	0	60,537	109,113	31,239	519,113	21,891	0	1,672,778	62,867	3,687	6,923	233,381	511,361	1,760,645	2,302,009	225,602
30 Central	9,368,439	2,111,912	7,056,527	1,269,208	8,951	23,187	0	370,356	316,881	323,323	9,651	592,928	191	1,071,789	2,958,331	1,213,193	31,231	174,137	970,161	1,665,211	8,205,827	9,871,038	1,112,701
40 N/Western	12,520,028	1,231,587	11,296,111	728,093	0	0	310,088	0	0	163,106	8,260	2,113,708	0	635,812	6,612,859	527,651	9,712	17,178	1,066,878	3,053,550	7,140,513	10,194,063	903,181
50 Western	12,731,381	1,462,897	11,271,484	5,728	0	0	1,369,396	0	0	83,773	2,456	618,832	0	576,256	7,612,676	0	31,818	37,232	2,392,181	1,195,088	7,612,676	8,807,761	1,457,160
60 Southern	8,519,860	1,963,977	6,555,883	0	0	0	286,808	912,929	567,582	166,658	10,836	662,903	0	184,569	2,798,536	1,331,659	272,070	108,558	1,179,752	851,172	4,130,195	4,981,667	1,963,977
70 Luapula	4,959,417	1,252,699	3,706,718	565,079	455,017	191,497	0	0	0	38,106	9,089	383,037	0	110,796	1,820,495	419,277	176,371	262,630	165,017	523,933	2,269,735	2,793,668	687,620
80 Northern	14,729,191	5,417,716	9,281,418	4,995,616	20,682	115,011	318,129	0	5,920	82,355	13,261	1,123,148	299	725,681	3,911,719	1,198,232	426,381	203,981	1,618,743	1,819,128	5,130,951	6,989,079	512,092
90 Eastern	6,911,628	1,337,360	5,177,268	56,239	263,139	0	0	1,215,263	11,671	158,718	3,451	805,135	0	418,323	2,035,476	1,829,015	1,123	1,138	39,600	1,266,361	3,964,491	5,230,952	1,681,121
Zambia	75,185,079	16,352,281	58,832,798	7,808,831	833,712	332,695	2,315,421	2,612,821	1,237,808	1,211,993	106,506	7,203,199	22,928	3,753,258	30,251,516	7,465,132	1,262,116	837,912	7,989,863	10,979,683	33,656,688	58,636,331	8,513,350

(Note)

1) Acreage is measured based on the Land Use Map of Zambia (1/50,000, 1975, Ministry of Land), and revised based on the Revised District Acreage in 1991.
2) Urban area, Lakes and Swamps are following the areas analysed by satellite imagery interpretation.
3) Area of Reserved Forests is adjusted to the area as of 31 Dec/1993.
4) Afforestation area is not adjusted to present area due to no reliable recent data. The area is measured on the 1975 Land Use Map.
5) National Parks are counted partly as Hills' Escarpments, in case duplicated with Hills' Escarpment.

1.1.3 Soil and Land Classification

(1) Soils

There are 19 major soil series in Zambia. Soil series are classified into four groups by suitability for cultivation as below:

(a) Suitable Soils for Crop Cultivation

1) Soil Series suitable for Upland Crop Cultivation

Soils suitable for upland crops are widely distributed in the country. There are nine soil series suitable for upland crop cultivation. Among nine soil series, Acrisols in particular cover large areas of Northern, Luapula and Central Provinces, and are utilised for cultivation. Those soil series are as follows:

1. Acrisols 2. Alisols 3. Lixisols 4. Luvisols 5. Cambisols
6. Phaeozems 7. Ferralsols 8. Nitosols 9. Arenosols

2) Soil Series suitable for Paddy Rice Cultivation

Gleysols suitable for paddy cultivation are found in the inland dambos scattered in several places including the flood plains of the Zambezi in Western Province and the Chambeshi basin from Northern Province to the southern part of Luapula Province.

10. Gleysols

3) Soil Series suitable to Upland Crop and Pasture Grass Cultivation by Drainage or Soil Improvement.

Soils requiring drainage or soil improvement extend over the flood plains of the Zambezi, Kafue and Luangwa rivers. There are two soil series, which are utilised mainly for cattle grazing at present.

11. Vertisols 12. Fluvisols

Detail characteristics of above twelve soil series are described on drainability, soil depth, structure and chemical property in Table 1-15. These soil series are further classified into three classes by crop productivity depending on soil properties.

(b) Unsuitable Soil Series to any Crop Cultivation

4) Soil Series not suitable to any Crop Cultivation

Unsuitable soils are totally seven series, and they are found in hilly ranges or piedmont mainly in Lusaka, Central, Southern, Eastern and Northern Provinces.

13. Histsols 14. Leptosols 15. Regosols 16. Planosols
17. Solonchaks 18. Solonetz 19. Pozols

Major restrictions of unsuitable soils are as follows:

Histsols

Unsuitable for production of all crops at all input levels due to strong acidity, land workability problems and low oxygen availability. Draining these soils would cause rapid decomposition of organic matter. It is recommended that they should be left under natural vegetation and used as grazing lands.

Regosols and Leptosols

Unsuitable to all crops considered at all input levels due to very severe limitations which include, rooting depth, rootability, high aluminium toxicity, calcium deficiency, drought hazard and hindrance to machinery.

Solonetz

Unsuitable to all crops considered at all input levels due to very severe limitation in oxygen availability. Sodium levels are too high for normal growth of crops. They are recommended for cattle grazing during the dry season.

Solonchaks

Unsuitable for production of all crops considered at all input levels due to very high salinity conditions. It is recommended that they be used as range lands or for recreation purposes.

(c) Acreage of Soil Series by Provinces

Distribution of acreage of the soil series is shown in Table 1-7. As shown in the table, suitable soils cover more than 80% of the land in Northern, North-Western and Western Provinces. Suitable soil series cover at least 37% of lands in Lusaka Province, and 40 to 74% in other provinces.

Table 1-7 Summary on Acreage of Soil Series by Province

(Unit: 1,000 ha)

Group of Soil Series	Central	Copper-belt	East-ern	Luapula	Lusaka	North-ern	N/ Western	South-ern	West-ern	Total
1) Suitable for Upland Crops										
	3,546	2,025	2,751	3,106	816	11,118	10,268	4,108	10,852	48,590
	37%	65%	40%	70%	37%	77%	82%	50%	85%	66%
2) Suitable for Paddy Rice										
	335	62	18	180	0	813	763	6	1,376	3,553
	4%	2%	0%	4%	0%	6%	6%	0%	11%	5%
Sub-total										
	3,881	2,087	2,769	3,286	816	11,931	11,031	4,114	12,228	52,143
	41%	67%	40%	74%	37%	83%	88%	50%	96%	70%
3) Soil Series need Soil Improvement										
	682	114	1,455	28	21	448	0	1,284	21	4,053
	7%	4%	21%	1%	1%	3%	0%	16%	0%	5%
4) Unsuitable Soil Series										
	4,894	921	2,691	1,131	1,372	2,051	1,497	2,867	485	17,909
	52%	29%	39%	25%	62%	14%	12%	35%	4%	24%
Total										
	9,457	3,123	6,916	4,446	2,210	14,431	12,529	8,266	12,735	74,106
	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

(Note) Acreage of each Soil Series by Province are Table 1-13

(2) Land Classification

(a) General Classification by Crop Productivity

Suitable soil series (12 series) are further classified into as Class-I, Class-II and Class-III according to the productivity of crops. Productivity of each class is defined approximately as below:

Table 1-8 Land Classification by Productivity of Crops

Crops	Management Level	Rainfed Productivity (Unit: tons/ha)			Evaluation of Productivity		
		I	II	III	I	II	III
Maize	High	4.40	1.50	-	Good	Fair	None
	Moderate	3.00	1.50	0.50			
	Low	* 1.80	-	0.50			
Soy beans	High	1.05	0.75	-	Good	Fair	None
	Moderate	0.75	0.20	0.20			
	Low	-	0.20	0.10			
Ground nuts	High	1.76	0.87	-	Good	Fair	None
	Moderate	1.26	0.31	0.30			
	Low	0.76	0.30	0.10			
Cassava	High	22.00	-	-	Good	Fair	None
	Moderate	15.75	-	-			
	Low	9.50	4.75	-			

(Data Source) Soil Survey Report 1987, DOA
(Note) *: assumed from a national average yield of maize.

Four major crops, maize, soybeans, groundnuts and cassava are selected as indicators of productivity. As shown in Table 1-8, Class-I soil produces highest productivity, and Class-III soil produces lowest productivity. However, productivity differs according to farm management level of farmers, such as High level (complete LIMA "cultivation" approach mainly by commercial farmers), Moderate level (LIMA approach by emergent farmers), and Low level (traditional approach with scarce application of purchased inputs).

Class-I soil ensures stable growth of crops and produces the highest production with high management level. However, Class-II soil does not show much difference according to the management levels, but its productivity reduces to about half of Class-I. On the other hand, productivity of Class-III soil is much lower than Class-I and II due to inferior properties, topographical conditions and lower drainability. Therefore, Class-III soil has been excluded as a cultivable soil for cultivation in this report.

Definition of Land Class

Cultivable Soil	Class-I, Class-II
Un-cultivable Soil	Class-III

(b) Land Classification by Soil Properties

As mentioned above, although classified into suitable soils (12 soil series), there is some limitation of productivity as class-III among them. Major restrictions are due to strong acidity and excessive drainability in Zambia. Strong acidity extends as centralised in the

northern region, and excessive drainability in Western Province. The soils have been classified into three classes depending on their properties as shown in Table 1-9.

Table 1-9 Classification Criteria of Soils by Soil Properties

Land Classification	Classification Criteria by Physical and Chemical Properties					Equivalent Soil Groups
	Drainability	Effective Depth (cm)	Acidity (pH by KCl)	Texture of Top Soil	Nutrient Retention Capacity (ECEC in meq/100g soil)	
U-I	Well to Moderate	60-200 Moderately deep to very deep	4.5-7.4 Moderately acid to Moderately alkaline	SL-C (Sandy Loam - Clay)	2-8 Medium to high	Fu/,Fo/1,Fr/1,FG/1,FB/1, Ho/1,Eo/1, Uo/1,Ug/1,UA/1, Lc/1,LH/1,LI/1,Lx/1, BC/1,BR/1,Bd/1, Bi/1,QE/1
P-I	Poor		4.1-5.5 Strongly acid to slightly acid		1-8 Low to high	Gd/1,Gu/1,GG/1, Gn/1
U-II	Well to Moderate	60-90 Moderately deep	4.1-4.5 Strongly acid		1-2 Low	Ah/1,Ah/2,AF/1,AQ/1, Al/1,AL/1,Ag/1, Ao/1,Qf/1,QI/1, Qg/1,QA/1,QQ/1, QB/1,QW/1, Uo/2,Fo/2
P-II	Poor					Gd/2,Gu/2,GG/2
U-III	Excessive	< 30-60 Shallow to Moderately Shallow	< 3.5-4.0 Extremely acid to very strongly acid	White Sand and Including Rocks or stone.	< 1 Extremely Low	Fx/1,Fx/2,Fr/4 Qa/1,QB/1,QG/3 ,Ah/3,Ah/4
P-III	Poor			Including rocks or stones		Gu/3,Gu/4,GG/3,GG/4
Unsuitable	Je/1,Jv/1,JL/1 Id/1,Id/2,IE/1,IF/1 AA/1,RI/1,Zg/1,Wd/1,We/1,Vd/1,Ve/1,VH/1,VL/1,Vu/1, Pc/1,Pw/1,Le/1					

(Note)

1) Criteria refer to Map Unit Description.

2) U- : suitable for Upland Crops, P- : suitable for Paddy Rice

3) Unsuitable- : Soil Groups not suitable to any crop cultivation

(c) Soil Series restricted on Crop Productivity

There are three soil series involving some soil groups which are classified into class-III by their poor properties restricting productivity of crops. These soil series are Acrisols, Ferralsols and Arenosols. They extent widely in Zambia particularly in the northern and western regions that are Northern, Luapula, North-Western, and Western Provinces. They share the largest extent of about 78% of suitable soils in whole Zambia as shown in Table 1-10. When observing in provincial basis, the largest extent can be observed at 92% in Luapula, and followed by Western Province at 89%, Northern Province at 86%, and North-eastern Province at 80% respectively. They extent only at 56% in other provinces than mentioned four province

Table 1-10 Restricted Soils and Their Extents

(Unit: 1,000 ha)

Province	Soil Series contain Restrictions				None Restricted Soils	Total
	Acrisols	Ferralsols	Arenosols	Sub-Total		
Luapula	2,898	23	104	3,025	261	3,286
	88%	1%	3%	92%	8%	100%
Northern	8,251	1,045	599	9,895	1,636	11,531
	72%	9%	5%	86%	14%	100%
N/Western	1,969	2,641	4,224	8,834	2,197	11,031
	18%	24%	38%	80%	20%	100%
Western	731	0	10,121	10,852	1,376	12,228
	6%	0%	83%	89%	11%	100%
Other Provinces	6,041	516	1,309	7,866	6,201	14,067
	43%	4%	9%	56%	44%	100%
Zambia	19,890	4,225	16,357	40,472	11,671	52,143
	38%	8%	31%	78%	22%	100%

(Data Source) Land Husbandry Section, DOA, MAFF

(Note) Details are in Table 1-13.

Characteristics and major extents of above problem three soil series are explained as below:

Acrisols: involving some soil groups extremely or very strongly acid.
Ferralsols: involving some soil groups extremely or very strongly acid.
Arenosols: involving some soil groups extremely or very strongly acid and excessively drained.

1) Major Extent of Very Strongly Acid Soils

Those soils cover 3,025,000 ha extending in the western plateau of Lake Bangweulu in Luapula Province, 9,898,000 ha in the central plateau in Northern Province, and 8,834,000 ha in the right bank plateau of Kabompo River and in the both bank plateau of Upper Zambezi River in North-Western Province. Most of acid soils of North-Western Province are also excessively drained, relating to the sandy soils extending from Western Province.

2) Major Extent of Excessively Drained Soils

In the both bank plateau of Zambezi River, excessive drained sandy soils (Kalahari sand or white sand) are widely extended covering about 10,852,000 ha in Western Province. The soil of left bank plateau of Zambezi River is defined as somewhat excessive and strongly acid. In this study, this soil is classified into class-II based on the criteria mentioned in Table 1-9. It is considered that the lower productivity of maize and drought sensibility are mainly caused by those sandy soils in Western Province.

(d) Classification of Soils by their Properties

As mentioned above, it is very important to identify the soils cultivable (class-I and II) or un-cultivable (class-III) particularly for mentioned above three soil series. The results of investigation of land classification are mapped in Figure 1-3, and summarised as shown in Table 1-11.

Table 1-11 Present Planted Area and Potential Cultivable Area

Lusaka	Copper-belt	Central	N/ Western	Western	South ern	Luapula	Northern	Eastern	Zambia
Planted Area in 1993 (ha)									
38,580	50,346	247,365	39,715	109,972	280,129	72,622	151,383	362,751	1,352,863
Potential Cultivable Area (ha) (class-I, II : refer to Table 1-12)									
104,422	303,100	1,356,162	814,779	1,041,280	935,997	832,785	1,225,692	1,234,268	7,848,485
Ratio to Planted Area									
2.7	6.0	5.5	20.5	9.5	3.3	11.5	8.1	3.4	5.8

As shown in Table 1-11, potential cultivable area extents over 5 times of present planted area in Zambia. Maximum potential ration is over 20 times in North-Western, and minimum is 2.7 times in Lusaka Province. In the problem four provinces, where restricted soil series are largely extended, potential ratio is over 8 times. This means that potential cultivable area is largely extended in the problem provinces.

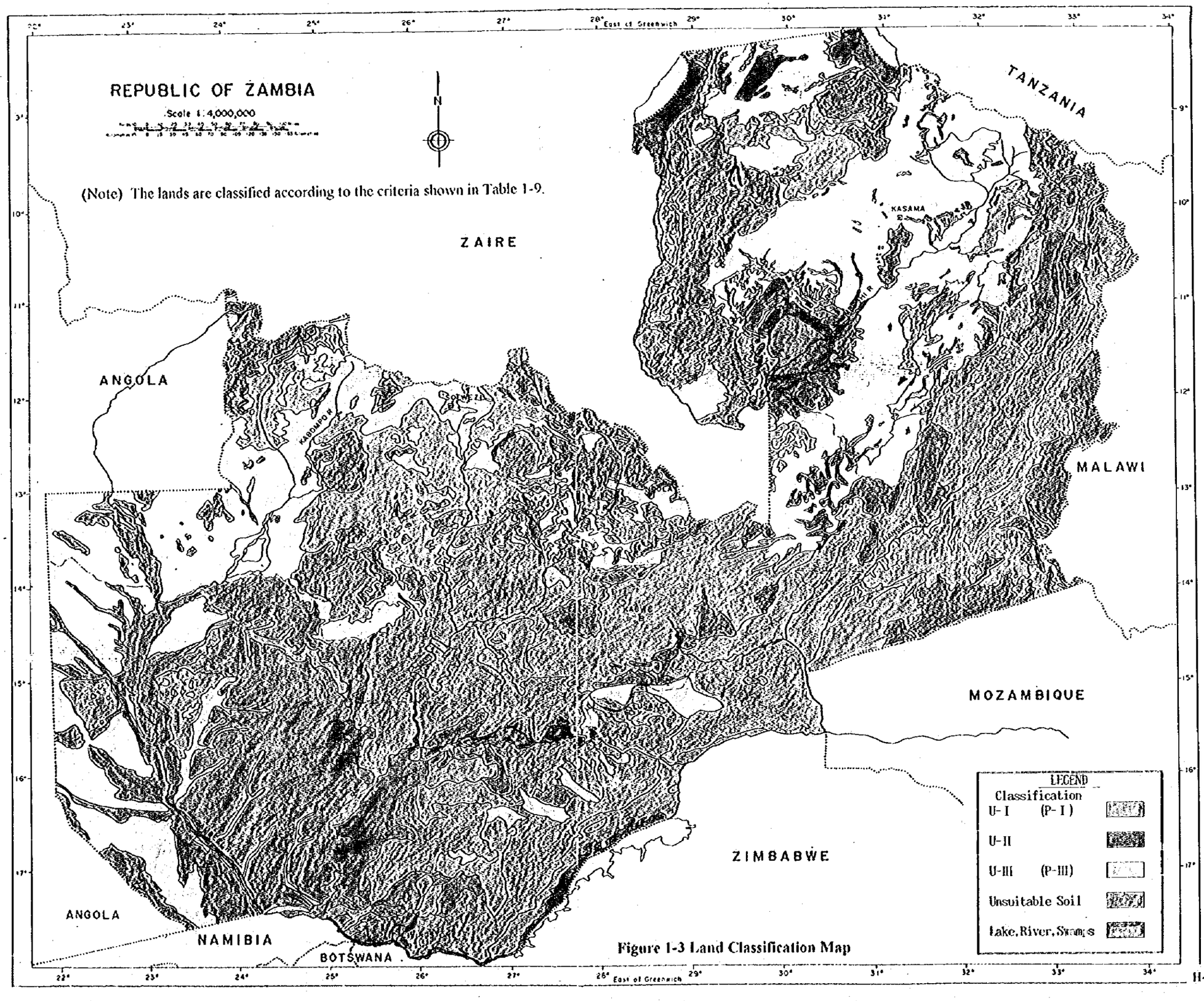


Figure 1-3 Land Classification Map

Table 1-12 Acreage of Agricultural Land by Land Classification

(unit: ha)

Province	Agricultural Land						Total Provincial Area
	Suitable Soils				Unsuitable Soils	Total	
	Cultivable			Un-cultivable			
	I	II	Total	III	U		
Lusaka	71,141	33,281	104,422	12,028	223,216	339,666	2,209,426
	3%	2%	5%	1%	10%	15%	100%
	21%	10%	31%	4%	66%	100%	
Copperbelt	84,141	218,960	303,100	128,618	72,722	504,440	3,121,679
	3%	7%	10%	4%	2%	16%	100%
	17%	43%	60%	25%	14%	100%	
Central	912,960	443,202	1,356,162	277,296	778,454	2,411,912	9,468,439
	10%	5%	14%	3%	8%	25%	100%
	38%	18%	56%	11%	32%	100%	
N/Western	366,619	448,160	814,779	344,064	72,743	1,231,587	12,528,028
	3%	4%	7%	3%	1%	10%	100%
	30%	36%	66%	28%	6%	100%	
Western	105,940	935,340	1,041,280	195,793	225,824	1,462,897	12,734,381
	1%	7%	8%	2%	2%	11%	100%
	7%	64%	71%	13%	15%	100%	
Southern	672,400	263,597	935,997	192,072	835,908	1,963,977	8,519,860
	8%	3%	11%	2%	10%	23%	100%
	34%	13%	48%	10%	43%	100%	
Luapula	56,944	775,841	832,785	224,058	195,856	1,252,699	4,959,447
	1%	16%	17%	5%	4%	25%	100%
	5%	62%	66%	18%	16%	100%	
Northern	712,522	513,170	1,225,692	3,579,582	642,469	5,447,743	14,729,191
	5%	3%	8%	24%	4%	37%	100%
	13%	9%	22%	66%	12%	100%	
Eastern	708,902	525,366	1,234,268	18,741	484,351	1,737,360	6,914,628
	10%	8%	18%	0%	7%	25%	100%
	41%	30%	71%	1%	28%	100%	
Total	3,691,568	4,156,917	7,848,485	4,972,253	3,531,545	16,352,282	75,185,079
	5%	6%	10%	7%	5%	22%	100%
	23%	25%	48%	30%	22%	100%	

(Note)

1) classified based on Soil Exploratory Map(1:1,000,000),and Soil Report(1989-88),MAFF

Table 1-13 Acreage of Soil Series by Provinces

(Unit: 1,000 ha)

Soil Group	Soil Series	Central	Copper-belt	Eastern	Luapula	Lusaka	Northern	North-Western	Southern	Western	Total
Soil Series Suitable for Crops	Acrisoils	2,939	1,518	413	2,898	175	8,251	1,969	996	731	19,890
	Alisols			94	70	41	503		81		789
	Lixisols	385				22			523		930
	Luvisols	138		1,871		309	584	194	786		3,882
	Combisols			266		228	136	1,240	426		2,296
	Phaeozems		12	107	11	41					171
	Ferralsols		445		23		1,045	2,641	71		4,225
	Nitosols		50								50
	Arenosols	84			104		599	4,224	1,225	10,121	16,357
	Gleysols *1	335	62	18	180		813	763	6	1,376	3,553
	Sub-Total	3,881	2,087	2,769	3,286	816	11,931	11,031	4,114	12,228	52,143
	%	41%	67%	40%	74%	37%	83%	88%	50%	96%	70%
Soil Series needs Improvement	Vertisols *2	621	114	916		5	448		1,276		3,380
	Fluvisols *2	61		539	28	16			8	21	673
	Sub-Total	682	114	1,455	28	21	448	0	1,284	21	4,053
	%	7%	4%	21%	1%	1%	3%	0%	16%	0%	5%
Soil Series Unsuitable for Crops	Histsols		9		194		122				325
	Leptosols	3,348	834	2,106	395	1,351	881	1,069	2,671	29	12,684
	Regosols	1,260	47	1	366		149	313	42		2,178
	Planosols			3				66	154	53	276
	Solonchaks						27				27
	Solonetz			580		21					601
	Pozols									340	340
	Swamp(As)	286	31	1	176		872	49		63	1,478
	Sub-Total	4,894	921	2,691	1,131	1,372	2,051	1,497	2,867	485	17,909
	%	52%	30%	39%	25%	62%	14%	12%	35%	4%	24%
	Total *3	9,457	3,122	6,915	4,445	2,209	14,430	12,528	8,265	12,734	74,105

(Data Source) Land Husbandry Section, DOA, MAFF

(Notes)

*1: suitable for paddy rice.

