Fertilizer use by crop in Ghana

International Fertilizer Industry Association

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Land and Plant Nutrition Management Service
Land and Water Development Division

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Preface

The Food and Agriculture Organization of the United Nations (FAO) commissioned this study. It is one of a series of publications on fertilizer use on crops in different countries.

The aim of the series is to examine the agro-ecological conditions, the structure of farming and cropping patterns, the availability and use of mineral and organic plant nutrients, the economics of fertilizer use, research and advisory requirements and other factors that have led to present fertilizer usage. The reports examine, country by country, the factors that will or should determine the future development of plant nutrition.

During the past two decades, increasing attention has been paid to the adverse environmental impact of both the underuse and the overuse of plant nutrients. The efficient use of plant nutrients, whether from mineral fertilizers or from other sources, involves the shared responsibility of many segments of society, including international organizations, governments, the fertilizer industry, agricultural research and advisory bodies, traders and farmers. The publications in the series are addressed to all these parties.

Fertilizer use is not an end in itself. Rather it is a means of achieving increased food and fibre production. Increased agricultural production and food availability can, in turn, be seen as an objective for the agricultural sector in the context of contributing to the broader macroeconomic objectives of society. A review of the options available to policy-makers is given in the FAO/IFA 1999 publication entitled *Fertilizer Strategies*.

The contents of the series of studies differ considerably from country to country, in view of their different structures, histories and food situation. But in each case the aim of the study is to arrive at a better understanding of the nutrition of crops in the country concerned.

Acknowledgements

This study is based on the work of Mensah Bonsu, Department of Soil Science, School of Agriculture, University of Cape Coast, Ghana.

The study benefited from the contributions of P. Heffer, International Fertilizer Industry Association (IFA), K. Isherwood (consultant FAO), J. Poulisse and T. van den Bergen (FAO).

The background cover photograph is from the FAO Mediabase: FAO/18309/C. Cenini. The other photographs from the FAO Mediabase are pepper: FAO/20967 (no author) and cocoa: FAO/17254/L. Withers. The photograph on cassava was provided by EcoPort (International Institute of Tropical Agriculture Annual Report 1998).

Abstract

The population of Ghana is increasing at a rate of 1.7 percent per annum with almost two-thirds living in rural areas. Agriculture accounts for about a third of the gross domestic product (GDP), although this proportion is tending to decline. Ghana has extensive areas of land suitable for agriculture but the soils are infertile and only productive with proper management. The coarse nature of the soils has an impact on their physical properties and water stress is common during the growing season. Traditional, soil mining cultivation practices are still used extensively.

Cocoa is the main export crop but its production has been irregular. The crop has received little fertilizer. However, production increased in 2002/03 and, with improved practices including fertilization, there are good prospects for improving crop production. The production and exports of higher value crops, fruit and vegetables, are tending to increase.

All fertilizers used in Ghana are imported. The most important group of fertilizers is that of compound fertilizers. The consumption of fertilizers fell substantially between the early 1980s and 2000 mostly because of adverse economic conditions but in 2002 it recovered to the former level. Maize accounts for about 40 percent of fertilizer use on food crops. The retail price of fertilizers increased several-fold between the 1980s and the 2000s largely owing to the depreciation of the Cedi. Subsidies on fertilizers were removed progressively from 1987 onwards.

The correct use of fertilizers is particularly profitable on flooded rice and cassava but was profitable on most crops under 2002 economic conditions. Several crops respond positively to organic manures. Maize, for example, responds well to applications of NPK, to a lesser extent to application of manure, but in on-farm trials manure plus NPK gave a seven-fold increase over plots with no treatment. A special grade of fertilizer has been developed for use on cocoa. In on-farm trials, compared with unfertilized plots, a yield increase of 62 percent was obtained in the first year rising to 107 percent in the fourth year of application.

Among the important constraints to increased fertilizer use are inadequate and expensive credit, unsatisfactory marketing arrangements for the produce, the relatively small area under irrigation, insufficient funding of agricultural projects and inefficient use of fertilizers by farmers. Only 0.2 percent of the cultivated land is irrigated whereas several large irrigation schemes are underutilized.