*2: drainage and soil improvement are required.

*3: excluding lakes and open water bodies.

Table 1-14 Acreage of Agricultural Land by Land Classification

(Unit: ha)

District/ Province	Suitalbe Soil Series				Unsuitable Soil Series	Sub-Total	Agricultural Land	Ratio of Cultivable	Total District Area
	Cultivable			Unsuitable					
Code	I	II	Sub-Total	III	U	III + U			
			(1)			(2)	(3)=(1)+(2)	(1)/(3)	
11 LusakaUrban	3,705	0	3,705	4,828	18,223	23,051	26,756	14%	44,105
12 LusakaRural	61,036	33,281	94,317	0	199,802	199,802	294,119	32%	1,779,391
13 Luangwa	6,400	0	6,400	7,200	5,191	12,391	18,791	34%	385,930
21 NdolaUrban	0	13,059	13,059	2,791	0	2,791	15,850	82%	99,333
22 NdolaRural	63,572	69,588	133,160	84,800	72,312	157,112	290,272	46%	2,342,346
23 Chililabombwe	439	3,478	3,917	414	0	414	4,331	90%	100,986
24 Chingola	19,169	34,768	53,937	21,634	0	21,634	75,571	71%	175,150
25 Mufulira	849	20,382	21,230	822	0	821.73	22,052	96%	128,015
26 Kalulushi	0	20,040	20,040	0	0	0	20,040	100%	113,509
27 Kitwe	0	46,086	46,086	0	0	0	46,086	100%	75,071
28 Luanshya	112	11,558	11,670	18,158	410	18,568	30,238	39%	87,269
31 KabweUrban	114,063	0	114,063	0	0	0	114,063	100%	152,991
32 KabweRural	266,581	80,320	346,901	3,390	165,790	169,180	516,081	67%	2,553,641
33 Mumbwa	87,801	100,344	188,145	0	174,410	174,410	362,555	52%	2,157,640
34 Mkushi	406,449	91,827	498,276	26,998	227,489	254,488	752,764	66%	2,246,961
35 Serenje	38,066	170,711	208,777	246,908	210,765	457,672	666,449	31%	2,357,206
41 Solwezi	210,559	66,284	276,843	124,803	0	124,803	401,646	69%	3,012,192
42 Mwinilunga	84,718	100,045	184,763	60,155	1,667	61,823	246,586	75%	2,089,449
43 Zambezi	0	195,513	195,513	114,402	0	114,402	309,915	63%	1,874,616
44 Kabompo	1,133	70,266	71,398	37,624	0	37,624	109,022	65%	1,453,502
45 Mufumbwe	8,453	10,844	19,296	5,597	10,255	15,852	35,148	55%	1,907,817
46 Kasempa	61,757	5,208	66,965	1,484	60,821	62,305	129,270	52%	2,190,452
51 Mongu	0	120,475	120,475	62,648	138,145	200,793	321,268	37%	1,007,086
52 Lukulu	0	156,769	156,769	0	0	0	156,769	100%	1,563,946
53 Kalabo	0	67,168	67,168	58,772	41,980	100,752	167,920	40%	1,723,044
54 Kaoma	105,940	145,667	251,607	0	13,242	13,242	264,849	95%	2,302,365
55 Senanga	0	278,897	278,897	74,373	18,593	92,966	371,863	75%	3,185,707
56 Sesheke	0	166,364	166,364	0	13,864	13,864	180,228	92%	2,952,233
61 Livingstone	6,217	16,579	22,795	18,652	0	18,652	41,448	55%	104,131
62 Naluwala	15,960	79,798	95,758	0	10,640	10,640	106,398	90%	2,152,792
63 Mazabuka	115,852	0	115,852	0	173,778	173,778	289,630	40%	662,465
64 Monze	16,172	80,863	97,035	66,691	161,727	228,418	325,453	30%	490,148
65 Choma	122,228	20,371	142,599	40,743	224,085	264,828	407,427	35%	700,752
66 Kalomo	296,935	65,986	362,921	65,986	230,950	296,936	659,857	55%	3,142,473
67 Siavonga	27,720	0	27,720	0	11,960	11960	39,680	70%	260,858
68 Gwembe	43,488	0	43,488	0	0	0	43,488	100%	526,231
69 Sinazongwe	27,828	0	27,828	0	22,768	22768	50,596	55%	480,010
71 Mansa	0	366,211	366,211	28,517	76,027	104,544	470,755	78%	1,599,736
72 Nchelenge	2,569	60,798	63,366	17,286	26,456	43,743	107,109	59%	794,438
73 Kawambwa	6,024	206,019	212,043	4,631	32,208	36,839	248,882	85%	910,837
74 Mweuse	9,795	78,686	88,481	79,818	31,230	111,048	199,529	44%	667,214
75 Samfya	38,557	64,127	102,683	93,805	29,936	123,741	226,424	45%	987,222
81 Kasama	0	107,148	107,148	992,145	9,875	1,002,020	1,109,168	10%	2,045,750
82 Kaputa	13,985	822	14,807	99,296	26,223	125,519	140,326	11%	1,238,834
83 Mbala	57,179	99,380	156,560	622,795	90,962	713,757	870,317	18%	1,869,524
84 Mporokoso	296,032	18,238	314,270	431,771	13,947	445,721	759,991	41%	1,193,293
85 Luwingu	7,388	3,694	11,082	220,352	231,434	451,786	462,868	2%	883,133
86 Chilubi	0	7,312	7,312	28,490	20,715	49,205	56,517	13%	526,922
87 Isoka	140,710	186,605	327,315	156,570	105,057	261,627	588,942	56%	1,376,750
88 Chinsali	117,789	21,237	139,025	623,248	93,059	716,308	855,333	16%	1,544,514
89 Mpika	79,438	68,734	148,172	404,911	51,198	456,109	604,281	25%	4,050,470
91 Chipata	165,258	65,663	230,922	12,159	129,945	142,103	373,025	62%	1,218,943
92 Chama	74,559	59,881	134,440	0	76,111	76,111	210,551	64%	1,780,311
93 Lundazi	63,661	124,919	188,580	1,721	190,301	192,022	380,602	50%	1,368,723
94 Chadiza	27,676	66,728	94,405	2,234	34,075	36,309	130,714	72%	250,156
95 kateto	88,474	152,545	240,719	1,408	13,117	14,525	255,244	94%	384,156
96 Petauke	289,573	55,629	345,202	1,220	40,802	42,022	387,224	89%	1,912,339
10 Lusaka	71,141	33,281	104,422	12,028	223,216	235,244	339,666	31%	2,209,426
20 Copperbelt	84,141	218,960	303,100	128,618	72,722	201,340	504,440	60%	3,121,679
30 Central	912,960	443,202	1,356,162	277,296	778,454	1,055,750	2,411,912	56%	9,468,439
40 N.Western	366,619	448,160	814,779	341,064	72,743	416,808	1,231,587	66%	12,528,028
50 Western	105,940	935,340	1,041,280	195,793	225,824	421,617	1,462,897	71%	12,734,381
60 Southern	672,400	263,597	935,997	192,072	835,908	1,027,980	1,963,977	48%	8,519,860
70 Luapula	56,944	775,841	832,785	224,058	195,856	419,914	1,252,699	66%	4,959,447
80 Northern	712,522	513,170	1,225,692	3,579,582	642,469	4,222,051	5,447,743	22%	14,729,191
90 Eastern	708,902	525,366	1,234,268	18,741	484,351	503,092	1,737,360	71%	6,914,628
Total	3,691,568	4,156,917	7,848,485	4,972,253	3,531,545	8,503,797	16,352,282	48%	75,185,079

(Data Source): Soil Exploratory Map (1:1,000,000),and Soil Reports (1985-88), MAFF

(Note) Gwembe district includes Siavonga and Sinazongwe Districts.

Table 1-15 Soil Properties of Suitable Soil Series (1/2)

Suitable Soil Series	Soil Groups		Province	Drained	Effective Depth (cm)	Soil Colour	Structural Top-Soil	Acidity (PHkcl)	Leaching base saturation(%)	Nutrient Retention Capacity	Aluminum Saturation (%)
1 Acrisols											
	chromi-haplic	Ah1	Lusaka	well	90->200	7.5YR-5YR5/8	L-SCL	3.5-4.5	<10-35	2-4	50-80
	pisi-haplic	Ah2		well	30-60	7.5YR4/4-5/8	SCL	4.1-5.0	10-35	2-4	50-80
	orthi-haplic	Ah3		well-moderately	90->200	10YR5/6-7.5YR4/4	SL-SCL	3.5-4.5	10-35	1-2	50-80
	gleyi-haplic	Ah4		moderate-imperfect	60-120	10YR6/8	LS-SL	4.1-4.5	10-35	1-2	50-80
	association orthi rhodic	Af1		soils similar to Ah3							
	association orthi dystric	Af1		soils similar to Ah3							
		Af1		soils similar to fd1							
	rhodi-haplic	Ah1	Northern	well	90->200	2.5yr3/6	SCL-SC	5.1-5.5	35-75	2-4	<20
	chromi-haplic	Ah2		well	>200	7.5YR5/8-2.5YR4/8	LS-SL	5.1-5.5	10-35	2-4	50-80
	chromi-haplic	Ah3		well	90->200	7.5YR-5YR5/8	SL-SCL	3.5-4.5	<10-35	1-2	50-80
	chromi-haplic	Ah4		well	60-120	7.5YR-5YR5/8	LS-SL	3.5-4.5	<10-35	1-2	50-80
	pisi-haplic	Ah5		well	60-120	7.5YR-5YR5/8	SCL-SL	4.1-5.0	10-75	1-2	50-80
	association chromi pisi	Ah6		soils similar to Ah2							
		Ah6		soils similar to Ah4							
	gleyic	Ag1	N-Western	Imperfectly	90-200		C-L	4.1-5.0			
	rhodi-haplic	Ah1		moderate-imperfectly			L-C	4.1-5.0			
	association orthi pisi-haplic	Af1		soils similar to Ah1							
		Af1		soils similar to Fo2							
	chromi-haplic	Ah1	Copperbelt	well	120->200	7.5YR-5YR5/8	L-SCL	3.5-4.5	<10-35	2-4	50-80
	chromi-haplic	Ah2		well	>200	5YR5/6-2.5YR3/6	L-SL	4.1-5.0	10-35	1-2	-
	plinthic	Ap1		well-moderately	120->200	10YR5/6-7/4	SL-LS	4.1-4.5	10-35	1-2	50-80
	gleyic	Ag1		well-imperfectly	90-200	10yr5/4-6/3	SL-SCL	4.1-4.5	<10	1-2	50-80
	chromi-haplic	Ah1	Central	well	60-200		L-C	3.5-4.0			
	association chromic dystric	Af1		soils similar to Ah3			L-C				
		Af1		soils similar to fd3							
	chromi-haplic	Ah1	Eastern				L-C	4.1-5.0			
	association chromic dystric	Ag1		soils similar to Ah1							
		Ag1		moderately well			L	4.1-5.0			
	chromi-haplic	Ah1	Lusaka	well	60-120	7.5yr-5yr5/6	SL	4.1-4.5	10-35	1-2	50-80
	areni-haplic	Aa1	Western	excessively			L	4.1-4.5			
	association orthi-e stagni-ferallic	AA1		well			L-C	4.1-4.5			
		AA1		moderate-imperfectly			L-C	4.1-4.5			
2 Arenosols											
	umbric	Au1	Luapula	well	120->200	10YR3/3-5/4	SL	4.1-4.5	10-35	1-2	50-80
	haplic	Ue1	Northern	well	120->200	7.5yr-5yr5/6	SL-LS	4.1-4.5	10-35	1-2	50-80
	pisi-haplic	Ue2		well	60-120	5YR-2.5YR4/8	SL-SCL	4.6-5.5	10-75	2-8	50-80
	chromi-haplic	Ue3	Eastern		60-90		L-C	4.6-5.5			
	chromi-haplic	Le1					L-C	4.6-5.0			
	chromi-haplic	Le1					C	4.6-5.5			
	association chromi-h entric	Le1		soils similar to Le3							
		Le1		soils similar to fe1							
	complex chromic xerti	LB1					C	4.6-5.5			
		LB1					C	5.1-5.5			
	chromi-haplic	Ue1	Lusaka	well-moderately	90-120	7.5YR5/8	SL-SCL	4.1-4.5	10-35	1-4	-
3 Lixisols											
	chromi-haplic	Le1	Central				L-C	4.6-5.0			
	haplic	Le1	Lusaka	well-moderately	90->200	2.5YR4/8-7.5YR5/6	SL	4.6-5.0	35-75	1-2	20-50
4 Luvisols											
	rhodi-haplic	Le1	Northern	well	90->200	2.5YR3/6	SL-SCL	4.6-5.0	35-75	2-4	-
	complex-xerti	LN1	N-Western	well-moderately	90-120	10yr3/4-7.5yr3/2	CL	4.6-5.5	35-75	2-8	20-50
	association orthi-chromic	Le1			60-120		C	4.6-5.0			
	chromic	Le1	Central				C	4.6-5.0			
	chromic	Le1	Lusaka	well	90->200	5YR4/4-10YR4/4	SL-SCL	5.1-5.5	>75	>8	-
	calcic-dystric	Le1		well-moderately	90-200	5YR4/6-7.5YR5/4	LS-SCL	7.5-8.0	>75	4-8	-
5 Cambisols											
	chromic	Be1	Northern	well-moderately	90->200	7.5YR4/6	L-SL	5.1-6.0	35-75	1-4	-
	chromic-dystric	Be1		well	60-120	7.5YR-5YR5/8	SL	4.1-5.0	35-75	2-4	-
	ferrali-chromic	Be1	N-Western		30-200		C	4.1-4.5			
	ferralic-chromic	Be1	Copperbelt	well	30-200	7.5YR-5YR5/8	CL	4.1-4.5	10-35	2-8	50-80
	chromic-eutric	Be1	Eastern		60-120		L	4.1-5.0			
	chromic-eutric	Bf1		soils similar to Be1			L	4.1-5.0			
	eutric	Bf1			<30-60		L	4.1-5.0			
	chromic-eutric	Be1	Lusaka	well	60-120	5YR4/6	SCL-SL	4.1-5.0	35-75	4-8	-
6 Phaeozems											
	haplic	Ho1	Luapula	well	>200	10YR5/3	LS	6.4-7.4	>75	2-8	-
	haplic	Ho1	Copperbelt	moderately well	120-200	10YR4/2-5/2	SCL	5.6-6.3	35-75	2-8	-
	chromi-haplic	Ho1	Eastern				C	4.6-5.5			
	nitri-luvic	Ho1	Lusaka	well	90-200	7.5YR-5YR3/4	SL-SCL	4.1-5.5	35-75	4-8	<20
7 Fersialsols											
	rhodi-umbric	Fu1	Luapula	well	90->200	2.5YR3/6	SCL-C	4.1-5.0	10-35	1-4	50-80
	haplic	Fa1	Northern	well	90-200	7.5YR-5YR5/8	CL-SCL	4.1-4.5	<10	1-2	>80
	xanthic	Fx1		well	>200	7.5YR5/8	SCL-SL	3.5-4.5	<10	1-2	50-80
	rhodi-akric	Fa1	N-Western				C	4.1-4.5			
	luvi-akri rhodic	Fo1					C	4.1-4.5			
	pisi-rhodic	Fr2			90-200		C	4.1-4.5			
	akri-rhodic	Fc4					C	4.6-5.0			
	association akri rhodic orthi-umbric	Fg1		soils similar to Fr4							
		Fg1		soils similar to Gu3							
	akri-xanthic	Fx1			120->200		C	3.5-5.0			
	akri-xanthic	Fx2		well-moderately			L	3.5-4.0			
	akri-haplic	Fa1			120-200		C	4.1-4.5			
	xanthic	Fx1	Copperbelt	well-moderately	120-200	10YR5/6	C	4.6-5.0	35-75	1-4	50-80
	rhodic	Fr1		well	>200	2.5YR3/6-2.5YR4/8	SCL	4.6-5.0	10-35	1-4	50-80
	rhodic haplic	Fr2		well	>200	2.5YR4/6	CL-C	4.1-5.0	<10-35	1-2	50-80
	association haplic	Fh1		well	120-200	7.5YR5/8-5YR5/8	SC-CL	4.1-4.5	<10	<1-2	50-80
	complex luvi	Ff1		well	120-200	7.5YR5/8-5YR5/8	HC-SC	4.1-4.5	10-35	<1-2	50-80
8 Nitisols											
	dystri-rhodic	Nr1	Copperbelt	well	120->200	2.5YR2/6-5YR5/8	C	4.1-5.0	35->75	2-8	-
9 Arenosols											
	ferralic	Qf1	Luapula	well	>200	7.5YR4/6	LS	4.1-5.0	10-35	1-2	50-80
	ferralic	Qf2		poorly	>200	10YR6/4-6/6	SL	4.1-5.0	10-35	1-2	-
	association ferralic	Qs1		soils similar to Qf1							

Table 1-15 Soil Properties of Suitable Soil Series (2/2)

Suitable Soil Series	Soil Groups		Province	Drained	Effective Depth (cm)	Soil Colour	Structured Top-Soil	Acidity PH(cf)	Leaching base saturation(%)	Nutrient Retention Capacity	Aluminium Saturation (%)
	dystric	Qd1		soils similar to Id1							
	gleyic	Qg1		imperfectly	>200	10YR6/2-8/1	S	4.6-5.5	10-35	1-2	-
	ferralic	Qf1	Northern	well	>200	5YR4/4-2.5YR3/6	S-L	4.1-5.0	10-35	1-2	50-80
	ferralic	Qf2		excessively	>200	10YR5/6-7.5YR5/6	LS	3.5-4.5	10-35	1-2	50-80
	ferralic	Qf3		well	50-120	7.5YR5/8	LS	4.1-4.5	10-35	1-2	50-80
	gleyic	Qg1		poorly-imperfectly	>200	10YR-7.5YR3/5	LS	4.6-5.0	10-35	1-2	50-80
	association fluvic	Qw1		well	90-200	5YR-2.5YR4/6	LS	4.6-5.5	10-75	1-4	20-80
	gleyic	Qg1	N-Western	imperfectly	120->200		S	4.5-5.0			
	association gleyic orthi-dystric	Qg1		soils similar to Qg1							
		Qg1		soils similar to Qd1			S	3.5-4.5			
	albic	Qa1		excessively			L	3.5-4.5			
	chromic-ferralic	Qf1		excessively							
	association chromi-fe chromi-haplic	Qw1		soils similar to Qf1							
		Qw1		soils similar to Afh1							
	gleyic	Qg1	Central	poorly-imperfectly			L	4.6-5.0			
	orthi-ferralic	Qf1	Western	excessively			S	4.1-4.5			
	orthi-albic	Qa1		excessively			S	3.5-4.0			
	orthi-gleyic	Qg1		imperfectly			S	3.5-4.0			
	association orthi-g podi-ferralic	QQ1		soils similar to Qg1			S	3.5-4.0			
		QQ1		excessively			S	3.5-4.0			
10	Gleysols										
	umbric	Gu1	Luapula	poorly	120-200	10YR3/1	L-SCL	4.6-5.0	10-75	2-4	20-80
	umbric	Gu2		poorly-very poorly	120-200	10YR5/2-6/1	L	3.5-4.5	10-35	1-4	-
	dystric	Gd1		very poorly	60->200	10YR6/2	SL-SCL	4.1-4.5	10-35	1-4	-
	fluvi-dystric	Gd2		poorly	120-200	10YR6/1	SC	4.1-5.0	35-75	1-4	50-80
	dystric	Gd1	Northern	poorly-very poorly	>200	10YR6/2-2.5YR7/3	SL-SCL	3.5-4.0	10-35	2-8	20-80
	dystric	Gd2		poorly	120-200	10YR7/1	SCL	4.6-5.5	35-75	4-8	-
	dystric	Gd3		poorly	120-200	7.5YR5/2	SCL-CL	4.1-5.0	10-35	1-2	50-80
	dystric	Gd4		poorly	>200	10YR5/4	LS-S	4.1-4.5	10-35	1-2	50-80
	umbric	Gu2		poorly	>200	2.5Y5/2	SL-SCL	4.1-5.0	10-35	1-2	50-80
	fluvi-mollic	GG1	N-Western	complex of poorly			C	4.6-5.5			
	fluvi-umbric	Gu1		very poorly			C	4.6-5.0			
	association fluvi-umbric fluvi-dystric	GG2		soils similar to Gu1							
		GG2		soils similar to Gu1							
	orthi-dystric	Gd1		poorly			S	4.1-5.0			
	fluvi-dystric	Gd2		poorly			CL	4.1-5.0			
	umbric	Gu1	Copperbelt	poorly	120-200	2.5Y5/6	CL	3.5-4.5	10-35	1-4	20-80
	mollic	Gm1		poorly	120-200	5Y5/1	SC-C	5.5-6.5	-	2-8	-
	mollic	Gm2		very poorly	120-200	2.5Y5/5	C	7.5-8.0	-	2-8	-
	dystric	Gd1		poorly	120-200	10YR6/1-8/1	SCL-SC	4.1-4.5	10-35	1-2	50-80
	vertic-mollic	Gm1	Eastern	poorly			C	6.9-8.0			
	dystric	Gd1	Central				L	4.1-4.5			
	umbric	Gu1		very poorly			L	4.1-4.5			
	association eutric dystric	OU1					C	6.4-6.8			
		QU1		soils similar to Id1	<30-60		L	4.1-5.0			
	association orthi-eutric orthi-fibric	GH1	Western	poorly-imperfectly	60-200		S	3.5-4.0			
		GH1		very poorly			S	<3.5			
	complex orthi-umbric orthi-fibric			poorly			S-L				
				very poorly			S	<3.5			
11	Vertisols										
	complex calci/ vertic	Vl1	Northern	poorly-imperfectly	120-200	10YR3/2	C	5.6-6.8	35->75	4->8	20-80
		Vl1		moderately well	60-90	5YR3/4-10YR5/4	SCL	5.6-6.3	35-75	2-8	50-80
	calcaric	Vk1	Copperbelt	poorly	120-200	2.5YN5/2-2.5Y5/2	C	6.9-7.4	>75	>8	-
	pellic	Vp1		poorly	>200	2.5Y5/2-5Y4/1	C	4.1-5.5	>75	>8	-
	eutric	Ve1		very poorly	120-200	10YR3/1	SCL-SL	4.6-5.5	35-75	4-8	-
	association pellic dystric	Vf1		soil similar to Vd1							
		Vy1		soil similar to Id2							
	eutric	Ve1	Eastern	poorly			C				
	association eutric chromi-luvic	VH1		soil similar to Ve1							
		VH1			120-200		L	4.6-5.5			
	complex calcaric chromi-haplic	VL1		poorly-imperfectly			C	6.4-6.8			
		VL1		soil similar to Le1				5.6-6.3			
	eutric	Ve1	Central	poorly			C				
	complex calcaric	VB1		poorly-imperfectly			C	5.6-6.8			
		VB1			60-90		C	5.6-6.3			
	association eutric	VU1		poorly			C	5.6-6.3			
		VU1					C	5.6-6.3			
	eutric	Ve1	Lusaka	poorly	120-200	10YR3/1-5YR3/2	C	6.9-7.4	>75	>8	-
	association calcic haplic	Vw1		poorly		5YR3/1	L-CL	5.1-6.3	-	>8	-
		Vw1		well-moderately	90-120	10YR4/4-2.5YR5/8	SCL-CL	5.6-6.3	-	1-4	-
12	Fluvisols										
	eutric	Je1	Luapula	very poorly	120-300	10YR6/2	SCL	4.1-5.0	35-75	1-2	50-80
	eutric	Je1	Eastern	imperfectly			L-C	5.1-7.4			
	association eutric calcaric	JL1					C	5.6-6.3			
		JL1					L	5.6-6.3			
	eutric	Je1	Central				L-C	4.6-5.8			
	complex gleyi-dystric orthi-calcic	Je1	Western	moderately well			L	4.6-5.0			
		Je1		imperfectly			L	6.9-7.4			
	eutric	Je1	Lusaka	well-imperfectly	90->300	10YR4/4-7.5YR3/4	CL	5.1-7.4	>75	>8	-

(Data Source)
Map Unit Description on Soil Survey Report, Soil Survy Unit Research Branch, Department of Agriculture 1987.

(Note)
1) Effective Depth (cm) Shallow <30, Moderately shallow 30-60, Moderately deep 60-90, Deep 90-120, Very deep 120-200, Extremely deep >200
2) Acidity (pH in KCl): Extremely acid <3.5, Very strongly acid 3.5-4.0, Strongly acid 4.1-4.5, Moderately acid 4.6-5.0, Slightly acid 5.1-5.5
3) Alkalty (pH in KCl): Neutral 6.9 - 6.6-6.8 mildly alkaline 6.9-7.4 moderately alkaline 7.5-8.0 strongly alkaline >8.0 very strongly alkaline
4) Leaching (base saturation in %) <10 very strongly leached 10-35 strongly leached 35-75 moderately leached >75 non-leached
5) Nutrient retention capacity(RCEC in meq/100g soil) <1 extremely low 1-2 low, 2-4 medium, 4-8 high, >8 very high
Aluminium Saturation(%) <20 low 20-50 moderately high, 50-80 high, >80 extremely high

1.2 Social Background of Agriculture

1.2.1 Agricultural Population

Agricultural survey was conducted in 1990 by CSO, and the results are reported in the National Census of Agriculture (1990/92). In this survey, agricultural households and economically active population were surveyed. Agricultural population in this study refers to this Census.

(1) Agricultural Households

(a) Number of Agricultural Households and Farming Size

The national total of agricultural households in 1990 was 520,520 as shown in Table 1-16.
As show in Table 1-16, average farming size is 2.22ha per household in Zambia in 1990. Farming size differs by province. The largest farming size is 5.78ha in Southern province, and followed by Central as 3.34ha, Lusaka as 2.94ha, and Eastern as 2.53ha. These four provinces exceed national average farming size. Other five provinces are below national average in farming size. Luapula and North-western are particularly much less than national average as 0.63ha and 0.80ha respectively.
On the other hand, minimum required farming size is estimated at 1.86ha from a viewpoint of farm income. Therefore, former four provinces exceed minimum required farming size, and later five provinces are below minimum required farming size.

Table 1-16 Cultivated Area per Household

Province	Planted Area in 1990	Households in 1990	Cultivated Area per Household
	(ha)	(holds)	(ha)
10 Lusaka	39,082	13,305	2.94
20 Copperbelt	39,123	24,108	1.62
30 Central	165,844	49,683	3.34
40 N/Western	31,847	39,788	0.8
50 Western	65,916	47,951	1.37
60 Southern	332,459	57,491	5.78
70 Luapula	43,026	68,206	0.63
80 Northern	102,554	88,186	1.16
90 Eastern	334,049	131,802	2.53
Total	1,153,900	520,520	2.22

(b) Categories of Agricultural Households

Agricultural households are categorised into three sizes by scale of farming, namely Small, Medium and Large-scale households. Definition of farming scale is as follows;

- Small-scale farmers (households):
  All those farmers engaged in small-scale farming systems that include hand hoe, ox cultivation (either owned or hired oxen), produce mainly for home consumption and employing low input level of technology. These farmers predominantly depend on family labour for most farm operations. They rear mostly local or indigenous

livestock breeds under traditional or semi-traditional husbandry e.g. communal and range grazing, mixed cropping patterns, etc.

-Medium-scale farmers (households):

All those farmers engaged in semi-intensive farming systems that involve partial mechanisation, extensive use of draught power, mixed farming or less specialised farming and employ medium input level of technology. They rear livestock under semi-intensive husbandry and employ improved management e.g. grazing in paddocks and some form of sales schedules. The category incorporates farmers producing a wide range of crops and livestock partly for home consumption and partly for sale.

- Large-scale farmers (households)

All those farmers engaged in large-scale intensive farming systems that often include extensive mechanisation, specialised farming, use of high level technology and management, rearing of mostly exotic or improved breeds, use of high levels of purchased inputs and relying heavily on permanent and casual labour for farm operations. This category incorporates farmers that produce specialised crops and/or rear intensive poultry, pigs, dairy and beef ranching predominantly for sale.

As shown in Table 1-18, most (92%) households are involved in small-scale farming. Medium-scale households comprise 7%, and large-scale households comprise only 0.4% of total households. Large-scale households share high proportion of 1.7% in Central, 0.9% in Lusaka and 0.8% in Southern Province. Medium-scale households share much higher proportion in Southern and Central Provinces at 16.7% and 14.3% respectively. Small-scale households are particularly high in North-western and Luapula Provinces exceeding 97%.

(c) Male headed and Female headed Households

Of the total households, 442,561 households (85%) were headed by males and 77,959 (15%) headed by females. (see Table 1-20 and -21) Family sizes averaged 6 members in male headed households and 5 members in female headed households. Therefore, total population is estimated as around 3,045,000 persons in agricultural sector. It comprised about 41% of national population of 7,383,000 in 1990.

(d) Type of Households by Activities

Almost all (85.5%) households rear poultry or livestock, but only about 14.5% produce crops. Specialised households, such as livestock only, poultry only or livestock and poultry, are involved in large or medium-scale households.

(2) Economically Active Members of Agricultural Households

Economically active members, classified as either sex above the age of 12 working or seeking work, were surveyed at 1,115,112 in 1990 as shown in Table 1-17. Of the total economically active members, 613,569 (55%) are males and 501,543 (45%) are females as shown in Table 1-19. In case taking female farming capacity as at 50% of male, total farming population becomes 864,343.

When comparing the planted area of crops, per capita cultivated land is extremely high at 2.5 ha (or 3.15 ha) in Southern Province, and lower in Luapula, North-Western, Northern and Copperbelt at less than 1.0 ha per capita. In this sense, northern provinces have a high potential for expansion of cultivation in future. Average per capita cultivated area is 1.03 ha (or 1.34 ha) in national level. Number of active member per household re 2.14 (or 1.66) in the same level.

Table 1-17 Number of Economically Active Population and Cultivated Area

(as of 1990)

Province	Cultivated Area	Economically Active Population				Per Farmer Cultivated Area (ha/Farmer)		Active Member per Household	
	(ha)	Total (1)	Total (2)	Male	Female	for (1)	for (2)	for (1)	for (2)
Lusaka	39,082	33,402	26,060	18,717	14,685	1.17	1.50	2.51	1.96
Copperbelt	39,123	60,594	47,269	33,943	26,651	0.65	0.83	2.51	1.96
Central	165,844	120,986	95,681	70,375	50,611	1.37	1.73	2.44	1.93
N/Western	31,847	77,269	59,420	41,571	35,698	0.41	0.54	1.94	1.49
Western	65,916	95,307	72,476	49,644	45,663	0.69	0.91	1.99	1.51
Southern	332,459	133,022	105,574	78,126	54,896	2.50	3.15	2.31	1.84
Luapula	43,026	109,826	86,585	63,343	46,483	0.39	0.50	1.61	1.27
Northern	102,554	181,935	141,181	100,427	81,508	0.56	0.73	2.06	1.60
Eastern	334,049	302,771	230,097	157,423	145,348	1.10	1.45	2.30	1.75
Total	1,153,900	1,115,112	864,343	613,569	501,543	1.03	1.34	2.14	1.66

(Note)

1) Total 1: Total of all economically active population.

2) Total 2: counting female as 50% for farming activity.

3) Number of households are referring to Table 1-16.

Table 1-18 Distribution of Agricultural Households by Type of Activity and by Scale of Farming

Code	Scale of Agricultural Households				Type of Agricultural Activity						
District/ Province	Small	Medium	Large	Total	Crops Only	Livestock Only	Poultry Only	Crops and Livestock	Crops and Poultry	Livestock and Poultry	Crops, Livestock and Poultry
11 Lusaka Urban	216	45	17	279	107	12	35	23	43	12	47
12 Lusaka Rural	10,313	621	99	11,033	1,147	86	967	456	3,999	454	3,924
13 Luangwa	1,964	29	0	1,993	116	6	202	94	465	158	972
21 Ndola Urban	247	48	6	301	141	7	10	18	72	14	39
22 Ndola Rural	18,214	657	32	18,903	2,820	64	421	780	9,892	297	4,629
23 Chililabombwe	526	155	1	682	335	1	4	160	74	1	107
24 Chingola	663	36	9	708	347	23	7	38	176	18	99
25 Mufulira	1,587	51	4	1,642	748	18	131	11	637	44	53
26 Kalulushi	531	294	3	828	299	18	10	17	177	4	303
27 Kitwe	231	31	1	263	77	17	14	6	44	8	97
28 Luanshya	681	93	7	781	109	5	46	47	317	41	222
31 Kabwe Urban	315	82	25	422	166	14	7	102	34	5	94
32 Kabwe Rural	12,526	3,491	409	16,426	1,981	320	323	1,508	3,452	630	8,212
33 Mumbwa	8,607	1,966	163	10,736	860	34	240	285	3,156	251	5,910
34 Mkushi	8,626	1,014	241	9,881	1,469	65	533	330	3,502	234	3,748
35 Serenje	11,659	538	21	12,218	1,451	2	154	172	8,300	57	2,132
41 Solwezi	9,639	401	7	10,047	2,187	45	181	384	5,189	110	1,948
42 Mwinilunga	10,628	98	11	10,737	2,590	25	323	789	4,100	65	2,846
43 Zambezi	7,056	91	7	7,154	1,405	200	99	705	1,950	219	2,576
44 Kabompo	5,352	156	12	5,520	1,068	41	44	479	1,836	99	1,953
45 Mufumbwe	2,250	32	0	2,312	587	0	16	21	1,568	1	89
46 Kasempa	3,943	71	4	4,018	1,013	2	57	37	2,717	2	190
51 Mongu	7,664	563	18	8,245	2,147	137	137	615	2,838	204	2,167
52 Lukulu	3,232	107	2	3,341	744	30	83	270	1,034	81	1,099
53 Kalabo	10,074	602	3	10,679	2,762	112	96	847	3,221	189	3,452
54 Kaoma	8,949	492	30	9,471	2,350	25	187	593	3,735	166	2,365
55 Senanga	10,097	1,355	13	11,465	2,209	304	294	1,143	2,678	535	4,699
56 Sesheke	3,667	659	24	4,350	740	41	26	316	1,252	157	1,818
61 Livingstone	223	19	8	250	43	9	60	17	64	16	41
62 Namwala	4,442	875	15	5,332	190	77	169	198	745	494	3,459
63 Mazabuka	5,549	1,365	206	7,120	427	59	192	457	1,009	350	4,626
64 Monze	5,338	1,079	42	6,459	256	55	51	419	593	412	4,643
65 Choma	10,560	1,962	37	12,559	493	27	278	302	2,681	494	8,884
66 Kalomo	10,886	3,189	134	14,209	774	66	246	436	2,053	596	10,038
67 Siavonga	2,915	446	4	3,365	569	33	70	338	733	82	1,540
68 Gwembe	2,707	374	2	3,083	200	55	37	245	437	278	1,828
69 Sinazongwe	4,678	431	5	5,114	344	51	202	312	675	424	3,106
71 Mansa	15,354	507	13	15,874	3,875	23	267	356	8,603	67	2,683
72 Nchelenge	14,211	190	11	14,412	3,869	25	607	253	8,160	84	1,414
73 Kawambwa	13,625	537	16	12,178	2,311	35	411	148	7,564	66	1,633
74 Mwense	13,665	292	4	13,961	3,128	19	280	317	7,948	70	2,199
75 Samfya	11,554	219	8	11,781	3,318	43	313	499	5,029	143	2,431
81 Kasama	14,946	1,694	56	16,696	2,310	26	157	482	8,317	164	5,240
82 Kaputa	3,015	228	5	3,248	669	1	43	34	2,401	1	99
83 Mbala	13,168	1,716	19	14,903	1,811	36	535	433	7,369	292	4,426
84 Mporokoso	6,216	246	10	6,472	681	5	153	104	3,839	58	1,632
85 Luwingu	6,854	385	7	7,246	618	10	102	146	3,423	105	2,842
86 Chilubi	3,807	46	2	3,855	863	11	67	149	1,935	29	801
87 Isoka	12,417	1,076	13	13,506	906	28	223	202	7,146	337	4,664
88 Chinsali	9,904	451	15	10,370	1,042	8	116	285	5,217	117	3,585
89 Mpika	11,334	546	10	11,890	1,647	14	132	126	8,281	52	1,638
91 Chipata	31,941	1,344	44	33,329	4,036	235	605	1,917	9,521	580	16,435
92 Chama	8,184	25	0	8,209	952	0	233	5	6,938	0	81
93 Lundazi	23,549	1,988	83	25,620	2,819	33	566	662	12,956	215	8,369
94 Chadiza	8,570	864	6	9,440	644	32	89	655	1,643	145	6,232
95 Katete	20,009	792	62	20,863	1,773	54	94	1,459	3,378	276	13,829
96 Petauke	32,609	1,686	46	34,341	2,835	178	603	1,812	7,136	564	21,193
10 Lusaka	12,493	696	116	13,305	1,370	104	1,204	573	4,507	654	4,893
20 Copperbelt	22,680	1,365	63	24,108	4,870	153	643	1,077	11,389	417	5,559
30 Central	41,733	7,091	859	49,683	5,927	435	1,257	2,343	18,444	1,177	20,096
40 N/Western	38,898	849	41	39,788	8,850	316	719	2,415	17,390	496	9,602
50 Western	43,683	4,178	90	47,951	10,952	699	823	3,784	14,758	1,335	15,600
60 Southern	47,298	9,740	453	57,491	3,326	432	1,305	2,723	8,390	3,146	38,165
70 Luapula	66,409	1,745	52	68,206	16,501	125	1,908	1,573	37,304	435	10,360
80 Northern	81,661	6,388	137	88,186	10,547	139	1,529	1,561	47,928	1,155	24,927
90 Eastern	124,862	6,699	241	131,802	13,059	532	2,190	6,510	41,572	1,800	66,139
Zambia	479,717	38,751	2,052	520,520	75,402	2,935	11,578	22,567	201,682	10,615	195,341
Ratio by Categories											
10 Lusaka	93.9%	5.2%	0.9%	100%	10.3%	0.8%	9.0%	4.3%	33.9%	4.9%	36.8%
20 Copperbelt	94.1%	5.7%	0.3%	100%	20.2%	0.6%	2.7%	4.5%	47.2%	1.7%	23.1%
30 Central	84.0%	14.3%	1.7%	100%	11.9%	0.9%	2.5%	4.7%	37.1%	2.4%	40.4%
40 N/Western	97.8%	2.1%	0.1%	100%	22.2%	0.8%	1.8%	6.1%	43.7%	1.2%	24.1%
50 Western	91.1%	8.7%	0.2%	100%	22.8%	1.5%	1.7%	7.9%	30.8%	2.8%	32.5%
60 Southern	82.3%	16.9%	0.8%	100%	5.8%	0.8%	2.3%	4.7%	14.6%	5.5%	66.4%
70 Luapula	97.4%	2.6%	0.1%	100%	24.2%	0.2%	2.8%	2.3%	54.7%	0.6%	15.2%
80 Northern	92.6%	7.2%	0.2%	100%	12.0%	0.2%	1.7%	2.2%	54.3%	1.3%	28.3%
90 Eastern	94.7%	5.1%	0.2%	100%	9.9%	0.4%	1.7%	4.9%	31.5%	1.4%	50.2%
Zambia	92.2%	7.4%	0.4%	100%	14.5%	0.6%	2.2%	4.4%	38.7%	2.0%	37.5%