Abbreviations

Cif	Cost, insurance and freight
CSIR	Council for Scientific and Industrial Research
CRIG	Cocoa Research Institute of Ghana
CV	Coefficient of variation
GDP	Gross Domestic Product
GPRS	Ghana Poverty Reduction Strategy
IFDC	International Fertilizer Development Centre
ISSER	Institute of Social and Economic Research
MOFA	Ministry of Food and Agriculture
RP	Rock phosphate
SE	Standard error
SRI	Soil Research Institute
VCR	Value Cost Ratio

Fertilizers

AN	Ammonium nitrate
AS	Ammonium sulphate
KNO_3	Potassium nitrate
MOP	Muriate of potash
SSP	Single superphosphate
TSP	Triple superphosphate
NPK	Compound fertilizer containing N, P_2O_5 and K_2O
NP	Compound fertilizer containing N and P_2O_5
PK	Compound fertilizer containing P_2O_5 and K_2O

N: Nitrogen
P_2O_5 or P: Phosphate*
K_2O or K: Potash*

* Phosphate and potash may be expressed as their elemental forms P and K or as their oxide forms P_2O_5 and K_2O. Nitrogen is expressed as N. In this study, phosphate and potash are expressed in their oxide forms.

Chapter 1
Introduction

Ghana is located on the southern coast of West Africa, between latitudes 4° 44' N and 11° 11'N and longitudes 3° 11' W and 1° 11' E.

The country is divided into ten administrative regions. These regions are shown in Table 1.

According to the World Bank, in 2003 the country had a population of 20.4 million people with a population growth rate of 1.7 percent per annum. Agriculture accounted for 35 percent of the GDP.

TABLE 1
The regions of Ghana and their capitals

Region	Capital
Ashanti	Kumasi
Brong Ahafo	Sunyani
Central	Cape Coast
Eastern	Koforidua
Greater Accra	Accra
Northern Region	Tamale
Upper East Region	Bolgatanga
Upper West	Wa
Volta	Ho
Western	Sekondi-Takoradi

The total and rural populations of the different regions in 1999 are given in Table 2.

TABLE 2
Population

Region	Population ('000)	Growth rate (%)	Rural ('000)	Rural (%)
Ashanti	3 613	3.4	1 685	46.6
Brong Ahafo	1 815	2.5	1 137	62.6
Central	1 594	2.1	995	62.5
Eastern	2 107	1.4	1 379	65.4
Greater Accra	2 906	4.4	359	12.3
Northern	1 821	2.8	1 337	73
Upper East	577	1.7	476	82.6
Upper West	921	1.1	776	84.3
Volta	1 635	1.9	1 194	73
Western	1 925	3.2	1 226	63.7
Total/Average	**18 914**	**2.6**	**10 564**	**55.9**

TABLE 3
Land use

	'000 ha	Percentage
Total land area	23 854	100
Agriculture land area	13 628	57.1
(of which under cultivation)	(6 331)	(26.5)
Total area under irrigation	11	0.05
Area under inland waters	1 100	4.6
Others*	9 064	38.3

* Others: Forest reserves and savanna woodlands.
Source: MOFA, 2003.

LAND USE

The land areas according to their utilization are given in Table 3 and Figure 1.

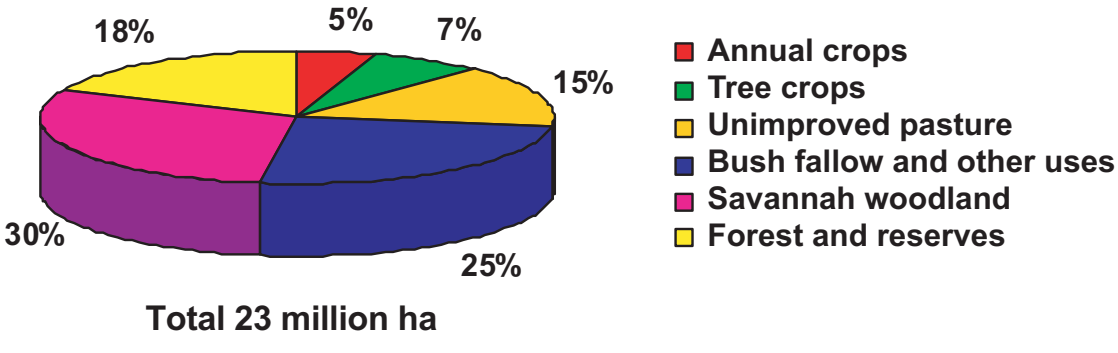
AGRO-ECOLOGICAL ZONES

The country is divided into six agro-ecological zones on the basis of their climate. The natural vegetation is determined by the different climatic conditions and influenced by different soil types. These agro-ecological zones from north to south are: Sudan Savannah Zone, Guinea Savannah Zone, Transition Zone, Semi-deciduous Forest zone, Rain Forest Zone and the Coastal Savannah Zone (Figure 2).