Source: National Census of Agriculture (1990/92), CSO

Table 1-19 Number of Economically Active Members of Agricultural Households

(as of 1990)

Code	District/ Province	Total Population	Number of Economically Active Population			
			Male		Female	
			Number	(%)	Number	(%)
11	Lusaka Urban	1,533	845	55	688	45
12	Lusaka Rural	27,562	15,838	57	11,724	43
13	Luangwa	4,307	2,034	47	2,273	53
21	Ndola Urban	1,282	719	56	563	44
22	Ndola Rural	46,972	25,554	54	21,418	46
23	Chililabombwe	918	630	69	288	31
24	Chingola	2,741	1,636	60	1,105	40
25	Mufulira	3,692	2,368	64	1,324	36
26	Kalulushi	2,438	1,540	63	898	37
27	Kitwe	1,122	634	57	488	43
28	Luanshya	1,429	862	60	567	40
31	Kabwe Urban	1,627	928	57	699	43
32	Kabwe Rural	38,418	23,584	61	14,834	39
33	Mumbwa	23,727	14,620	62	9,107	38
34	Mkushi	22,698	13,350	59	9,348	41
35	Serenje	34,516	17,893	52	16,623	48
41	Solwezi	21,537	11,902	55	9,615	45
42	Mwinilunga	20,661	10,619	51	10,042	49
43	Zambezi	13,439	7,299	54	6,140	46
44	Kabompo	10,915	5,951	55	4,964	45
45	Mufumbwe	4,537	2,390	53	2,147	47
46	Kasempa	6,200	3,410	55	2,790	45
51	Mongu	15,112	7,514	50	7,598	50
52	Lukulu	5,908	3,365	57	2,543	43
53	Kalabo	17,164	8,127	47	9,037	53
54	Kaoma	26,624	14,553	55	12,071	45
55	Senanga	23,894	12,433	52	11,461	48
56	Sesheke	6,605	3,652	55	2,953	45
61	Livingstone	1,153	642	56	511	44
62	Namwala	12,598	7,509	60	5,089	40
63	Mazabuka	14,971	9,486	63	5,485	37
64	Monze	12,722	7,639	60	5,083	40
65	Choma	29,052	16,627	57	12,425	43
66	Kalomo	33,861	20,048	59	13,813	41
67	Siavonga	9,924	5,145	52	4,779	48
68	Gwembe	6,112	3,909	64	2,203	36
69	Sinazongwe	12,629	7,121	56	5,508	44
71	Mansa	27,513	15,138	55	12,375	45
72	Nchelenge	21,885	14,154	65	7,731	35
73	Kawambwa	18,647	11,512	62	7,135	38
74	Mwense	20,840	11,333	54	9,507	46
75	Samfya	20,941	11,206	54	9,735	46
81	Kasama	38,564	19,978	52	18,586	48
82	Kaputa	6,723	4,247	63	2,476	37
83	Mbala	29,660	17,001	57	12,659	43
84	Mporokoso	13,077	6,951	53	6,126	47
85	Luwingu	12,630	7,270	58	5,360	42
86	Chilubi	6,573	3,319	50	3,254	50
87	Isoka	24,375	14,127	58	10,248	42
88	Chinsali	21,343	12,508	59	8,835	41
89	Mpika	28,990	15,026	52	13,964	48
91	Chipata	73,235	40,529	55	32,706	45
92	Chama	18,731	8,653	46	10,078	54
93	Lundazi	74,401	34,328	46	40,073	54
94	Chadiza	17,645	10,797	61	6,848	39
95	Katete	43,698	24,469	56	19,229	44
96	Petauke	75,061	38,647	51	36,414	49
10	Lusaka	33,402	18,717	56	14,685	44
20	Copperbelt	60,594	33,943	56	26,651	44
30	Central	120,986	70,375	58	50,611	42
40	N/Western	77,269	41,571	54	35,698	46
50	Western	95,307	49,644	52	45,663	48
60	Southern	133,022	78,126	59	54,896	41
70	Luapula	109,826	63,343	58	46,483	42
80	Northern	181,935	100,427	55	81,508	45
90	Eastern	302,771	157,423	52	145,348	48
	Zambia	1,115,112	613,569	55	501,543	45

Source: National Census of Agriculture (1990/92), CSO

Table 1-20 Number of Male headed Agricultural Households by Size of Household

Code District/ Province	Total of Households	Size of Household					Average Size of Households
		1 person	2 - 3 persons	4 - 5 persons	6 - 9 persons	10 and more persons	
11 Lusaka Urban	257	4	22	47	89	95	7
12 Lusaka Rural	9,231	359	1,119	1,572	3,749	2,432	7
13 Luangwa	1,619	34	282	457	661	179	6
21 Ndola Urban	271	15	41	42	88	85	7
22 Ndola Rural	15,621	410	3,171	3,659	5,739	2,642	6
23 Chililabombwe	521	4	86	33	124	274	8
24 Chingola	544	1	0	2	1	540	10
25 Mufulira	1,508	81	173	374	591	289	6
26 Kalulushi	783	14	125	70	217	357	7
27 Kitwe	249	6	113	32	50	48	5
28 Luanshya	649	2	59	63	390	135	7
31 Kabwe Urban	377	18	48	70	134	107	7
32 Kabwe Rural	14,924	205	1,515	2,754	5,519	4,931	7
33 Mumbwa	9,604	85	796	1,462	3,370	3,891	8
34 Mkushi	8,808	105	1,264	1,627	3,603	2,209	7
35 Serenje	9,908	60	1,234	2,180	4,127	2,307	7
41 Solwezi	8,984	158	1,730	1,790	2,922	2,384	6
42 Mwinilunga	9,305	138	1,723	2,015	3,597	1,832	6
43 Zambezi	6,310	95	1,183	1,526	2,265	1,241	6
44 Kabompo	4,844	54	801	925	1,824	1,240	7
45 Mufumbwe	2,039	27	405	519	714	374	6
46 Kasempa	3,296	57	375	701	1,273	890	7
51 Monga	6,671	112	1,058	1,405	2,593	1,503	7
52 Lukulu	2,840	0	2	5	4	2,829	10
53 Kalabo	8,529	139	1,561	2,236	3,191	1,402	6
54 Kaoma	7,575	5	37	27	53	7,473	10
55 Senanga	9,948	107	1,406	2,239	3,854	2,342	7
56 Sesheke	3,694	51	789	764	1,441	649	6
61 Livingstone	189	9	18	29	77	56	7
62 Namwala	4,992	47	480	710	1,585	2,170	8
63 Mazabuka	6,358	46	420	775	2,141	2,976	8
64 Mooze	6,007	28	348	690	1,893	3,043	8
65 Choma	21,461	205	992	1,942	4,109	4,213	7
66 Kalomo	12,988	202	1,597	2,293	4,225	4,671	7
67 Siavonga	2,887	21	425	598	1,105	738	7
68 Gwembe	2,877	13	264	578	1,086	936	7
69 Sinazongwe	4,608	44	540	870	1,601	1,553	7
71 Mansa	13,417	287	2,746	3,709	5,202	1,473	6
72 Nchelenge	11,876	251	2,940	3,432	4,159	1,094	5
73 Kawambwa	9,800	237	2,231	2,665	3,749	918	6
74 Mwense	10,979	285	2,761	3,215	3,837	880	5
75 Samfya	9,295	115	1,945	2,863	3,472	900	6
81 Kasama	14,540	189	2,863	3,931	5,538	2,019	6
82 Kapata	2,862	26	523	694	1,229	390	6
83 Mbala	13,010	140	2,737	3,523	4,813	1,797	6
84 Mporokoso	5,564	45	1,143	1,353	2,225	798	6
85 Luwingu	6,280	39	1,094	1,901	2,439	807	6
86 Chilubi	2,977	32	631	916	1,158	240	6
87 Isoka	11,615	68	2,068	2,765	4,722	1,992	6
88 Chinsali	8,864	75	1,705	2,356	3,549	1,179	6
89 Mpika	9,920	116	1,849	2,576	3,933	1,446	6
91 Chipata	27,591	608	5,760	6,998	9,455	4,770	6
92 Chama	7,092	34	1,692	1,904	2,774	688	6
93 Lundazi	23,436	359	4,395	6,159	8,516	4,007	6
94 Chadiza	8,142	142	2,234	1,852	2,866	1,048	6
95 Katete	17,300	309	3,863	4,610	6,758	1,760	6
96 Petauke	26,725	558	5,244	6,791	10,259	3,873	6
10 Lusaka	11,107	397	1,423	2,076	4,505	2,706	7
20 Copperbelt	20,146	533	3,768	4,275	7,200	4,370	6
30 Central	43,621	473	4,857	8,093	16,753	13,445	7
40 N/Western	34,778	529	6,217	7,476	12,595	7,961	6
50 Western	39,257	414	4,833	6,676	11,136	16,198	7
60 Southern	52,367	615	5,084	8,485	17,827	20,356	7
70 Luapula	55,367	1,175	12,623	15,885	20,419	5,265	6
80 Northern	75,632	730	14,613	20,015	29,606	10,668	6
90 Eastern	110,286	2,010	23,188	28,314	40,628	16,146	6
Zambia	442,561	6,876	76,606	101,295	160,669	97,115	6

Source: National Census of Agriculture (1990/92), CSO

Table 1-21 Number of Female headed Agricultural Households by Size of Household

Code	District/ Province	Total of Households	Size of Household					Average Size of Households
			1 person	2 - 3 persons	4 - 5 persons	6 - 9 persons	10 and more persons	
11	Lusaka Urban	22	1	7	3	9	2	5
12	Lusaka Rural	1802	78	187	429	589	519	7
13	Luangwa	374	34	91	113	116	20	5
21	Ndola Urban	30	1	7	5	11	6	6
22	Ndola Rural	3282	409	717	720	1118	318	5
23	Chililabombwe	161	0	2	5	7	147	10
24	Chingola	164	0	0	0	0	164	10
25	Mufulira	134	13	23	25	59	14	6
26	Kalulushi	45	3	6	8	16	12	7
27	Kitwe	14	3	1	5	4	1	5
28	Luanshya	132	4	14	4	10	100	9
31	Kabwe Urban	45	7	8	8	18	4	5
32	Kabwe Rural	1502	52	293	363	526	268	6
33	Mumbwa	1132	63	159	205	415	289	7
34	Mukshi	1073	32	272	198	383	188	6
35	Serenje	2310	81	363	529	888	449	6
41	Solwezi	1063	161	255	245	288	114	5
42	Mwinilunga	1432	201	390	334	383	124	5
43	Zambezi	844	154	270	192	171	57	4
44	Kabompo	676	84	188	144	188	72	5
45	Mufumbwe	273	29	80	58	78	28	5
46	Kasempa	722	74	100	157	267	124	6
51	Mongu	1574	148	433	449	398	166	5
52	Lukulu	501	0	1	0	1	499	10
53	Kalabo	2150	267	618	603	522	140	5
54	Kaoma	1895	0	2	3	4	1887	10
55	Senanga	1917	176	465	469	613	194	5
56	Sesheke	656	65	165	167	157	102	5
61	Livingstone	61	0	7	10	41	3	7
62	Namwala	340	13	45	79	99	104	7
63	Mazabuka	762	17	69	92	418	166	7
64	Monze	452	9	54	86	182	121	7
65	Choma	1098	51	152	256	438	201	6
66	Kalomo	1221	69	310	231	365	246	6
67	Siavonga	478	49	91	118	164	56	5
68	Gwembe	206	10	35	43	87	25	6
69	Sinazongwe	506	10	86	107	218	85	6
71	Mansa	2457	286	659	641	726	145	5
72	Nchelenge	2536	300	737	758	620	121	5
73	Kawambwa	2378	350	636	703	600	89	4
74	Mwense	2982	392	915	887	696	92	4
75	Samfya	2486	295	802	690	601	98	4
81	Kasama	2156	221	574	640	636	85	5
82	Kaputa	386	29	78	133	121	25	5
83	Mbala	1893	190	466	570	554	113	5
84	Mporokoso	908	93	229	251	282	53	5
85	Luwingu	966	103	261	258	298	45	5
86	Chilubi	878	86	265	281	217	29	4
87	Isoka	1891	142	450	503	596	200	5
88	Chinsali	1506	124	429	438	453	64	5
89	Mpika	1970	163	533	500	628	146	5
91	Chipata	5738	781	1498	1538	1499	422	5
92	Chama	1117	98	224	301	436	58	5
93	Lundazi	2184	254	661	537	596	136	5
94	Chadiza	1298	245	326	316	314	97	4
95	Katete	3563	434	894	1063	942	230	5
96	Petauke	7616	672	1712	2013	2295	924	5
10	Lusaka	2,198	113	285	545	714	541	6
20	Copperbelt	3,962	433	770	772	1,225	762	6
30	Central	6,062	235	1,095	1,304	2,230	1,198	7
40	N/Western	5,010	703	1,283	1,130	1,375	519	5
50	Western	8,694	656	1,664	1,691	1,695	2,988	6
60	Southern	5,124	228	849	1,027	2,012	1,008	6
70	Luapula	12,839	1,623	3,749	3,679	3,243	545	4
80	Northern	12,554	1,351	3,285	3,574	3,783	761	5
90	Eastern	21,516	2,484	5,315	5,768	6,082	1,867	5
	Zambia	77,959	7,626	18,295	19,490	22,359	10,189	5

Source: National Census of Agriculture (1990/92), CSO

1.2.2 Government Agricultural Projects

There are several agricultural projects or schemes on research and production, which are implemented by the Government, mostly by MAFF. From landuse acreage (see Table 1-6), Governmental agricultural schemes are implemented in large lands of about 1,212,000 ha that are categorised as Government Agricultural Project Lands (14% of agricultural lands excluding shifting cultivation). However, the projects are not fully utilising the lands. The productive projects are now utilising only about 230,000 ha, which corresponds to about 19% of Government Agricultural Project Lands.

Governmental Agricultural Projects (excluding Research Projects)

Agricultural Settlement Schemes	100 Schemes		(Acreage are not defined)
Parastatal Irrigation Projects	13 Projects	24,993 ha	(Irrigated Area only)
Maize Seeds Project	1 Project	1,303 ha	(Lusaka Rural)
Livestock Projects	21 Projects	203,758 ha	
Total	135 Projects	230,054 ha	

Following projects are now executed or under implementation:

- Agricultural Settlement Schemes

  Agricultural settlement schemes are implemented under the Office of President with the help of MAFF. In the settlement schemes, most small-holders irrigation projects are involved. In these projects, irrigation facilities are generally not well managed due to several reasons. Irrigation is partially operated only for 170 ha presently.

Agricultural Settlement Schemes

Copperbelt	20 schemes
Central	9 schemes
N/Western	9 schemes
Western	4 schemes
Southern	29 schemes
Luapula	3 schemes
Northern	7 schemes
Eastern	19 schemes
Total	100 schemes

- Parastatal Irrigation Projects(13 Projects including Kaleya Small-holders Scheme)

  These projects are categorised into Medium or Large-scale Irrigation Projects, which have been invested mainly by the parastatal companies except Kaleya Small-holders Scheme. Kaleya Small-holders scheme has been jointly invested by International Funds and small-holder farmers. These projects are presently well operated for producing specialised crops such as sugarcane, cotton, wheat, coffee and tea etc.. Most projects have their own processing factories to produce processed products. These projects are now privatised or under privatisation and nearly 25,000 ha are now irrigated by these projects.

- Livestock Projects

  Governmental livestock projects are composed of three components: Dairy, Ranches, and Piggery Projects. Activities and acreage of these projects are as follows;

  - Dairy (Milk Production): Marketing of milk produced by dairy farmers, and breeding stock for dairy farmers by DPB. 11,374 ha
  - Ranches: Supply of breeding stock for farmers who produce beef cattle or try to introduce oxen for cultivation. 191,214 ha
  - Piggery: Supply of breeding stock for farmers who are engaged in pig production. 1,170 ha

  Total 203,758 ha

1.2.3 Donor Assisted Agricultural Projects

(1) Category of Projects and Donors

There have been 200 agricultural projects since 1970s in Zambia. Out of 200 projects, donor assisted agricultural projects account for 159 projects, and 41 projects are funded only by Government of Republic of Zambia (GRZ). Sweden has assisted the largest number of projects (29 projects), and followed by Netherlands (23 projects). Japan has so far assisted 9 projects.

Donor assisted projects are categorised into 13 categories. Research project shares the largest number of projects, and followed by extension project. Veterinary and irrigation projects also share large number of projects. All donor assisted projects and GRZ projects are listed in Appendix-4 in this Report. Donor assisted agricultural projects are summarised as below:

Table 1-22 Category and Project Number of Donor Assisted Agricultural Projects

Project Category		Projects	Share Order	Project Category		Projects	Share Order
Arip	Agricultural Planning	6	8	Mkt	Marketing	4	10
Ext	Extension	27	2	P&M	Animal Power & Mechanisation	7	6
F/S	Food Security	5	9	Phv	Post Harvest	1	13
Fin	Financial	2	12	Res	Research	38	1
Fis	Fisheries	10	5	Trn	Training	7	6
Frst	Forestry	3	11	Vet	Veterinary	25	3
Iri	Irrigation	24	4		Total	159	

(2) Japan Assisting Agricultural Projects

Japan assisted following 9 agricultural projects since 1987.

Table 1-23 Japan Assisting Agricultural Projects

No.	Title of Projects	Cate-gory	Type of Finance	Start Year	End Year
1	Mazabuka Traditional Farm Development	Vet	Grant	1989	1996
2	Fish Hatchery Project	Fis	c.v. funds	1991	1993
3	Dam Construction and Machinery for LDS	Iri	Grant	1988	
4	Kaunga Rural Development Project	Iri	Grant	1987	1994
5	Agricultural Verification Study for Development of Rice	Res	Grant	1988	1992
6	Agricultural Village Development (Kanakantapa)	Iri	Grant	1990	1996
7	Forest Resources Management Study for Zambia Teak Forests in South-Western Zambia	Frst	Grant	1993	1995
8	Mongu Rural Development	Arip	Grant	1994	1995
9	Veterinary Medicine Research Study	Vet	Grant	1993	1996

The Mazabuka Traditional Farm Development Project and the Veterinary Medicine Research Project are concerning to livestock project. The former project deals with the improvement of traditional cattle breeding in Mazabuka Area in Southern Province. The latter project is proceeding research works for veterinary medicine development in the

Zambia University.
The Fish Hatchery Project is assisting the strengthening project of fry supply to small-scale farmers for aquaculture. The project is conducted at Kitwe in Copperbelt Province.
The Kaunga Rural Development Project provided the irrigation facilitated area of 100 ha in Kaunga Area in Lusaka Rural District. The project, however, is not well operated presently, and improvement works are now continued.
The Agricultural Verification Study for Development of Rice was conducted in the left bank of Zambezi Floodplain. Depending upon the results of this verification study, the feasibility study of rural development was conducted in the Mongu Rural Development Project.
The Agricultural Village Development Project has been conducted in the Kanakantapa Settlement Project. The development project has provided 30ha of irrigated farm in the settlement area for training the farmers settled in the area. The main aim of this project is to transfer the knowledge of cultivation of irrigated cash crops such as vegetables.
The Forest Resources Management Study for Zambia Teak Forests in South-Western Zambia was conducted to enhance the capacity of the Forest Department to conserve and protect the Teak Forests in the South-western Zambia.

1.2.4 Present Status of Irrigation

History of irrigation development is not so long in Zambia. Irrigation development was initiated in early 1960s, and proceeded by both sectors of Government and commercial basis. Government or state irrigation projects were vigorously executed in late 1960s and in 1970s.
There is no accurate information on acreage of irrigated area and location at this stage. Therefore, irrigation information was surveyed in the current water use survey and the water right survey. Present status of irrigation has been estimated by the current water use survey for the government projects and by the water right survey for the total irrigation acreage and water use in Zambia. The national total irrigated area is estimated at 53,020 ha at present. Out of the national total, commercial sector achieves 58% or 30,750 ha of irrigation, and the government achieves 42% of 22,270 ha. Consequently, commercial sector contributes more than the government on irrigation development. Provincial composition of irrigated areas is summarised in Table 1-24.

Total Irrigated Area: 53,020 ha
Commercial Farms: 30,750 ha (58%)
Government Irrigation Projects: 22,270 ha (42%)
Small Holders Irrigation Projects: 77 ha (1.2%)
Medium Scale Irrigation Projects: 1,693 ha (7.6%)
Large Scale Irrigation Projects: 20,300 ha (91.2%)

Table 1-24 shows the irrigated area in dry season in 1993 in Zambia. Irrigated area is concentrated to Southern provinces as 36.4% and followed by Copperbelt and Northern as 17.5% and 17.3% respectively. Western province is the most behind in irrigation development.