CLIMATE

The climatic conditions of the different agro-ecological zones are shown in Table 4. The wet and dry seasons are determined by rainfall and temperature. The Tropical Eastern Coastal Belt is warm and comparatively dry, the southwest is hot and humid and the north is relatively hot and dry, compared with the other parts of the country. The mean annual rainfall ranges from 800 mm in the Coastal Savannah to 2 200 mm in the Rain Forest. The rainfall pattern is uni-modal in the Sudan and Guinea Savannah Zones and bi-modal in all the other zones (Table 4).

FIGURE 1
Land use



Source: FAOSTAT.

SOILS

The soils of Ghana are highly weathered with predominantly light textured surface horizons in which sandy loams and loams are the common textural classes. The lower soil horizons have relatively heavier textures varying from coarse sandy clay loams/sandy loams to clays. Heavier textured soils are normally abundant in the valley bottoms, which are ideal for rice cultivation. The B-horizons – subsurface horizons showing features of accumulation or significant alterations – may contain abundant coarse material either as gravel or stone/ concretionary materials. The coarse nature of the soils has an adverse impact on their physical properties, particularly their water holding capacity. Thus crop water stress is not uncommon during the growing season. The soil map of Ghana based on the FAO Legend is given in Figure 3.

FIGURE 2
Agro-ecological zones

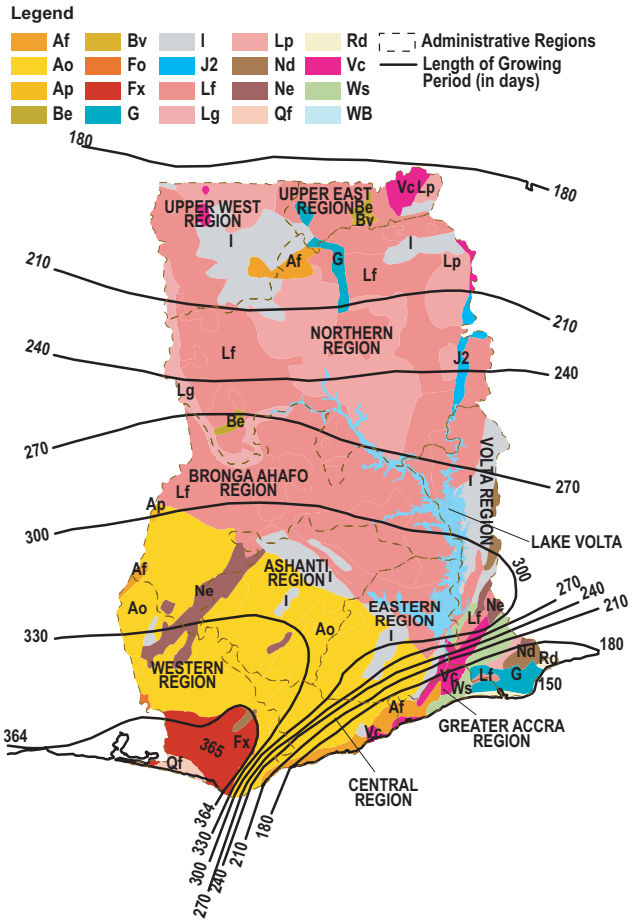
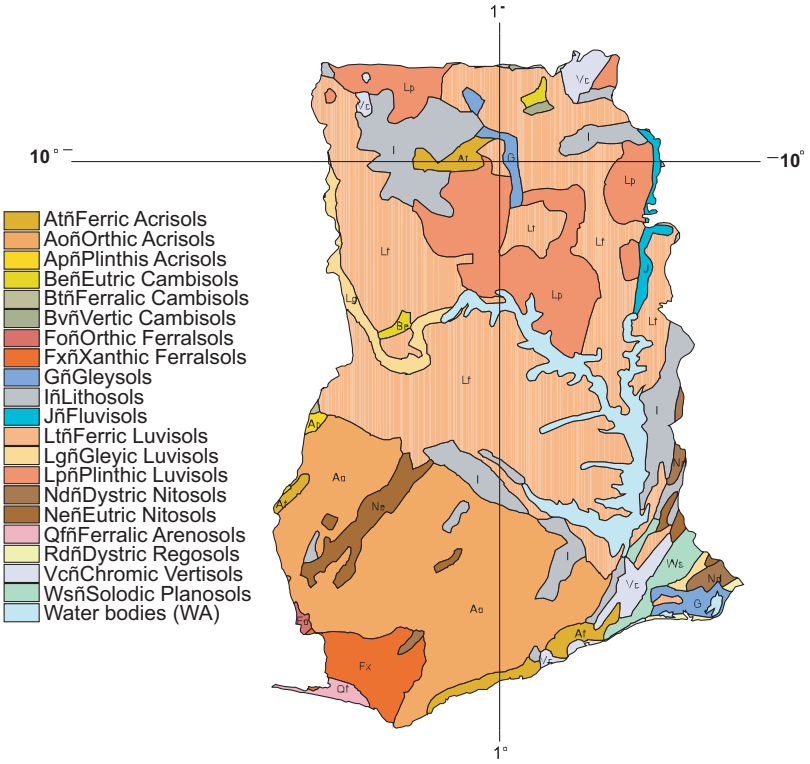


TABLE 4
Climates of the agro-ecological zones

Agro-ecological zone	Area (km²)	Mean annual rainfall (mm)	Range (mm)	Major rainy season	Minor rainy season
Rain Forest	9 500	2 200	800-2 800	March-July	Sept.-Nov.
Deciduous Forest	66 000	1 500	1 200-1 600	March-July	Sept.-Nov.
Transitional Zone	8 400	1 300	1 100-1 400	March-July	Sept.-Oct.
Coastal Savannah	4 500	800	600-1 200	March-July	Sept.-Oct.
Guinea Savannah	147 900	1 000	800-1 200	May-Sept.	
Sudan Savannah	2 200	1 000		May-Sept.	

Source: Adapted from data from the Meteorological Department, Legon, Accra, Ghana.

FIGURE 3
Dominant soils of Ghana, major climates and length of growing period



Original scale 1:5 million.
Source: DSMW-FAO-UNESCO.

The average fertility status of soils of the different regions is presented in Table 5. The levels of organic carbon, nitrogen and available phosphorus are generally very low. Figures are not given for potassium since it is mostly abundant in the soils of Ghana.

TABLE 5
Average soil fertility status of some regions

Region	Soil pH	Organic matter (%)	Total nitrogen (%)	Available P (mg/kg soil)	Available Ca (mg/kg soil)
Ashanti	4.3–7.8	1.5–3.0	0.1–0.3	0.1–12.0	50–100
Brong Ahafo	3.5–6.7	0.3–1.7	-	0.1–64.3	16–140
Greater Accra	5.4–8.2	0.1–1.7	0.05–0.9	0.8–144.0	14–470
Northern	4.5–6.7	0.6–2.0	0.02–0.05	2.5–10.0	45–90
Upper East	5.1–6.8	1.1–2.5	0.06–0.14	1.8–14.8	44–152
Upper West	6.0–6.8	0.5–1.3	0.01–0.07	2.0–7.4	52–152
Western	3.8–7.1	1.0–5.7	0.06–5.4	0.4–11.3	28–420

Source: Soil Research Institute (SRI) CSIR – Kumasi.