Table 1-24 Estimated Dry Season Irrigation by Province

District	Irrigation in Dry Seasin (ha)		Water (1000m³ /day)	Wheat (ha)	Sugar cane (ha)	Coffee (ha)	Tea (ha)	Citrus Fruits (ha)	Banana (ha)	Vegetables (ha)	Flowers (ha)
10 Lusaka	5,674	10.7%	490	3,327	0	22	0	336	44	1,736	209
20 Copperbelt	9,294	17.5%	803	2,978	0	1,057	0	1,684	46	3,493	36
30 Central	6,525	12.3%	564	2,585	0	349	0	1,315	13	2,263	0
40 N/Western	522	1.0%	45	0	0	215	0	42	10	255	0
50 Western	0	0.0%	0	0	0	0	0	0	0	0	0
60 Southern	19,229	36.3%	1,661	4,616	13,000	485	0	462	72	594	0
70 Luapula	2,139	4.0%	185	0	0	403	140	578	320	695	3
80 Northern	9,143	17.2%	790	0	0	3,643	0	2,631	453	2,415	1
90 Eastern	497	0.9%	43	150	0	11	0	107	17	212	0
Zambia	53,023	100.0%	4,581	13,656	13,000	6,185	140	7,155	975	11,663	249
	100.0%			25.8%	24.5%	11.7%	0.3%	13.5%	1.8%	22.0%	0.5%

(Note) Irrigated area is estimated by Water Right Survey 1994. (Irrigated area as of 1993)

1.2.5 Gross Value Added (GVA) of Agriculture

Agriculture is composed of three sectors, namely agricultural, forestry, and fishery sectors.

Table 1-25 GVA of Agriculture, Forestry and Fishery: 1985 - 1993

Year	1985	1986	1987	1988	1989	1990	1991	1992	1993	Ave.
Rural Population (1000)										
High population growth case						4,602	4,746	4,891	5,035	
Base case	4,003	4,123	4,243	4,363	4,483	4,602	4,738	4,874	5,010	
Low population growth case						4,602	4,730	4,857	4,985	
GDP (National) (Kwacha Billion)										
	7.071	12.96	19.78	30.02	55.18	113.3	218.3	569.2	1,423.2	
% of Agri.VA	13.1%	12.2%	11.0%	16.8%	19.1%	18.2%	15.8%	21.3%	27.7%	17.2%
Agricultural GVA at Current Prices (Kwacha Million)										
Agriculture	788.1	1,303.3	1,707.8	4,048.4	8,126.4	16,853	28,759	101,406	326,946	
Forestry	59.5	125.6	179.0	435.8	1,006.7	1,685	2,621	12,900	48,979	
Fishery	77.6	148.9	293.6	571.3	1,429.0	2,092	3,138	6,825	18,004	
Total	925.2	1,577.8	2,180.4	5,055.5	10,562.	20,630	34,518	121,132.	393,929	
Percent Distribution (%)										
Agriculture	85.2%	82.6%	78.3%	80.1%	76.9%	81.7%	83.3%	83.7%	83.0%	81.6%
Forestry	6.4%	8.0%	8.2%	8.6%	9.5%	8.2%	7.6%	10.6%	12.4%	8.8%
Fishery	8.4%	9.4%	13.5%	11.3%	13.5%	10.1%	9.1%	5.6%	4.6%	9.5%
GDP at 1977 Constant Prices (K' Million)										
Agriculture	303.6	331.7	326.2	389.6	379.0	339.7	361.4	226.6	362.2	335.6
Forestry	15.9	14.4	14.2	16.8	16.4	19.4	19.4	21.0	21.9	17.7
Fishery	24.3	27.7	25.2	29.8	29.1	27.6	25.9	24.6	29.9	27.1
Total	343.8	373.8	365.6	436.2	424.5	386.7	406.7	272.2	414.0	380.4
Annual Growth (%)										
Agriculture	-	9.3%	-1.7%	19.4%	-2.7%	-10.4%	6.4%	-37.3%	59.8%	2.2%
Forestry	-	-9.4%	-1.4%	18.3%	-2.4%	18.3%	0.0%	8.2%	4.3%	4.1%
Fishery	-	14.0%	-9.0%	18.3%	-2.3%	-5.2%	-6.2%	-5.0%	21.5%	2.6%
Total	-	8.7%	-2.2%	19.3%	-2.7%	-8.9%	5.2%	-33.1%	52.1%	2.3%
GDP at 1993 Constant Price (K' Billion)										
Total GDP	327.1	355.7	347.9	415.1	403.9	368.0	387.0	259.0	393.9	362.0
Percapita GDP (K'1000)										
High population growth case						80.0	81.5	53.0	78.2	80.9
Base case	81.7	86.3	82.0	95.1	90.1	80.0	81.7	53.1	78.6	81.0
Low population growth case						80.0	81.8	53.3	79.0	81.0

(Data Source): Preliminary Estimation of GDP, CSO

Agricultural sector is further divided into three sub-sectors of crops, livestock, and wildlife. As shown in Table 1-25, Gross Value Added (GVA) of agriculture grew at 2.2% annually from 1985 to 1993 although fluctuated annually. Agricultural GVA shared about 17% of national GDP, and amounted at K'Million 393,930 in 1993. Percapita GVA of agricultural sector was around K'81,000 in average for 9 year from 1985 to 1993. Percapita GVA of agriculture tended to decrease from K'81,700 to K'81,000 in this period. In 1992 GDP declined because of severe drought and inclined in 1993 by good weather condition. Wildlife shares only about 3.5% of total GDP of agriculture as shown in Table 1-29.

On the other hand, gross value added (GVA) and gross earning of agriculture has been estimated based on actual data of production in 1993 as shown in Table 1-27, and summarised in Table 1-26. However, total GVA of agriculture does not match the preliminary GDP as shown below.

Table 1-26 GVA, Gross Margin and Gross Earning of Agriculture (1993)

Sector / Sub-Sector	Estimation by Available Data		CSO Estimation GDP	
	Gross Value Added (GVA)(*1)	Composition		
Agriculture	236,221	78.9%	326,946.7	83.0%
Crops	177,607	59.2%	N.A.	
Livestock	45,614	15.3%	N.A.	
Wildlife	13,000 (*3)	4.4%	N.A.	
Fishery	14,082 (*4)	4.7%	18,004.0	4.6%
Forestry	48,979 (*5)	16.4%	48,979.2	12.4%
Total	299,282	100%	393,929.9	100%

(Note)
(*1) GVA= Gross Earning - Production Cost (excluding labour cost, seed cost)
(*2) Gross Earning = Production x Farm Gate Price
(*3) estimated at 3.5% of K393,929.9 million depending on average composition to GDP.
(*4) see section 3.4.1
(*5) depending on estimation of Preliminary Estimation of GDP by CSO.

Above differences are considered to be differences of farm gate prices of products and input materials due to rapid incline of prices. The evaluation of agriculture will be based on the studied GVA. According to the studied GVA, crop GVA shares largest composition of about 60% of total agricultural GVA, followed by forestry GVA (of about 16%), and by livestock sector of about 15%.

Table 1-27 GVA of Crops and Livestock Products in 1993

Crops		Gross Earning 1 (2)*(4) (K/ha)	Gate Price (1994) 2 (K/bag)	Unit Weight 3 (kg/bag)	Yield 4 (Bags/ha)	Yield 5 (ton/ha)	Production (5)*(9) (ton)	Production Cost 6 (K/ha)	Income Net 7 (1)-(6) (K/ha)	Income Rate 8 (7)/(1) (%)	Planted Area 9 (ha)	1994 Price G. Margin 10 (7)*(9) (K'million)	1994 Price G. Earning 11 (1)*(9) (K'million)	Conversion factor 12	1993 Price G. Margin 13 (10)*(12) (K'million)	1993 Price G. Earning 14 (11)*(12) (K'million)
Maize		196,588	8,330	90	23.6	2.12	1,739,240	61,900	134,688	69%	820,396	110,497.5	161,280.0	0.667	73,701.8	107,573.8
Sorghum		83,000	10,000	90	8.3	0.75	35,844	15,100	67,900	82%	47,792	3,245.1	3,966.7	0.667	2,164.5	2,645.8
Millet		82,960	12,200	90	6.8	0.61	33,433	6,800	76,160	92%	54,808	4,174.2	4,546.9	0.667	2,784.2	3,032.8
Rice (Extensive)	*	192,000	15,000	80	12.8	1.02	13,985	32,800	159,200	83%	13,711	2,182.8	2,632.5	0.667	1,455.9	1,755.9
Rice (Int. Wet S.)	*	750,000	15,000	80	50.0	4.00	0	512,600	237,400	32%	0	0.0	0.0	0.667	0.0	0.0
Rice (Int. Dry S.)	*	844,500	15,000	80	56.3	4.50	0	719,050	125,450	15%	0	0.0	0.0	0.667	0.0	0.0
Rainfed Wheat		128,620	21,800	90	5.9	0.53	1,954	44,200	84,420	66%	3,686	311.2	474.1	0.667	207.6	316.2
Irrigated Wheat	*	1,227,340	21,800	90	56.3	5.07	69,236	907,471	319,868	26%	13,656	4,368.1	16,760.6	0.667	2,913.5	11,179.3
							1,893,692				954,049	124,778.9	189,660.8		83,227.5	126,503.8
Cassava (chips)		188,400	7,850	90	24.0	2.16	232,874	61,600	126,800	67%	107,812	13,670.6	20,311.8	0.667	9,118.3	13,548.0
Potatoes		3,350,000	2,500	10	1,340	13.4	22,378	920,500	2,429,500	73%	1,670	4,057.3	5,594.5	0.667	2,706.2	3,731.5
Sugarcane	*	1,825,200	16,900	1,000	108	108	1,404,000	1,567,000	258,200	14%	13,000	3,356.6	23,727.6	0.667	2,238.9	15,826.3
Mixed Beans		241,400	35,500	90	6.8	0.61	23,478	26,800	214,600	89%	38,489	8,259.7	9,291.2	0.667	5,509.2	6,197.2
Soybean		211,950	13,500	90	15.7	1.41	28,008	15,700	196,250	93%	19,864	3,898.3	4,210.2	0.667	2,600.2	2,808.2
Rainfed G.nuts		243,570	35,300	80	6.9	0.55	37,844	10,468	233,103	96%	68,808	16,039.3	16,759.6	0.667	10,698.2	11,178.7
Irrigated G.nuts	(*)	811,900	35,300	80	23.0	1.84	25,127	308,188	503,713	62%	13,656	6,878.7	11,087.3	0.667	4,588.1	7,395.2
Sunflower		52,000	6,500	50	8.0	0.40	14,360	8,000	44,000	85%	35,899	1,579.6	1,866.7	0.667	1,053.6	1,245.1
Seed Cotton		91,350	145	1	630	0.63	48,190	19,800	71,550	78%	76,492	5,473.0	6,987.5	0.667	3,650.5	4,660.7
Tobacco(V)		1,670,400	1,440	1	1,160	1.16	4,127	95,600	1,574,800	94%	3,558	5,603.1	5,943.3	0.667	3,737.3	3,964.2
Tobacco(B)		885,500	1,150	1	770	0.77	2,609	76,100	809,400	91%	3,388	2,742.2	3,000.1	0.667	1,829.0	2,001.1
Tomatoes	*	4,133,250	2,500	15	1,653	24.8	297,600 1)	1,941,040	2,192,210	53%	6,000	26,306.5 1)	49,599.0 1)	0.667	17,546.4	33,082.5
Onion	*	3,000,000	1,500	10	2,000	20	40,000 1)	1,363,125	1,636,875	55%	1,000	3,273.8 1)	6,000.0 1)	0.667	2,183.6	4,002.0
Cabbage	*	3,000,000	150	1	20,000	20	120,000 1)	939,467	2,060,533	69%	3,000	12,363.2 1)	18,000.0 1)	0.667	8,246.3	12,006.0
Lettuce	*	1,600,000	80	1	20,000	20	26,520 1)	877,550	722,450	45%	663	958.0 1)	2,121.6 1)	0.667	639.0	1,415.1
Carrots	*	2,700,000	150	1	18,000	18	36,000 1)	897,810	1,802,190	67%	1,000	3,604.4 1)	5,400.0 1)	0.667	2,404.1	3,601.8
Veg. SubTotal							520,120				11,663	46,505.9	81,120.6		31,019.4	54,107.4
Coffee	*	3,060,000	1,530	1	2,000	2.0	12,368	953,200	2,106,800	69%	6,184	13,028.5	18,923.0	0.667	8,690.0	12,621.6
Tea	*	3,285,600	740	1	4,440	4.44	622	1,128,500	2,157,100	66%	140	302.0	460.9	0.667	201.4	306.8
Orange	*	2,069,952	1,440	12	1,438	17.3	125,195	1,007,030	1,092,922	52%	7,154	7,818.8	15,023.1	0.667	5,215.1	10,020.4
Banana	*	993,600	240	1	4,140	4.14	4,032	763,050	230,550	23%	974	224.6	967.8	0.667	149.8	645.5
Flower	*	12,000,000	12,000,000	1	1	1	250	3,758,000	8,242,000	69%	250	2,060.5	3,000.0	0.667	1,374.4	2,001.0
Total											1,363,050	266,277.6	417,935.1		177,607.1	278,762.7

Livestock	Gross Earning 1 (2)*(3) (K/head)	Gate Price (1994) 2 (K/kg)	Production 3 (kg/head)	Feed 4 (K/day /head)	Maturing Length 5 (days)	Production Cost 6-(4)*(5) (K/head)	Income Net 7 (1)-(6) (K/head)	Income Rate 8 (7)/(1) (%)	Slaught 1989 9 (heads) or (lit., kg)	1994 Price G. Margin 10 (7)*(9) (K'million)	1994 Price G. Earning 11 (1)*(9) (K'million)	Conversion factor 12	1993 Price G. Margin 13 (10)*(12) (K'million)	1993 Price G. Earning 14 (11)*(12) (K'million)
Dairy Cattle	262,500	1,500	175	42	730	30,660	231,840	88%						
Beef Cattle	262,500	1,500	175	42	730	30,660	231,840	88%	92,218	21,302.4	24,207.2	0.667	14,208.7	16,146.2
Pig Breeding	175,000	2,500	70	30	548	21,372	153,628	88%	14,644	2,255.2	2,562.7	0.667	1,504.2	1,709.3
Poultry Breeding	3,600	2,000	2	2	365	548	3,053	85%	9,828,026	30,073.8	35,380.9	0.667	20,059.2	23,599.1
Sheep/Goats	35,000	2,500	14	14	365	5,110	29,890	85%	951	28.5	33.3	0.667	18.9	22.2
Milk	400	400	1 lit			0	400	100%	34,808,000	13,923.2	13,923.2	0.667	9,286.8	9,286.8
Eggs	125	125	1 kg			0	125	100%	6,425,000	803.1	803.1	0.667	535.7	535.7
SubTotal										68,386.0	76,910.4		45,613.5	51,299.3
Total										334,663.6	494,845.5		223,220.6	330,062.0

(Notes)

1) Vegetables are counted as 2 times of one crop in production, gross margin and gross earning, because of double cropping.

2) Gross earning and margin are converted to the 1993 price using a conversion factor 0.667 that is estimated by the price index between Mid 1993 and Jan-Jul 1994 of Food,Beverages and Tobacco.

3) Production cost for dairy cattle are included in beef cattle.

4) Production costs for milk and eggs are included in dairy cattle and poultry production costs.

5) Due to no statistics data or uncertainty of data of livestock for 1990~93, following data has been applied for livestock production.
Slaughtering: 1989, Production of Milk and Eggs: 1988, Production Cost of Milk and Eggs is counted in Dairy Cattle and Poultry.

6) Production cost, gate price and gross earning of flower are shown in Kwacha/ha.

Table 1-28 Value Added (VA) and Gross Margin of Crops for 1993

Crops		Producer Price(1994 price) (bag basis)		Producer Price(1994 price) (ton basis)	1993 Yield (bags /ha)	1993 Yield (t/ha)	1993 Gross Earning (K/ha)	1993 G.V.A. Productn Cost (K/ha)	1993 G.V.A. GVA (K/ha)	1993 Gross Margin Productn Cost (K/ha)	1993 Gross Margin Gross Margin (K/ha)
Maize	*1	K 8,330 /	90 kg	K 92,556 /t	23.6	2.12	196,588	61,900	134,688	139,000	57,588
Irrigated Maize	*4	K 8,330 /	90 kg	K 92,556 /t	60	5.4	499,800	475,900	23,900	526,150	-26,350
Sorghum	*1	K 10,000 /	90 kg	K 111,111 /t	8.3	0.75	83,000	15,100	67,900	86,600	-3,600
Millet	*2	K 12,200 /	90 kg	K 135,556 /t	6.8	0.61	82,960	6,800	76,160	83,160	-200
Rice (Ext.)	*4	K 15,000 /	80 kg	K 187,500 /t	12.8	1.02	192,000	32,800	159,200	139,080	52,920
Rice (Int. Wet)	*4	K 15,000 /	80 kg	K 187,500 /t	50	4.00	750,000	512,600	237,400	586,880	163,120
Rice (Int. Dry)	*4	K 15,000 /	80 kg	K 187,500 /t	56.3	4.5	844,500	719,050	125,450	793,330	51,170
Wheat (Rain)	*4	K 21,800 /	90 kg	K 242,222 /t	5.9	0.53	128,620	44,200	84,420	111,292	17,328
Wheat (Irri.)	*1	K 21,800 /	90 kg	K 242,222 /t	56.3	5.07	1,227,340	907,471	319,869	958,371	268,969
Cassava	*4	K 7,850 /	90 kg	K 87,222 /t	24	2.16	188,400	61,600	126,800	160,000	28,400
Potatoes	*2	K 2,500 /	10 kg	K 250,000 /t	1340	13.4	3,350,000	920,500	2,429,500	2,028,000	1,322,000
Sugarcane	*3	K 16,900 /	1 t	K 16,900 /t		108.00	1,825,200	1,567,000	258,200	1,877,000	-51,800
Mixed Beans	*1	K 35,500 /	90 kg	K 394,444 /t	6.8	0.61	241,400	26,800	214,600	163,300	78,100
Soybeans	*1	K 13,500 /	90 kg	K 150,000 /t	15.7	1.41	211,950	15,700	196,250	134,980	76,970
Groundnuts (R)	*1	K 35,300 /	80 kg	K 441,250 /t	6.88	0.55	242,864	10,468	232,397	189,468	53,397
Groundnuts (I)	*1	K 35,300 /	80 kg	K 441,250 /t	23	1.84	811,900	308,188	503,713	445,688	366,213
Sunflower	*1	K 6,500 /	50 kg	K 130,000 /t	8	0.4	52,000	8,000	44,000	56,172	-4,172
Seed Cotton	*1	K 145 /	1 kg	K 145,000 /t	630	0.63	91,350	19,800	71,550	107,425	-16,075
Tabacco V	*4	K 1,440 /	1 kg	K 1,440,000 /t	1,160	1.16	1,670,400	95,600	1,574,800	197,848	1,472,552
Tabacco B	*4	K 1,150 /	1 kg	K 1,150,000 /t	770	1	885,500	76,100	809,400	142,848	742,652
Tomatoes	*1	K 2,500 /	15 kg	K 166,667 /t	1,653	25	4,132,500	1,941,040	2,191,460	2,098,540	2,033,960
Onions	*1	K 1,500 /	10 kg	K 150,000 /t	2,000	20	3,000,000	1,363,125	1,636,875	2,363,125	636,875
Cabbage	*1	K 150 /	1 kg	K 150,000 /t	20,000	20	3,000,000	939,467	2,060,533	1,053,042	1,946,958
Lettuce	*1	K 80 /	1 kg	K 80,000 /t	20,000	20	1,600,000	877,550	722,450	1,058,525	541,475
Carrots	*1	K 150 /	1 kg	K 150,000 /t	18,000	18.00	2,700,000	897,810	1,802,190	1,056,194	1,643,806
Coffee	*4	K 1,530 /	1 kg	K 1,530,000 /t	2,000	2.00	3,060,000	953,200	2,106,800	1,129,200	1,930,800
Tea	*4	K 740 /	1 kg	K 740,000 /t	4,440	4.44	3,285,600	1,128,500	2,157,100	1,323,500	1,962,100
Orange	*4	K 1,440 /	12 kg	K 120,000 /t	1,458	17.50	2,099,952	1,007,030	1,092,922	1,096,830	1,003,122
Banana	*4	K 240 /	1 kg	K 240,000 /t	4,140	4.14	993,600	763,050	230,550	892,050	101,550
Flower	*4	K 240 /	2 kg	K 120,000 /t	1	1.00	12,000,000	3,758,000	8,242,000	4,212,000	7,788,000

(Notes)

*1) based on Gross Margin 1994 September, MAFF.

*2) based on Gross Margin 1994 August, MAFF

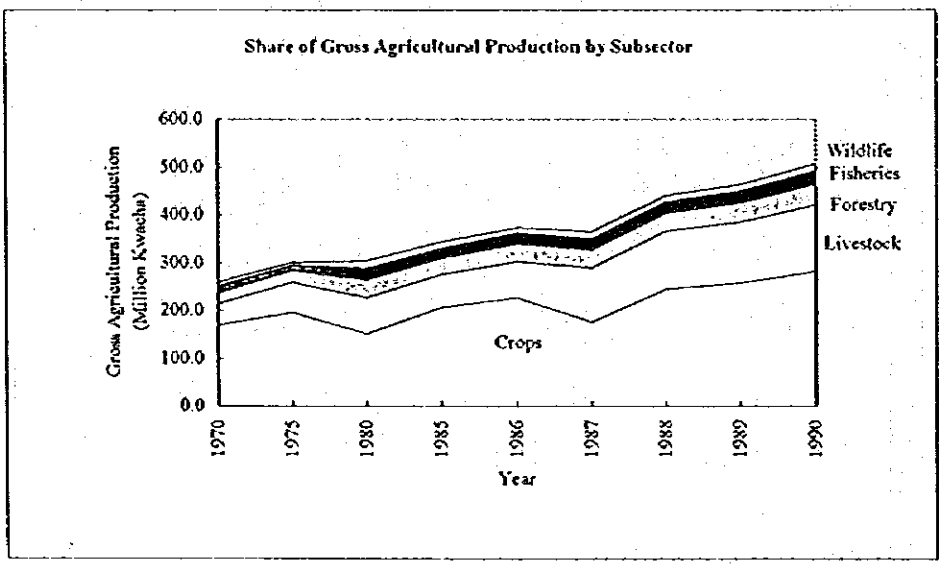
*3) based on the Notice of Zambia Sugar Company Limited, 1994.

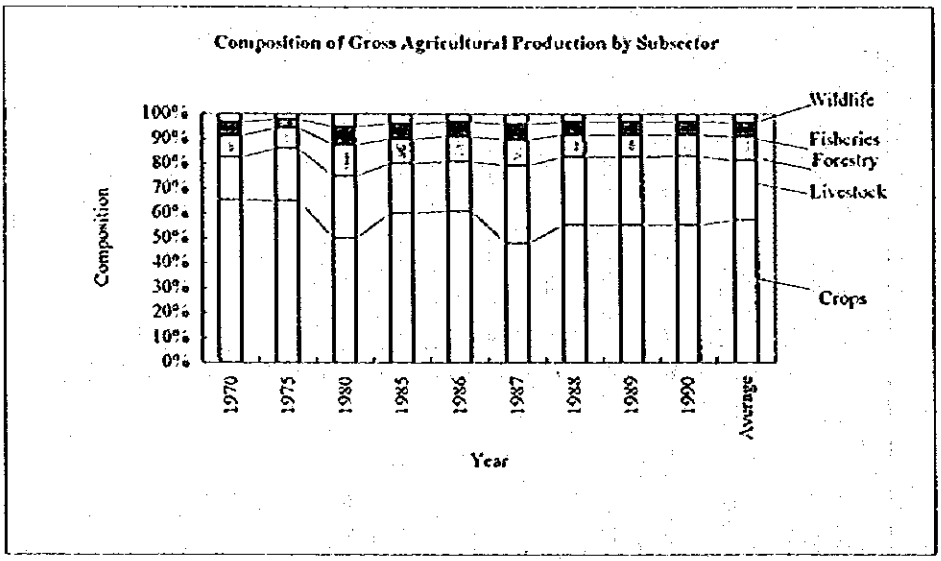
*4) assumed by this study.

Table 1-29 Gross Agricultural Production by Subsector, 1970-90

Subsector	1970	1975	1980	1985	1986	1987	1988	1989	1990	Average
	Million Kwacha in constant 1997 price									
Crops	169.1	195.7	151.5	206.3	227.3	175.5	244.0	257.2	281.3	
Livestock	45.0	63.2	75.8	68.8	74.8	114.1	121.0	127.4	139.4	
Forestry	22.7	25.3	38.0	34.4	37.4	38.0	39.0	41.1	44.9	
Fisheries	13.7	10.1	22.8	20.6	22.4	22.8	23.0	24.2	26.5	
Wildlife	9.2	6.8	15.8	13.7	11.9	15.2	13.5	14.2	15.5	
Total	260.2	301.1	303.9	343.8	373.8	365.6	440.5	464.1	507.6	
	Composition (%)									
Crops	65.0%	65.0%	49.9%	60.0%	60.8%	48.0%	55.4%	55.4%	55.4%	57.2%
Livestock	17.3%	21.0%	24.9%	20.0%	20.0%	31.2%	27.5%	27.5%	27.5%	24.1%
Forestry	8.7%	8.4%	12.5%	10.0%	10.0%	10.4%	8.9%	8.9%	8.8%	9.6%
Fisheries	5.3%	3.4%	7.5%	6.0%	6.0%	6.2%	5.2%	5.2%	5.2%	5.6%
Wildlife	3.5%	2.3%	5.2%	4.0%	3.2%	4.2%	3.1%	3.1%	3.1%	3.5%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
	Growth Rate (%)			1970-85						
Crops				1.3%	10.2%	-22.8%	39.0%	5.4%	9.4%	
Livestock				2.9%	8.7%	52.5%	6.0%	5.3%	9.4%	
Forestry				2.8%	8.7%	1.6%	2.6%	5.4%	9.2%	
Fisheries				2.8%	8.7%	1.8%	0.9%	5.2%	9.5%	
Wildlife				2.7%	-13.1%	27.7%	-11.2%	5.2%	9.2%	
Total				1.9%	8.7%	-2.2%	20.5%	5.4%	9.4%	

(Source) Report No.11570-ZA, Zambia, Prospects for Sustainable and Equitabel Growth, August 1993, World Bank





1.2.6 Land Ownership on Agriculture

Agricultural land is leased by the nation to Zambians or non-Zambians for agricultural purposes through the land alienation procedure.

There are two types of land tenure system in Zambia that are the traditional land system and the state land system. The traditional land system is composed of the Reserved and the Trust Lands.

In the State Land, the District Councils on behalf of the Commissioner of Land process the administrative works to evaluate the land utilisation plan of the applicants and to lease the agricultural lands to the applicants who want to conduct cultivation. The Department of Agriculture is in the position to make consultation on the plan of landuse and the evaluation of land ability for cultivation purposes on soils and topography.

<Land Alienation System>
On the other hand, in the Reserves and Trust Lands, the District Councils continue the works under the consent of the Chiefs. Currently, not more than 250 ha of land is allocated to an applicant in the Reserves and Trust Lands.

The land alienation system is not clear on succession of the land by the next generation for continuing the agricultural activities. It is one of the difficulties on lands for agricultural development especially for irrigation development. Irrigation development requires a certain amount of initial investment for the facilities on water resources, conveyance, and distribution. Farmers are reluctant to invest in the land if succession in not ensured.

<Land Taxing System>
There are no taxes levied on traditional lands nor can they be sold. The lack of mechanism for taxing land, or the improvements on it, removes an important source of revenue from the District Councils. State lands which are leased to commercial farmers are also not taxed and, furthermore, the rental rates are very low. This removes an important source of land revenue from District Councils, a factor which is inhibiting the maintenance of roads and the provision of other services. The provision of services in some regions is clearly inhibiting the expansion of agricultural land in those areas.

1.2.7 Agricultural Policy by the Ministry of Agriculture, Food and Fisheries

(1) General Direction of Agricultural Policy

In late 1992, the Ministry of Agriculture, Food and Fisheries (MAFF) established " Frame work for Agricultural Policies to the Year 2000 and Beyond". Review was given to that frame work on October, 1993 as "Statement of Agricultural Policies". Through those works, the long term agricultural policies have been established. However, donor agencies requested the MAFF to prepare the programme not depending on the aid of the donor agencies. Under these circumstances, MAFF prepared the Agricultural Sector Investment Programme (ASIP). The Programme was appraised by MAFF and the donor agencies in July 1994. Approval of the Parliament is proceeding as of October 1994. The policy of the ASIP is prepared mainly for its initial stage for 5 years from 1995 to 1999. During the initial stage, the donor agencies decrease the aid and terminate it by the end of initial stage.

Therefore, the policy of ASIP is characterised as a short term policy for the said period. On the other hand, the Frame Work and the Statement are characterised as a long term policy.

(2) Long Term Agricultural Policies

According to the Statement of Agricultural Policies, long term agricultural policies are established, and the long term policy sets up five objectives and prioritised ten strategies for achieving the objectives.

<Objectives>

1) to ensure national and regional food security through dependable annual production of adequate supplies of basic foodstuffs (cereals and proteins) at competitive costs,
2) to generate income and employment to maximum feasible levels in all regions through full utilisation of local resources and realisation of both domestic and export market potential,
3) to insure that the existing agricultural resource base (land, water, and air) is maintained and improved upon,
4) to contribute to sustainable industrial development, and
5) to significantly expand the sector's contribution to the national balance of payments by, among other sectors, expanding agricultural exports in line with international comparative advantage.

<Strategies>

1) High Priority Strategies
   - Liberalisation of Markets
   - Diversification of Crop Production
   - Emphasis on Provision of Services to Small-Holders
2) Medium Priority Strategies
   - Development of the Livestock Sector
   - Emphasising Sustainable Agriculture
   - Expanding Opportunities for Outlying Regions
   - Making full Use of Land Available for Agriculture
3) Lesser Priority Strategies
   - Improvement in the Economic Status of Women
   - Helping Farmers deal with Natural Disasters
   - Making improved Use of Available Water Resources

(3) Agriculture Sector Investment Programme (ASIP)

(a) Agricultural Policy and Food Security

Agricultural Sector Investment Programme (ASIP) was appraised by the Ministry of Agriculture, Food and Fisheries (MAFF) in July 1994, after extensive research in various sectors in agriculture. The ASIP has been prepared for five years from 1995 to 1999 as the initial stage. In this period, significant conditions imposed on agricultural sector are as follows:

- Donor aid will decrease gradually and terminate at the end of above five years.
- ASIP must be sustainable using only GRZ resources after this period.
- A rate of growth of 6% in agricultural GDP must be achieved while reducing GRZ expenditure on the sector to not more than 1.5% of total GDP.

The ASIP program consists of three main components as below.

- policy and institutional reforms,
- support for private sector investment, and
- rehabilitation and strengthening public sector agriculture services.

The following policies and institutional reforms are proposed by the ASIP under a continuous movement away from a centralised, command economy to a liberalised, market-driven economy.

- creation of the Food Security Agency to ensure 2.5 million bags of cereals
- restructuring of three small-scale lending institutions
- revamping land tenure arrangement
- restructuring MAFF and MOL
- phasing out agricultural credit subsidies
- completing the privatisation program
- establishing an Agricultural Training Board
- revising and updating agricultural legislation

The support for private sector investment is composed of the following five elements.

- Leasing of Crop Storage Facilities,
- Crop Marketing Revolving Fund,
- Production Credit Revolving Funds,
- New Product (or Export) Development,
- Special Credit Program for Vulnerable Groups.

The appraised ASIP comprises the following thirteen Sub-Programmes:

- Policy and Planning
- Agricultural Research
- Extension and Information
- Animal Production and Health
- Irrigation
- Marketing and Trade
- Fisheries
- Standards
- Land Use and Administration
- Food Security and Nutrition
- Farm Power and Mechanisation
- New Product Development
- Privatisation

(b) Food Security

Regarding food security, the ASIP proposes to establish the Food Security Agency to ensure 2.5 million 90kg-bags storage of cereals and to manage the storage by linking available market amount with areas of shortage under the services of NAIS. Background of 2.5 million bags storage is confirmed in MAFF, Food Security Section.

- A storage of 2.5 million bags is equivalent to food supply amount of 3 months.
- When shortages are forecast by NAIS, three months are necessary to import and distribute maize in the country. For this reason, a storage capacity of 2.5 million bags has been decided.
- However, the consumption amount of maize has dropped recently from previous consumption levels due to removal of subsidies. It is, therefore, necessary to review the storage amount of 2.5 million bags.
- The costs for storage facilities and maintenance of storage are also being reviewed. These costs will be a heavy burden for the Government and, consequently, the

Government is considering to prepare half of the storage by foreign currencies as well as to reduce storage capacity itself.

(c) New Product Development

The ASIP proposes an institution that will co-ordinate the activities of collecting production and marketing information for farmer groups. It is also proposed that this institution will investigate the feasibility studies for new products. In the Appraisal Program, the following possible exportable products are nominated:

- Tobacco: demands are stable, and exports have not yet peaked.
- Flowers: dominant market is Europe, earning highest export amount among non-traditional agricultural exports. Zambia has ideal weather conditions for growing flowers.
- Cotton: textile export showing steady increases over the last three years.
- Oilseeds: groundnuts and soybeans are showing increases, castor oil and sesame oil are currently being developed.
- Horticultural Products: declined in 1992, but still remain a challenge to capture the outside market.
- Livestock and Livestock Products: declining since 1989 due to decrease of exportable products caused by diseases.
- Beverages: Coffee and tea farmers have been discouraged by falling price of unprocessed coffee on the world market. However, locally processed coffee and tea could displace imported processed coffee brands - domestic consumption of Zambian coffee and tea is still low.

(d) Irrigation

In the ASIP Sub-Programs, the irrigation sector has only been allocated a small budget (US$5.9 million) for the initial five year period. However, within this scarce budget, the initial program establishes the following seven strategies (including long term strategies) to encourage farmers to take advantage of irrigated agriculture and so reduce the risk of financial losses inherent in rain-fed agriculture.

1) To develop a National Irrigation Water Master Plan in order to ascertain the actual irrigation potential in the country.
2) To strengthen the institutional capacity of the Irrigation Engineering Section (IES) to provide effective services and training to farmers.
3) To encourage and support the extension of the National Electricity Grid to potential irrigation areas.
4) To support the development of irrigation, for example where multipurpose dams are proposed.
5) To review and streamline procedure for granting water rights.
6) To encourage the development of smallholders irrigation schemes where socially and economically viable.
7) To provide technical and extension services to small scale farmers in rural areas.

Under the above strategies, the Irrigation Sub-Programs for the initial period are as follows:

- To establish the Headquarters Unit and Regional Offices of IES.

- To proceed with the rehabilitation or completion of the existing Smallholder Irrigation Schemes which have deteriorated or are not yet complete. There are nine existing schemes as shown in Table 1-30.

In this regard, government activity on the construction of irrigation schemes will be very limited in the initial five years. However, the Sub-Programme has clarified the responsibilities of the government and the benefiting farmers for irrigation development projects. This will be of great assistance for future irrigation development.

Table 1-30 Rehabilitation of Existing Smallholder Irrigation Schemes by ASIP

Scheme Name	Location	Present Irrigated Area (ha)	Irrigated Area After Rehabilitation (ha)	Expansion or Rehabilitation (ha)
O-14 Buleya Malima	Gwembe	23	57	57 *
O-9 Chapula	Kalulushi	0	60	60
N-1 Chipapa	Lusaka	0	10	10
N-2 Ipafu	Chingola	0	80	80
O-21 Nakandabwe	Gwembe	0	10	10
O-31 Lusowe	Chipata	0	10	10
O-28 Makungwa	Chipata	3	5	5 *
O-15 Siatwiinda	Gwembe	18	22	22 *
O-30 Vuu	Lundazi	3	13	13 *
Total		47	267	267

(Note) * : expansion and rehabilitation including operational area.

(e) Livestock

ASIP emphasises the encouragement of livestock production and health in the main livestock rearing provinces, namely Southern, Western, Eastern, Lusaka and Central Provinces, although the Forth National Development Plan (FNDP) had emphasised encouragement in northern parts as Northern, Luapula, Copperbelt and North-western Provinces. It is recognised that the ASIP puts urgency into high priority as the target in initial stage of ASIP. On the other hand, FNDP was prepared for long term target to expand livestock rearing in scarce areas in the northern parts.

According to the ASIP, the main constraints to increased livestock production in the traditional sector are as follows:

- Animal health situation: In particular, the incidence of Tsetse and other animal diseases. Tsetse infestation probably covers more than 30% of the country, and an estimated 20% of the national cattle stock is at risk from Trypanosomiasis, particularly in the traditional sector but also increasingly in the commercial sector. Health problems also constrain the development of export markets for beef, meat products, hides and skins.
- Animal husbandry: There are a number of socio-economic factors governing stock ownership and herd management which reduce productivity levels.
- Marketing: Livestock marketing in the traditional sector will be enhanced by the introduction of the marketing information system which will bring buyers and sellers to designated selling points.

Proposed Components of Livestock Sector Programme :
The Animal Production and Health Sub-Programme aims to redefine the role of the Department of Veterinary and Tsetse Control Services (DVTCS) and to develop animal production support services in a new Department of Animal Production and Health (DAPH) within a liberalised and privatised livestock industry. Moreover, the sub-programme aims to control Tsetse and Trypanosomiasis by implementing clearly defined vector control programmes to contain the spread of the fly, and to protect agriculturally important areas using integrated and environmentally sensitive techniques and with maximum community and private sector participation. Tics and Borne Diseases (TBD) Control : DVTCS will supervise the running of dip tanks in that it will prescribe the regime to be used for dipping and recommend appropriate chemicals to be used.

High Priority Areas :
DAPH efforts will be concentrated on the five main livestock rearing provinces, namely Southern, Western, Eastern, Lusaka and Central Provinces. In particular, the plateau areas with their generally high agricultural potential, high concentrations of livestock in the traditional and commercial sectors, and widely practised and productive ox-based, mixed farming systems will be protected. North of the common fly belt, ox-based mixed farming will continue to be promoted, with oxen protected by chemoprophylaxis at full cost to the farmer.

(f) Fishery

In the Fisheries Sub-Program, most fishery activity will depend on the private sector. The government activities are limited to research and extension of fisheries technology and administration. The strategies on fisheries are:

- providing incentives to fish producers to expand operations, especially support services to small-scale producers,
- improving the efficiency and technical capacity of the DOF,
- promoting aquacultural production.

For long term target of fish supply, the Sub-Program proposes to supply 12 kg/capita/year of fish. This target is considered to be achievable with a significant growth in aquaculture.

(g) Farm Power and Mechanisation

According to the ASIP, it is emphasised to encourage ox draught cultivation system especially for smallholder farmers to increase their cultivation capacity. For this purpose, it is proposed to set up the Palabana Farm Power and Mechanisation Centre, which is planed to locate at Chongwe District in Lusaka Province, for extension of farm mechanisation as well as crop storage and processing. The ox draught cultivation system is also recognised to mitigate overload of women work in rural area. On the other hand, the Forth National Development Plan (FNDP) had emphasised encouragement of ox draught cultivation as well as cattle breeding in the northern regions as Northern, Luapula, Copperbelt and North-western Provinces.

1) Present Status of Farm Power and Mechanisation recognised by ASIP

i) Hand Hoe Cultivation

Smallholder and emergent farmers are estimated to cultivate over 800,000 ha with hand hoe or with oxen. Out of 800,000 ha, 46% are cultivated by hand hoe farmers (430,000 households). They cultivate generally less land than 2 ha per household due to limitation of cultivation capacity. It is required for them to cultivate at least 2 ha for keeping minimum living condition. However, it forces them overburden to cultivate more than 2 ha with hand hoe. It is, therefore, an important subject to introduce ox draught system into hand hoe cultivation farmers.

ii) Ox Draught Cultivation

In Southern and Western Provinces, ox draught cultivation has been experienced among farmers since long time ago. Although ox draught cultivation is behind to former two provinces in Central, Lusaka and Eastern Provinces, ox draught system has been already introduced at certain level among farmers. There is less problem for expansion of ox cultivation in those provinces.

On the other hand, ox draught cultivation is not yet introduced and hand hoe cultivation is dominant in the northern region as Northern, Luapula, Copperbelt and North-western Provinces. It is necessary to encourage ox cultivation in these provinces through active extension and facilitation.

iii) Mechanised Cultivation

Commercial farms cultivate their crops with highly mechanised farming system and realise high yield in large farm by high cultivation techniques. Contribution of commercial farms, which share only 0.5% of national total farmers, is so large in national agricultural product as producing 20% of national maize product in 1993. They have high potential in food security aspect and in production of exportable crops. However, mechanisation is suffered and restricted by shortage of spare parts and repair shops, and by difficulties on credits.

2) Objectives and Strategies on Farm Power and Mechanisation by ASIP

ASIP aims following objectives on farm power and mechanisation:

Objectives:

- Improve the productivity of labour in the smallholder farming sector through the expanded use of animal draught power and increased adoption of associated technologies.
- Improve soil and water conservation tillage system based on appropriate range of implements, in accordance with region-specific agro-ecological conditions.
- Improve the crop handling and storage to minimise post harvest losses.

Strategies:

- Establish a farm power and mechanisation co-ordination and policy unit for government policy.