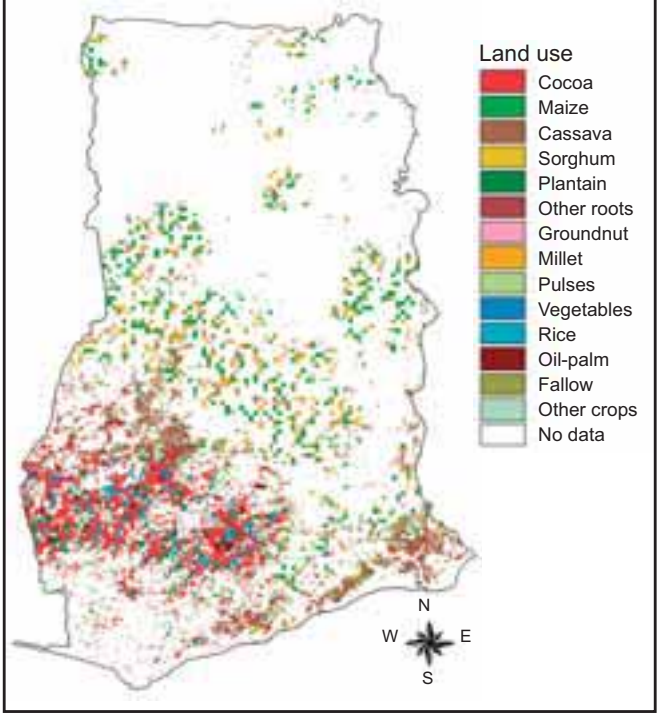
Chapter 2
Agricultural production

PRINCIPAL AGRICULTURAL CROPS

The principal agricultural crops produced in Ghana may be grouped as shown in Table 6.

Figure 4 shows a simulated land use map of Ghana. Cocoa and oil-palm are the dominant crops in the wetter southwest of the country, and maize, millet, sorghum and groundnuts in the drier north. Cassava is found between these zones and in the southeast.

FIGURE 4
Simulated land use map of Ghana



Source: FAO, 2004.

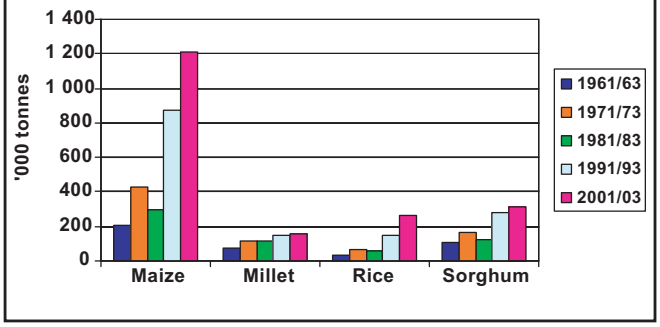
CEREALS

The quantities of cereals produced between 1961/63 and 2001/03 are shown in

TABLE 6
Crop groups

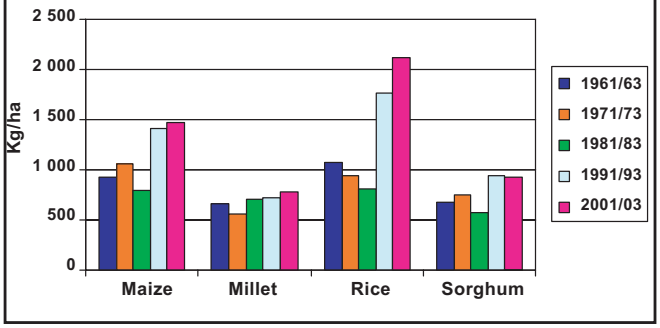
Group	Crops
Cereals	Maize, millet, sorghum, rice
Industrial crops	Cocoa, oil-palm, coffee, cotton, tobacco, sheanut, cola nut
Legumes	Cowpea, bambara nut, groundnut, soybean
Fruits	Papaya, avocado, mango, cashew, watermelon, plantain
Vegetables	Tomato, eggplant, onion, pepper, okra, cabbage, lettuce, carrot
Roots and tubers	Yam, cassava, cocoyam, sweet potato

FIGURE 5
Cereal production



Source: FAOSTAT.

FIGURE 6
Cereal yields



Source: FAOSTAT.

Figure 5. The yields during the same period are given in Figure 6. Maize production increased considerably due mainly to increase in area as the yield increase is not proportional with the production increase. Sorghum and millet production is affected by seasonal droughts in the northern savanna.

INDUSTRIAL CROPS

Table 7 shows the development of the production of six industrial crops.

The cocoa industry is the source of income and livelihood for about 25 percent of Ghana's population (ISSER, 2000). Between 1990 and 1999, the industry contributed an average of 31 percent of total foreign exchange earnings annually and an average of 12 percent of total annual government revenue. The relative proportion has tended to decline but in 2003, a year with

TABLE 7
Production of industrial crops ('000 tonnes)

Year	Cocoa	Coffee	Seed Cotton	Tobacco	Oil-palm	Sheanut
1996/97	322	2.9	25	2.0	984	22
1997/98	409	8.4	34	2.4	956	35
1998/99	398	4.0	38	2.6	1 022	17
1999/00	437	2.0	36	2.5	1 032	31
2000/01	390	1.4	18	1.2	1 066	20
2001/02	341	1.5	18	2.2	1 102	27
2002/03	475	1.5	15	n.a.	1 100	n.a.