- Establish Palabana Farm Power and Mechanisation Centre for development of smallholder mechanisation on use of animal power, and crop storage and processing through training and extension. It is expected to contribute to reduce farm labour constraints as well as of women.
- Encourage wide use of animal draught power through oxen ownership and privately oxen hiring units.
- Effective support by the Government/Private-sector to ensure adequate services to farmers in spare part availability and rural repair facilities.

1.2.8 Farm Gate Prices of Agricultural Inputs and Products

(1) Farm Gate Prices of Agricultural Inputs

Farm gates prices of agricultural inputs have been obtained from the Crop Margin 1994, DOA, MAFF. The major farm gate prices of agricultural inputs are as follows:

Table 1-31 Farm Gate Price of Agricultural Inputs

Fertiliser/Chemicals	Price	Labour/Machinery	Price
Basal F. (D.Comp.)	9,400 K/pkt.	Tractor Hire	12,000 K/hr
Top F. (Urea)	8,250 K/pkt.	Owned Tractor (*1)	10,000 K/hr
Herbicide (Primagram)	8,300 K/lit.	Combine Hire	10,000 K/ha
Pesticide (Thiodam)	10,000 K/lit	Oxen Hire	20,000 K/ha
Transport/Packing	1,000 K/90kg	Casual Labour	500 K/day
Irrigation Water	50 K/m3		

(Data Source) Crop Margin 1994, DOA, MAFF
(Note) (*1) : Fuel and Repair.

(2) Farm Gate Prices of Agricultural Products

Farm gate prices of agricultural products are collected from various sources, and summarised as shown in Table 1-32. The prices in Table 1-32 have been applied in this study. Production cost for livestock is mainly composed of concentrated feed. Maize bran is commonly used as concentrated feed. Therefore, production cost of livestock is estimated based on per capita consumption of concentrated feed made of maize bran, of which price is set at 15% of maize grain price.

Table 1-32 1994 Price of Agricultural Products

Crops	(Unit)	1994 Average Price (1)	MAFF Applied Price (2)	Applied Price for Report
Cereals		(Kwacha)	(Kwacha)	(Kwacha)
Maize	90kg-bag	8,331 *1	7,000	8,330
Rice	80kg-bag	11,125 *1	15,000	15,000
Sorghum	90kg-bag	9,590 *2	10,000	10,000
Millet	90kg-bag	12,216 *2	7,500	12,200
Wheat	90kg-bag	21,764 *2	20,000	21,800
Starchy				
Cassava (chips)	90kg-bag	7,851 *2		7,850
Potatoes	10kg-bag		2,500	2,500
Sugar Crops				
Sugarcane	ton			16,900 (3)
Pulse Crops				
Mixed Beans	90kg-bag	35,462 *1	26,500	35,500
Oil Crops				
Soybeans	90kg-bag	13,322 *1	13,500	13,500
Sunflower	50kg-bag	6,224 *1	6,500	6,500
Seed Cotton	kg		145	145
Groundnuts (shelled)	80kg-bag	35,336 *1	25,000	35,300
Cash Crops				
Tobacco V	kg	1,440 *3		1,440
Tobacco B	kg	1,150 *3		1,150
Vegetables				
Tomatoes	15kg-pkt		2,500	2,500
Onion	10kg-pkt		1,500	1,500
Cabbage	kg		150	150
Carrot	kg		150	150
Lettuce	kg		80	80
Stimulant				
Coffee (processed)	kg			1,530 (4)
Tea (processed)	kg			740 (5)
Fruit				
Oranges	12kg-pkt			1,440 (6)
Banana	kg			240 (6)
Livestock				
Beef Meat	kg			1,500 (7)
Pig Meat	kg			2,500 (7)
Poultry	kg			2,000 (7)
Seep/Goat Meat	kg			2,500 (7)
Milk	lit.			400 (7)
Eggs (50 g/egg)	egg			125 (7)

(Data Source)

(1) Weekly Market Bulletin on Food Security Division, MAFF

(2) Gross Margin 1994, MAFF

(3) Purchase Price from Kaleya Smallholders Co. Limited (Zambia Sugar Company Limited)

(4) FOB Dar es Saram (Zambia Coffee Growers Association)

(5) FOB Dar es Saram (estimated from International Price of Tea by same ration of Coffee.)

(6) estimated from Market Price in September 1994. (30 % of Market Price)

(7) Livestock Commercial Farm (September, 1994)

(Notes)

*1) 1994 Average Price.

*2) 1994 Price is estimated as 1.5 times of 1993 Average Price, due to less data in 1994.

*3) estimated by 1990 Price due to no accurate latest data. (24 times of 1990 Price)

1.2.9 Import and Export of Agricultural Products

(1) Import and Export of Agricultural commodities

Annual import and export of agricultural commodities were K16,772,000,000 and K6,816,000,000 respectively in average of 1991 and 1992. They shared 17.1% of total import and 6.8% of total export.

Table 1-33 Import and Export of Agricultural Commodities

Import/Export Commodities	Import/ Export			Share to All Import
	1991	1992	Average	(%)
Import	(K'1,000)	(K'1,000)	(K'1,000)	
1 Cereals and Cereal Preparations	384,184	13,491,088	6,937,636	7.1%
2 Fertilisers manufactured	573,329	4,277,607	2,425,468	2.5%
3 Textile Yarn, Fabrics and Related products	1,198,030	3,276,784	2,237,407	2.3%
4 Paper, Paper board and manufactures	1,084,739	2,229,229	1,656,984	1.7%
5 Textile fibres (not manufactured into yarn thread of fabrics)	461,291	745,899	603,595	0.6%
6 Fixed vegetable oils and fats	197,327	975,881	586,604	0.6%
7 Animal Foods (not unmilled cereals)	51,293	677,249	364,271	0.4%
8 Dairy Products and Eggs	99,463	574,452	336,958	0.3%
9 Beverages	151,670	440,023	295,847	0.3%
10 Miscellaneous Food Preparations	274,216	285,432	279,824	0.3%
Other Commodities	348,523	1,745,755	1,047,142	1.1%
Total Import of Agricultural Commodities	4,824,065	28,719,399	16,771,736	17.1%
Total Import	51,772,821	144,108,535	97,940,678	100.0%
Export				
1 Textile Yarn, Fabrics and Related products	1,889,860	2,125,426	2,007,643	2.0%
2 Sugar, Sugar Preparations and Honey	117,680	2,221,594	1,169,637	1.2%
3 Oilseeds and Oleaginous fruits	576,037	1,416,631	996,334	1.0%
4 Textile fibres (not manufactured into yarn thread of fabrics)	1,335,609	363,832	849,721	0.9%
5 Tobacco and Tobacco Manufactures	871,788	604,899	738,344	0.7%
6 Fruit and Vegetables	327,332	365,239	346,286	0.3%
7 Cereals and Cereal Preparations	55,199	222,437	138,818	0.1%
8 Fixed vegetable oils and fats	28,165	195,802	111,984	0.1%
9 Fertilisers manufactured	0	171,345	85,673	0.1%
10 Wood, Lumber and Cork	81,253	54,609	67,931	0.1%
Other Commodities	319,997	288,751	304,378	0.3%
Total Export of Agricultural Commodities	5,602,920	8,030,565	6,816,749	6.8%
Total Export	69,607,361	129,475,423	99,541,392	100.0%

(Data Source) External Trade Bulletin 1993, CSO

(a) Import

Import of cereals shared the largest portion of about 7% of total import, and followed by fertilisers(2.5%), textile yarn (2.3%) and paper (1.7%).

(b) Export

Export of agricultural commodities is around 40% of import of agricultural commodities in Kwacha value. Textile yarn shared the largest portion of export as 2.0%, followed by sugar (1.2%), oilseeds (1.0%) and textile fibres (0.9%). Since almost textile is produced by cotton, cotton share an important portion in export. Sugar shared second position, and oilseeds shared the third position in export. Therefore, sugarcane and oilseeds such as beans and groundnuts are also important exportable crops.

(2) Import of Grains

Zambia imports grains almost constantly around 200,000 tons annually as shown in Table 1-34. Maize shares the largest amount in import of grains, and followed by wheat and rice. Due to severe drought in 1992, import of grains reached over 1,000,000 tons. The average annual import amount is at 133,000 tons in case except 1992. Only in 1993, Zambia achieved export of maize of about 68,000 tons due to good yield by preferable weather condition.

Table 1-34 Import and Export of Grain

Year	Import (tons)				Export (tons)			
	Maize	Wheat	Rice	Total	Maize	Wheat	Rice	Total
1981	264,600 *1	79,348 *2	2,356 *2	346,304	0	0	0	0
1982	48,600 *1	9,463 *2	296 *2	58,359	0	0	0	0
1983	111,600 *1			111,600	0	0	0	0
1984	99,900 *1	42,251 *3	3,761 *3	145,912	0	0	0	0
1985	95,400 *1	66,936 *3	3,096 *3	165,432	0	0	0	0
1986	97,200 *1	34,862 *3	301 *3	132,363	0	0	0	0
1987	14,400 *1	88,027 *3	859 *3	103,286	0	0	0	0
1988	63,900 *1	80,997 *3	1,252 *3	146,149	0	0	0	0
1989	126,000 *1	18,141 *3	4,279 *3	148,420	0	0	0	0
1990	0 *1	13,230 *3	4,704 *3	17,934	0	0	0	0
1991	171,000 *1	24,000 *3	21,000 *3	216,000	0	0	0	0
1992	969,166 *4	32,625 *4	2,000 *4	1,003,791	0	0	0	0
1993	0 *5	0 *5	0 *5	0	68,000 *4	0	0	68,000
Ave.	158,597	40,823	3,659	199,658	5,231	0	0	5,231
Ave1	91,050	41,569	3,809	132,647	5,667	0	0	5,667

(Data Source)

*1) 1989/90 Agricultural Statistics Bulletin, CSO, MAFF
*2) Country Profile 1985, CSO
*3) Country Profile 1992, CSO
*4) Food Security Bulletin, March 1993, Early Warning Unit, MAFF
*5) Food Security Bulletin, April 1994, Early Warning Unit, MAFF
Ave1) except 1992

(3) Border Price and Economic Producer Price

Border price and economic producer price are investigated for wheat and rice, which are irrigated crops and largely imported.

Comparison of Producer Price and Economic Producer Price

Province	Crops	Economic Producer Price	Producer Price
Central	Wheat (K/t)	244,750	242,222
Western	Rice(K/t)	238,700	187,500

(Note) Details are shown in Table 1-35

Comparing producer price and economic producer price, both prices of wheat are almost at same level. Therefore, producer price of wheat reached almost economic producer price. It means that it is difficult to increase producer price of wheat.
On the other hand, producer price of rice is lower than economic producer price. Therefore, there is a room to increase producer price of rice little more.

Table 1-35 Border Price and Economic Produce Price

(1994 Price)

Composition		Wheat	Rice
International Price ($/t)		206 *1)	397 *1)
Sea freight and port charges ($/t)		144 *2)	246 *2)
Inland transport ($/t)		65 *3)	65 *3)
Border price Lusaka ($/t)		415	708
Border price Lusaka (K/t)		253,150 *4)	431,880 *4)
	Paddy Price (K/t)		289,360 *5)
	Milling Cost (K/t)		23,360 *6)
	Price of Paddy (K/t)		266,000
Economic Producer Price (*7)			
Lusaka	0	253,150	266,000
Copperbelt	10,500	242,650	255,500
Central	8,400	244,750	257,600
N/Western	23,600	229,550	242,400
Western	27,300	225,850	238,700
Southern	10,500	242,650	255,500
Luapula	15,500	237,650	250,500
Northern	18,100	235,050	247,900
Eastern	16,100	237,050	249,900

(Note)

*1) Wheat: Thunderbay Rice: Bangkok (f.o.b.)

*2) Sea freight and port charges refer to 1985 price of " Study on Option and Investigation Priorities in Irrigation Development", Euroconsult, 1987

Inflation rate = 1.1085 (1990 to 1994)/0.686 (1985 to 90) =1.616

Wheat: $ 89 (1985 Price) * 1,616 (inflation to 1994)

Rice : $152 (1985 Price) * 1,616 (inflation to 1994)

*3) Dar es Saram to Lusaka, 1994 Price (MAFF, D-compound)

*4) US$1.00 = K610

*5) Efficiency = 0.67

*6) 8% of paddy price

*7) Transport, handling and marketing cost (referring to MAFF, D-compound)

1.2.10 Farm Income and Expenditure

(1) Farm Expenditure

Annual expenditure of non-metropolitan area is reported at about K600,000/year /household as shown in Table 1-36. On the other hand, it is at K1,043,000/year/household in metropolitan area and K747,000/year/household as national average. There is, therefore, still some gap from metropolitan area.

Table 1-36 Household Expenditure by Metropolitan and Non-Metropolitan

Expenditure Type	Metro politan	Non-Met.	Average	Metro politan	Non-Met.	Average
Monthly Expenditure	(K)	(K)	(K)	(%)	(%)	(%)
Food	51,612	13,778	26,352	59.4%	27.6%	42.4%
Transport & Communication	6,177	3,759	4,561	7.1%	7.5%	7.3%
Housing & Fuel	7,341	1,829	3,661	8.4%	3.7%	5.9%
Household Goods	5,347	2,268	3,292	6.2%	4.5%	5.3%
Clothing	3,850	2,928	3,233	4.4%	5.9%	5.2%
Education & Entertainment	2,273	2,503	2,426	2.6%	5.0%	3.9%
Other Goods & Services	3,867	1,557	2,324	4.4%	3.1%	3.7%
Cash Given & Loan Payments	2,158	1,175	1,501	2.5%	2.4%	2.4%
Health	767	114	332	0.9%	0.2%	0.5%
Sub-Total	83,392	29,911	47,682	95.9%	59.9%	76.6%
Own Produce						
Food	2,422	15,605	11,224	2.8%	31.3%	18.0%
Housing & Fuel	1,099	4,158	3,137	1.3%	8.3%	5.0%
Other Goods & Services	0	250	167	0.0%	0.5%	0.3%
Sub-Total	3,521	20,013	14,528	4.1%	40.1%	23.4%
Total	86,913	49,924	62,210	100.0%	100.0%	100.0%
Annual Expenditure	1,043,000	599,000	747,000	100.0%	57.4%	71.6%

(Data Source)
Zambia Household Budget Survey, 1993-1994, (Preliminary Results), CSO
(Note)
Survey: July-September 1993

(2) Evaluation of Farm Income and Expenditure by Provinces

Gross earning of maize is estimated at K197,000/ha in 1993 price. (see Appendix A2-1) When producing expenditure only by maize, it will be, therefore, necessary to cultivate at least 3.0ha for one household.

K600,000/yr/household /K197,000/ha = 3.0 ha/household

Table 1-37 shows the average farming size per household. Farming size of national average is estimated at 2.22 ha, that is larger than minimum required farming size. Only two provinces, Central and Southern provinces are over minimum required farming size, and other seven provinces are less than minimum required farming size.

On the other hand, when taking provincial maize yield into account, seven deficit provinces are still less than minimum required farming size. Luapula province is the lowest in its equivalent farming size as 0.73ha per household or 24% of minimum required farming size. Western Province decreases its equivalent farming size to 0.74ha from 1.37ha due to the

lowest yield of maize among provinces.

Eastern Province also decreases its equivalent farming size from 2.53ha to 1.92ha sharply due to the second lowest yield among provinces.

Table 1-37 Evaluation of Per Household Planted Area

Province	Planted Area (ha)	House holds	Farming Size per Household (ha/hold)	Ratio to Mini. Required Size	Ave. Maize Yield (t/ha)	Ratio to National Average	Equivalent Farming Size/ Household (ha/hold)	Ratio to Mini. Required 1.86ha
	(1)	(2)	(3) (1)/(2)	(4) (3)/3.0ha	(5)	(6) (5)/1.80	(7) (3)x(6)	(8) (7)/3.0ha
Lusaka	39,082	13,305	2.94	98%	1.67	93%	2.73	91%
Copperbelt	39,123	24,108	1.62	54%	2.18	121%	1.96	65%
Central	165,844	49,683	3.34	111%	2.54	141%	4.71	157%
N/Western	31,847	39,788	0.8	27%	1.75	97%	0.78	26%
Western	65,916	47,951	1.37	46%	0.97	54%	0.74	25%
Southern	332,459	57,491	5.78	193%	1.99	111%	6.42	214%
Luapula	43,026	68,206	0.63	21%	2.09	116%	0.73	24%
Northern	102,554	88,186	1.16	39%	2.27	126%	1.46	49%
Eastern	334,049	131,802	2.53	84%	1.36	76%	1.92	64%
Total	1,153,900	520,520	2.22	74%	1.80	100%	2.22	74%

1.3 Crops

1.3.1 Cropping Calendar

Cropping calendar of major crops is shown in Figure 1-4. Rainfed agriculture is predominant in Zambia and most crops are grown under rainfed conditions. Consequently, cropping calendar of most crops relies on rainfall starting generally in November and continuing to March for five months. Rainfall is scarce and unreliable in October and April. Therefore, crops are generally planted depending on start of rainfall.

Climatic season of Zambia is generally divided into four seasons as shown below;

Climatic Seasons in Zambia

Rainy Season (Rainy Season):	November - March	(5 months)
Cool Dry Season (Post Rainy Season):	April - May	(2 months)
Winter Season (Winter Season):	June - August	(3 months)
Hot Dry Season (Pre-Rainy Season):	September- October	(2 months)

(Note) Climatic season refers to the naming by MAFF. ( ) by Department of Meteorology.

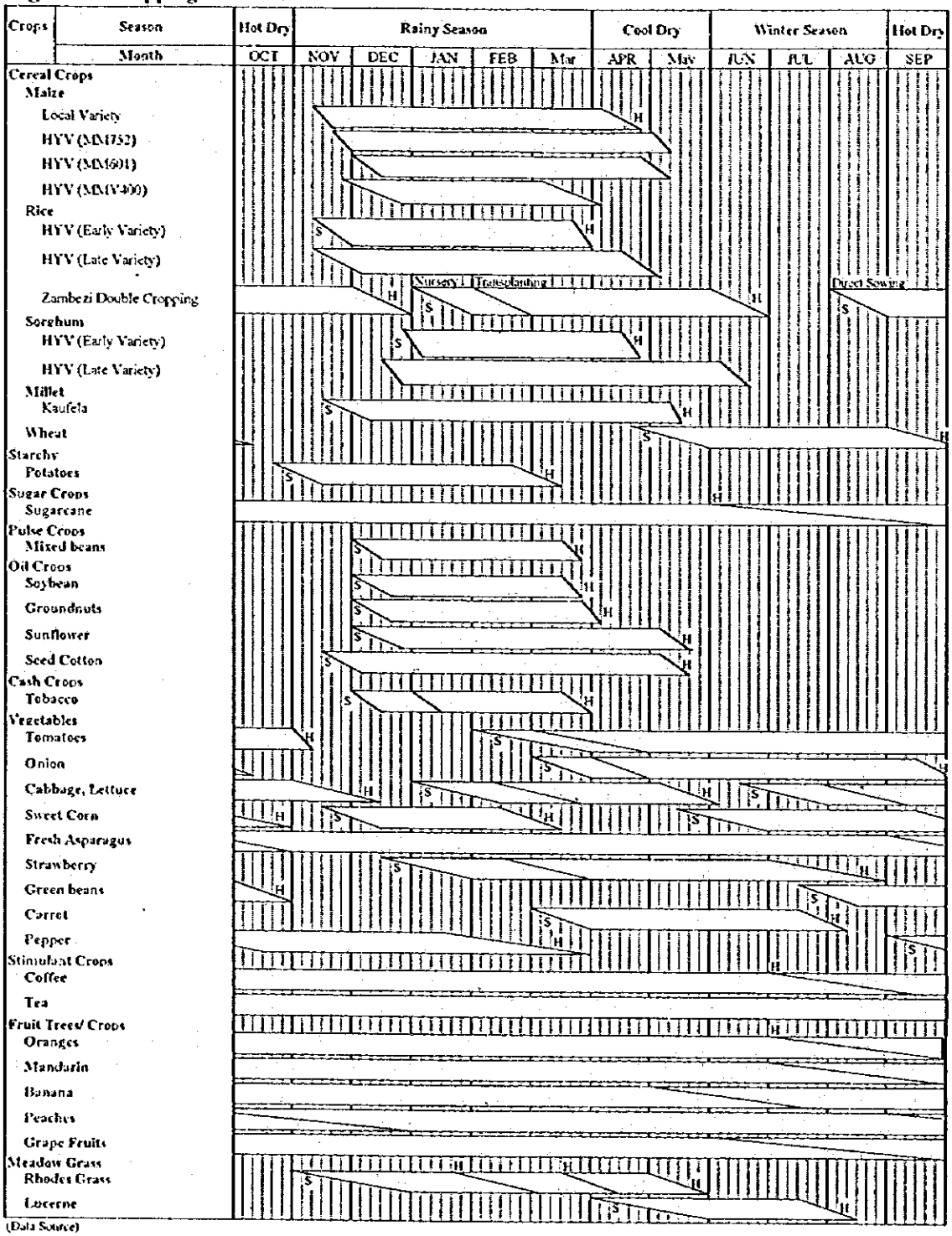
Monthly mean temperature ranges from 15°C to 16°C in July to 24 °C to 25°C in October through Zambia. Annual mean temperature is around 21 °C through all zones. That is indicating that there is not much difference in mean temperature by zones. However, minimum and maximum temperature of Zone-I goes down and up in large range in the Agro-ecology Zone-I. Minimum temperature falls to 4°C in July, and maximum temperature goes up to 34°C in October at Sesheke in Agro-ecology Zone-I. Ranges of temperature of other zones are much less than Zone-I, as 8 °C to 31 °C. Although winter season is moderate in temperature, but there is almost no rainfall in this season. Rainfall is predominant and stable in northern region, and scarce and unsteady in southern region.