Source: MOFA, 2003.

a rather high cocoa price, it still represented 27 percent of total export earnings.

The cocoa crop covers about 28 percent of the cropped land. The main growing areas are in central and southwest Ghana. Cocoa is produced mainly on about 700 000 small "crop tree" farms. The average cocoa farm covers 1.2 ha but there are a few large plantations.

Farmers normally burn small parts of the secondary forest to open up new cocoa land. After clearing, they intercrop the cocoa with maize, yams, plantains and cassava. In the early years, plantains grow fast and provide shade. After five years, the cocoa plants have developed a closed canopy and farmers then grow the crop as a monoculture. Most farmers do not apply fertilizer on cocoa. Without fertilization, yields decrease after 20 years, but production is possible for up to 50 years. The average cocoa yield is about 300 kg/ha compared with the potential yield of 1.0 to 1.5 tonnes/ha.

TABLE 8
Area planted to some industrial crops, 2002

Crop	Area ('000 ha)	Percent
Cocoa	1 195	78
Oil-palm	304	20
Cotton	19	1
Coffee	8	0.5
Tobacco	1	>5.0
Total	**1 527**	**100**

Source: MOFA, 2003; FAOSTAT.

TABLE 9
Oil-palm area

Year	Area planted ('000 ha)
1994	256
1995	262
1996	267
1997	273
1998	279
1999	285

Source: MOFA, 2003.

The area planted to industrial crops in 2002 is given in Table 8. The area of cocoa is highest, accounting for 78 percent of the total planted area of the industrial crops listed.

Oil-palm is the second most important industrial crop after cocoa. The growth of the area of oil-palm from 1994 to 1999 is presented in Table 9.

Starchy food crops other than cereals

The important starchy food crops other than cereals are yam, cocoyam, plantain and cassava. The trends in the areas planted to these crops are given in Table 10. The areas of cassava and yam have increased consistently.

TABLE 10
Planted areas of some starchy crops other than cereals ('000 ha)

Crop	Average 1997/99	2000	2001	2002	2003
Cassava	641	660	726	794	800
Yam	214	261	287	300	300
Plantain	241	244	265	277	280
Cocoyam	223	247	262	282	230

Source: MOFA, 2003; FAOSTAT.

TABLE 11
Production of some starchy crops other than cereals ('000 tonnes)

Crop	Average 1997/99	2000	2001	2002	2003
Cassava	7 339	8 107	8 966	9 731	10 000
Yam	2 787	3 363	3 547	3 900	3 900
Plantain	1 926	1 932	2 074	2 279	2 300
Cocoyam	1 605	1 625	1 688	1 860	1 860

Source: MOFA, 2003; FAOSTAT.

TABLE 12
Exports of some vegetable crops

Crop	2001	2002
	(tonnes)	
Pepper/chilies	5 281	4 687
Tomato	4 539	4 961
Eggplant	1 295	1 512

Source: ISSER, 2003.

The quantities of these starchy crops produced between 1997 and 2003 are given in Table 11. In terms of total production over the period considered, the share of cassava was about 54 percent followed by yam with 21 percent, plantain with 13 percent and cocoyam with 11 percent.

Edible legumes

The two most important edible legumes in Ghana are cowpea and groundnut. In 2002, the total domestic production of cowpea and groundnut amounted to 140 000 tonnes and 520 000 tonnes respectively (MOFA, 2003).

Vegetables

Tomato is the major vegetable crop in Ghana. The other important vegetable crops are pepper/chilies, eggplant and okra. The total area planted to tomato in 2002 was 26 700 ha, while the area planted to the other vegetables amounted to 13 700 ha. Information on the total production of vegetables is not documented. However, the quantities of some selected vegetables that were exported between 2001 and 2002 are presented in Table 12.

Fruit

Ghana produces a number of fruits, mostly for domestic consumption. The most important exported fruit is pineapple. Fertilizer use on pineapple is

fairly high, because pineapple is grown on sandy soils as the crop needs well drained soils. In 2002, the total area planted to pineapple stood at 5 000 ha (MOFA, 2003). The quantities of some selected fruits exported in 2001 and 2002 are given in Table 13.