Most crops are grown in rainy season, generally planted in November and harvested in April to May. However, yields of rainfed crops are affected by rainfall pattern and amount during drought years. On the other hand, winter crops like wheat, winter vegetables and perennial crops like sugarcane and tree crops have to be irrigated because of scarce or almost no rainfall in winter season.

When rain starts, sowing of maize and millet are started early in November, and followed by pulse crops and oil crops like mixed beans, soybeans, groundnuts, sunflower and seed cotton in December. Sowing of maize continues to late December, because planting area of maize shares the largest acreage at more than 60% of total planted area or around 820,000 ha. As shown in Figure 1-4, there are several different varieties of maize having different-growing periods. It is, therefore, important to select suitable varieties to avoid concentration of sowing and harvesting works. Early matured sorghum is sown in December to January because its growth period is shorter.

In extension works, it is recommended to introduce both early and late matured HYVs (High Yield Varieties) of paddy rice. Paddy rice is generally directly sown without transplanting, and is grown mainly by small-scale farmers utilising dambos in Northern and Western Provinces totally about 14,000 ha in rainy season. Transplanting of paddy rice has been researched and verified recently in Zambezi Flood Plain in Western Province.

Figure 1-4 Cropping Calendar



(Data Source)
Crops-Horticulture Section, MAFF
A Handbook for Agricultural Extension, 1991-92 Eastern, Western and Luapula Provinces, DOA, MAFF

(Note)
1) Season divided by Meteorology of Zambia, June 1981, ZMD
2) S: Sowing, T: Transplanting, H: Harvesting, Nursery: Raising of Seedling
3) Mainly rainfed Mainly irrigated

Wheat is mainly grown by commercial farmers under irrigation in winter season, and produces a high yield of about 5 tons/ha. Around 13,700 ha of irrigated wheat was planted in 1993, and this area is expanding steadily. Rainfed wheat was also planted in much smaller area of about 3,700ha in 1993, but it is insignificantly lower yield of about 1.0 tons/ha. Cropping system of "irrigated wheat + soybeans" is highly mechanised in cultivation.
In the rural area, vegetables are grown under rainfed condition mainly for home consumption in rainy season. However, year-round irrigated cultivation of vegetables is conducted under commercial basis for marketing along the Line of Rail.
Coffee and tea are grown with irrigation in winter season under commercial basis mainly in Northern Province. Fruit trees like citrus are grown in the same regions as commercial basis vegetables.

1.3.2 Planted Area and Production of Crops

(1) Planted Area of Crops

(a) Planted Area

Planted area of Zambia is increasing at a rate of about 56,000 ha annually, and it reached to 1,363,000 ha (1,335,000 ha by MAFF) in 1993.
Table 1-38 shows the planted area of 1993. As shown in the table, cereal crops shares the largest area (954,000ha or 70%), and followed by oil crops (215,000ha or 16%), and starchy crops (109,000ha or 8%). Those three major crops share 94% of total planted area. Among the provinces, Eastern Province shares the largest area of about 363,000ha (27%), and followed by the Southern (21%) and Central (18%) Provinces. These three provinces are predominant in farming in Zambia, and sharing 66% of the national total planted area.

Table 1-38 Present Planted Area in 1993 (ha)

Lusaka	Copper-belt	Central	N/ Western	West ern	South ern	Lua pula	North ern	East ern	Zambia	Share
Cereal Crops										
30,604	39,414	165,797	24,882	79,320	217,523	25,568	75,911	295,030	954,049	70.0%
Starchy Crops										
800	943	2,272	10,640	26,965	60	35,318	32,431	53	109,482	8.0%
Sugar Crops										
0	0	0	0	0	13,000	0	0	0	13,000	1.0%
Pulse Crops										
50	651	1,770	2,406	1,094	107	3,245	27,054	2,112	38,489	2.8%
Oil Crops										
6,049	4,841	73,631	1,315	2,496	47,241	7,393	9,925	61,828	214,719	15.8%
Tobacco										
119	157	1,883	2	97	1,179	0	4	3,505	6,946	0.5%
Vegetables										
1,736	3,493	2,263	255	0	594	695	2,415	212	11,663	0.9%
Tree Crops										
402	2,787	1,677	267	0	1,019	1,441	6,727	135	14,455	1.1%
Flower										
209	36	0	0	0	0	3	1	0	249	0.0%
Total of Planted Area										
39,969	52,322	249,293	39,767	109,972	280,723	73,663	154,468	362,875	1,363,052	100.0%
3%	4%	18%	3%	8%	21%	5%	11%	27%	100%	

(b) Increase of Planted Area by Provinces

Annual increase of planted area amounts to 56,400 ha in national level. The largest increase is observed in Southern Province at about 14,200 ha as shown in Table 1-39. Eastern, Northern, Western and Central Provinces follows Southern Provinces with annual increase rates of 10,700 ha, 6,100 ha, 5,300 ha and 5,100 ha respectively. Increase rates of Lusaka and Copperbelt are low at about 510 ha and 1,650 ha per annum.

Table 1-39 Increasing of Planted Area by Provinces

	Planted Area in 1993	Annual Increase	Increasing Rate	
			Share of Increase (to (1))	Increase to Planted Area
	(ha)	(ha/yr)	(%)	(%)
10 Lusaka	37,622	520	1.1%	1.4%
20 Copperbelt	46,006	1,650	3.4%	3.6%
30 Central	245,353	5,130	10.5%	2.1%
40 N/Western	39,245	2,040	4.2%	5.2%
50 Western	109,972	5,270	10.8%	4.8%
60 Southern	279,110	14,230	29.1%	5.1%
70 Luapula	71,524	3,350	6.8%	4.7%
80 Northern	145,325	6,100	12.5%	4.2%
90 Eastern	362,528	10,680	21.8%	2.9%
Sub-total	1,336,685	48,970	(1) 100.0%	3.7%
Others (*)	26,118	7,430		
Total	1,362,803	56,400		

(Note) (*) Vegetables and tree crops other than MAFF statistics.

As seeing above table, increasing rate to planted area is large in North-western Province (5.2%), and Western, Luapula, and Northern Provinces are also showing higher increase rate than national average increase of 3.7%. Lusaka, Copperbelt and Central Provinces are showing lower increase than national average.

From above increasing trend of planted area, expansion of planted area of the northern region is evaluated to be considerably rapid.

(c) Trend of Increase of Planted Area by Crop-basis

Table 1-40 shows the planted area of crop basis. Maize cultivation is predominant among crops. Maize was planted on 820,000 ha in 1993, which is equivalent to 61% of total planted area. Among provinces, maize is planted at largest extent in Eastern Province, and followed by Southern and Central Provinces. Cassava follows maize in its planted area (8%), followed by groundnuts (6%), seed cotton (5.6%), millet (4%), and sorghum (3.5%). Wheat, rice and tobacco etc. are less than 1% of total planted area.

Table 1-40 Planted Area by Crop-basis in 1993

Unit (ha)

Crops/ Province	Lusaka	Copper-belt	Central	N/Wes-tern	West-ern	Southern	Luapula	North-ern	Eastern	Zambia
Maize	24,981	30,343	152,091	17,742	46,062	203,431	15,197	50,439	280,110	820,396
	3.0%	3.7%	18.5%	2.2%	5.6%	24.8%	1.9%	6.1%	34.1%	60.2%
Sorghum	2,275	3,497	7,195	5,458	10,892	6,963	1,502	2,621	7,389	47,792
	4.8%	7.3%	15.1%	11.4%	22.8%	14.6%	3.1%	5.5%	15.5%	3.5%
Millet	3	163	3,467	910	15,149	2,513	8,466	18,259	5,878	54,808
	0.0%	0.3%	6.3%	1.7%	27.6%	4.6%	15.4%	33.3%	10.7%	4.0%
Rice	18	33	40	772	7,217	0	403	3,727	1,501	13,711
	0.1%	0.2%	0.3%	5.6%	52.6%	0.0%	2.9%	27.2%	10.9%	1.0%
Wheat (Irrigated)	3,327	2,978	2,585	0	0	4,616	0	0	150	13,656
	24.4%	21.8%	18.9%	0.0%	0.0%	33.8%	0.0%	0.0%	1.1%	1.0%
Wheat (Rainfed)	0	2,400	419	0	0	0	0	865	2	3,686
	0.0%	65.1%	11.4%	0.0%	0.0%	0.0%	0.0%	23.5%	0.1%	0.3%
Cassava)	0	733	1,672	10,640	26,965	0	35,318	32,431	53	107,812
	0.0%	0.7%	1.6%	9.9%	25.0%	0.0%	32.8%	30.1%	0.0%	7.9%
Potatoes	800	210	600	0	0	60	0	0	0	1,670
	47.9%	12.6%	35.9%	0.0%	0.0%	3.6%	0.0%	0.0%	0.0%	0.1%
Sugarcane	0	0	0	0	0	13,000	0	0	0	13,000
	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	1.0%
Mixed Beans	50	651	1,770	2,406	1,094	107	3,245	27,054	2,112	38,489
	0.1%	1.7%	4.6%	6.3%	2.8%	0.3%	8.4%	70.3%	5.5%	2.8%
Soybeans	1,387	2,429	7,931	153	18	4,872	60	137	2,877	19,864
	7.0%	12.2%	39.9%	0.8%	0.1%	24.5%	0.3%	0.7%	14.5%	1.5%
Groundnuts	915	2,033	17,682	1,060	2,371	8,454	7,304	9,742	32,903	82,464
	1.1%	2.5%	21.4%	1.3%	2.9%	10.3%	8.9%	11.8%	39.9%	6.0%
Sunflower	562	78	10,860	102	4	20,171	29	46	4,047	35,899
	1.6%	0.2%	30.3%	0.3%	0.0%	56.2%	0.1%	0.1%	11.3%	2.6%
Seed Cotton	3,185	301	37,158	0	103	13,744	0	0	22,001	76,492
	4.2%	0.4%	48.6%	0.0%	0.1%	18.0%	0.0%	0.0%	28.8%	5.6%
Tobacco V.	0	0	1,727	0	97	1,152	0	4	578	3,558
	0.0%	0.0%	48.5%	0.0%	2.7%	32.4%	0.0%	0.1%	16.2%	0.3%
Tobacco B.	119	157	156	2	0	27	0	0	2,927	3,388
	3.5%	4.6%	4.6%	0.1%	0.0%	0.8%	0.0%	0.0%	86.4%	0.2%
Vegetables	1,736	3,493	2,263	255	0	594	695	2,415	212	11,663
	14.9%	29.9%	19.4%	2.2%	0.0%	5.1%	6.0%	20.7%	1.8%	0.9%
Coffee	22	1,057	349	215	0	485	403	3,643	11	6,185
	0.4%	17.1%	5.6%	3.5%	0.0%	7.8%	6.5%	58.9%	0.2%	0.5%
Tea	0	0	0	0	0	0	140	0	0	140
	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%
Orange	336	1,684	1,315	42	0	462	578	2,631	107	7,155
	4.7%	23.5%	18.4%	0.6%	0.0%	6.5%	8.1%	36.8%	1.5%	0.5%
Banana	44	46	13	10	0	72	320	453	17	975
	4.5%	4.7%	1.3%	1.0%	0.0%	7.4%	32.8%	46.5%	1.7%	0.1%
Flower	209	36	0	0	0	0	3	1	0	249
	83.9%	14.5%	0.0%	0.0%	0.0%	0.0%	1.2%	0.4%	0.0%	0.0%
Total	39,969	52,322	249,293	39,767	109,972	280,723	73,663	154,468	362,875	1,363,052
	2.9%	3.8%	18.3%	2.9%	8.1%	20.6%	5.4%	11.3%	26.6%	100%

Using 12 year crop data, which are described in Appendix-1 , trend of increase of planted area was analysed in crop basis. The results of increase of planted area is summarised in Table 1-41.

Table 1-41 Trend of Planted Area by Crop-basis in Zambia

Crops	Actual Planted Area		Annual Increase (1982-93)	Ratio of Increase		Estimated Area by Trend (2015)
	1990	1993		to Total Increase	to 1993 area	
	(ha)	(ha)	(ha/yr)	(%)	(%)	(ha)
Cereal Crops	892,836	954,049	36,611	65.0%	3.8%	1,752,000
Maize	763,278	820,396	27,878	49.5%	3.4%	1,417,000
Sorghum	48,466	47,792	2,340	4.2%	4.9%	103,000
Millet	58,869	54,808	4,706	8.4%	8.6%	167,000
Rice (Extensive) (*)	9,628	13,711	660	1.2%	4.8%	29,000
Irrigated Wheat *1	11,595	13,656	1,027	1.8%	7.5%	36,000
Rainfed Wheat	1,000 *2	3,686		0.0%	0.0%	0 *4
Starchy Crops	97,300	109,482	4,367	7.7%	4.0%	206,300
Cassava	96,000 *2	107,812	4,310	7.6%	4.0%	204,000
Potatoes	1,300 *2	1,670 *2	57	0.1%	3.4%	2,300
Sugar Crops	11,974	13,000	0	0.0%	0.0%	21,000
Sugarcane *1	11,974	13,000		0.0%	0.0%	21,000 *5
Pulse Crops	26,436	38,489	2,393	4.2%	6.2%	87,000
Mixed Beans	26,436	38,489	2,393	4.2%	6.2%	87,000
Oil Crops	218,583	214,719	10,483	18.6%	4.9%	507,000
Soybean	29,815	19,864	2,048	3.6%	10.3%	73,000
Groundnuts (R)	80,443	82,464	5,643	10.0%	6.8%	218,000
Sunflower	44,289	35,899	-1,632	-2.9%	-4.5%	36,000 *6
Seed Cotton	64,036	76,492	4,424	7.8%	5.8%	180,000
Cash Crops	5,071	6,946	403	0.7%	5.8%	15,000
Tobacco(V)	3,588	3,558	114	0.2%	3.2%	5,700
Tobacco(B)	1,483	3,388	289	0.5%	8.5%	9,300
Vegetables	7,000	11,663	916	1.6%	7.9%	30,000
Vegetables *1	7,000 *2	11,663 *2	916	1.6%	7.9%	30,000
Tree Crops	8,820	14,455	1,185	2.1%	8.2%	38,840
Coffee *1	5,000 *2	6,185 *2	528	0.9%	8.5%	18,000
Tea *1	120 *2	140 *2	5	0.0%	3.3%	240
Orange *1	3,000 *2	7,155 *2	576	1.0%	8.1%	18,000
Banana *1	700 *2	975 *2	76	0.1%	7.8%	2,600
New Crops		249				
Flower *1		249 *2		0.0%	0.0%	
Total	1,268,020	1,363,052	56,357	100.0%	4.1%	2,657,140
Total of MAFF Data	1,153,900 *3	1,335,015 *3				
Total of Irrigated Crops	39,389	52,774	3,128	5.5%	5.9%	125,840

(Note) (*): not counted in the irrigated area, (*1): Irrigated crops

(*2) estimated by Water Right Survey. (no trend data for flower.)

(*3): Planted area reported by MAFF Statistics. (excluding estimated areas)

(*4): Rainfed wheat is considered to decrease in planted area due to lower productivity.

(*5): Planted area of sugarcane is based on expansion plan of the Nakanbala Sugar Company.

(*6): Sunflower tends to decrease. Planted area is projected to keep constant area of 1993.

As shown in Table 1-41, annual increase of total planted area is estimated at 56,400 ha in annum. Largest increase is achieved by maize at about 50% of total increase, but 3.4% to the total maize area. Oil crops and starchy crops follow maize, which share about 18% and 7.7% of total increase. Irrigated crops share 5.5% of total increase, and increase at 5.9% to irrigated area.

Highest increase rate is recorded by soybeans at 10.3%, and followed by millet at 8.6%, by tobacco at 8.5%, by irrigated tree crops at 7.9% and irrigated vegetables. Therefore, irrigated crops are increasing higher rate among crops.

(2) Production of Crops

As shown in Table 1-42, total crop production amounted to 2,821,000 tons in 1993, of which cereal crops share the largest production at 67%. Starchy crops, mainly cassava, follows production of maize. Maize production reached to 1,892,000 tons in 1993, which was third largest production since 1982. Maximum production was recorded at 1,943,000 tons in 1988. However, maize production dropped drastically to 483,000 tons in 1992, less than half of annual average production, due to severe drought.

Table 1-42 Present Crop Production in 1993

(Unit:1,000 tons)

	Lusaka	Copper-belt	Central	N/ Western	West ern	South ern	Luapula	North ern	Eastern	Zambia	Ratio
Cereal Crops	79	100	524	35	65	491	47	142	409	1,892	67.1%
Starchy Crops	2	2	5	23	58	0	76	70	0	236	8.4%
Sugar Crops (Row Sugar basis)	0	0	0	0	0	140	0	0	0	140	5.0%
Pulse Crops	0	0	1	2	0	0	2	17	1	23	0.8%
Oil Crops	6	6	47	1	1	28	4	6	37	136	4.8%
Tabacco	0.2	0.1	2.3	0.0	0.1	1.5	0.0	0.0	2.6	6.8	0.2%
Vegetables	35	70	45	5	0	12	14	48	4	233	8.3%
Tree Crops	7	32	24	1	0	10	17	61	2	154	5.5%
Total of Planted Area	129	210	648	67	124	683	160	344	456	2,821	100.0%
	5%	7%	23%	2%	4%	24%	6%	12%	16%	100%	

Table 1-43 Crop Production by Crop-basis in 1993 'Unit (tons)

	Lusaka	Copper-belt	Central	N/ Western	West-ern	South-ern	Luapula	North-ern	Eastern	Zambia
Maize										61.5%
	58,375	79,421	502,345	29,317	46,805	462,637	37,669	120,274	399,379	1,736,222
Sorghum										1.3%
	4,476	2,398	4,311	3,754	6,290	6,104	2,161	2,138	4,398	36,030
Millet										1.2%
	1	131	2,496	653	6,679	934	6,398	13,727	2,143	33,162
Rice (Extensive)										0.5%
	27	43	53	846	5,092	0	685	5,165	2,054	13,965
Irrigated Wheat										2.5%
	16,186	16,560	14,220			21,600			720	69,286
Rainfed Wheat										0.07%
	0	1,260	302	0	0	0	0	375	7	1,944
Cassava (estimated with an yield of 2.16 t/ha in Chips)										8.2%
	0	1,583	3,612	22,982	58,244	0	76,287	70,051	114	232,874
Potatoes (estimated with yield 13.42 t/ha)										0.13%
	1,728	454	1,296	0	0	130	0	0	0	3,607
Sugarcane (estimated with an yield of 10.8 t/ha as Row Sugar)										5.0%
	0	0	0	0	0	140,400	0	0	0	140,400
Mixed Beans										0.8%
	50	463	1,399	1,593	347	21	2,033	16,777	865	23,548
Soybean										1.0%
	3,191	4,610	9,912	125	23	7,801	68	115	2,181	28,026
Groundnuts (R)										1.6%
	612	1,359	10,998	916	542	3,382	4,285	6,059	17,594	45,747
Sunflower										0.5%
	320	38	2,570	60	1	9,443	17	30	1,851	14,330
Seed Cotton										1.7%
	2,071	139	23,047	0	23	7,361	0	0	15,758	48,399
Tobacco(V)										0.15%
	0	0	2,193	0	55	1,478	0	3	409	4,138
Tobacco(B)										0.09%
	224	101	110	3	0	19	0	0	2,168	2,625
Vegetables (estimated with an yield of 20 t/ha)										8.3%
	34,720	69,860	45,260	5,100	0	11,880	13,900	48,300	4,240	233,260
Coffee (estimated with an yield of 2.0 t/ha as processed coffee)										0.4%
	44	2,114	698	430	0	970	806	7,286	22	12,370
Tea (estimated with an yield of 4.44 t/ha as made tea)										0.02%
	0	0	0	0	0	0	622	0	0	622
Orange (estimated with an yield of 17.5 t/ha)										4.4%
	5,880	29,470	23,013	735	0	8,085	10,115	46,043	1,873	125,214
Banana (estimated with an yield of 4.14 t/ha)										0.6%
	770	805	228	175	0	1,260	5,600	7,928	298	17,064
Total Production										100.0%
	128,675	210,809	648,063	66,689	124,101	683,505	160,646	344,271	456,074	2,822,833
	4.6%	7.5%	23.0%	2.4%	4.4%	24.2%	5.7%	12.2%	16.2%	100%