TABLE 13
Exports of some fruit crops

Fruit crop	2001	2002
	(tonnes)	
Pineapple	35 174	46 391
Banana	3 251	3 251
Papaya	1 792	1 474
Orange (fresh)	1 336	1 521
Lime/lemon	778	1 310

Source: ISSER, 2003.

CROPS GROWN IN THE VARIOUS AGRO-ECOLOGICAL ZONES

The major food crops grown in the different agro-ecological zones are given in Table 14. Maize and rice are produced in all the agro-ecological zones. The highest production of maize is in the Transition Zone while the highest production of cassava is in the Semi-deciduous Forest Zone. The highest production of millet is in the Sudan Savannah Zone, that of sorghum and rice in the Guinea Savannah Zone (Table 15).

TABLE 14
Major crops grown in the agro-ecological zones

Zone	Cereals	Starchy Crops	Legume	Vegetables	Tree crops
High Rain Forest	Maize, rice	Cassava, cocoyam, plantain		Pepper, okra, eggplant	Citrus, coconut, oil-palm, rubber
Semi-deciduous Rain Forest	Maize, rice	Cassava, cocoyam, plantain	Cowpea	Pepper, okra, eggplant, tomato	Citrus, oil-palm, coffee, cocoa
Forest-Savannah Transition	Maize, rice, sorghum	Yam, cocoyam, plantain, cassava	Cowpea, groundnut	Tomato, pepper, eggplant, okra	Citrus, coffee, cashew
Guinea Savannah	Maize, rice, sorghum, millet	Yam, cassava	Cowpea, groundnut, bambara	Tomato, pepper	Sheanuts, cashew
Sudan Savannah	Maize, rice, sorghum, millet	Sweet potato	Cowpea, groundnut, bambara	Tomato, onion	
Coastal Savannah	Maize, rice	Cassava	Cowpea	Tomato, shallot	Coconut

Source: Gerken *et al.*, 2001.

TABLE 15
Production of selected crops in the agro-ecological zones

Zone	Maize	Cassava	Millet	Sorghum	Rice
			%		
Sudan Savannah	5		70	40	10
Guinea Savannah	15	10	30	50	40
Transition	50	20		10	10
Semi-deciduous forest	20	50			10
Coastal Savannah	6	10			15
High Rainforest	4	10			15

Chapter 3
Fertilizers in Ghana

At present, Ghana does not produce manufactured fertilizers, although there are some deposits of rock phosphate in the country. All the fertilizers used in the country are imported.

FERTILIZER IMPORTS

Table 16 shows the quantities of different types of fertilizers imported into the country between 1997 and 2001. The major importers of fertilizers into Ghana are private companies. The Agricultural Development Bank and some commercial farms also import fertilizers, either for their clients or for their own use. The imports of compound fertilizers far exceed the imports of the other fertilizers in Ghana. The second most important imported products are ammonium sulphate (AS) and muriate of potash (MOP). The imports of urea, SSP and TSP are marginal. The major importers account for about 80 percent of the total fertilizer requirements of the country.

FERTILIZER DISTRIBUTION

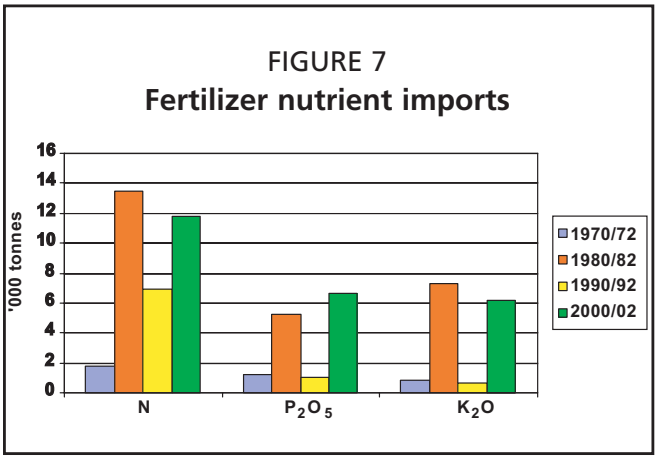
From the major importers, the fertilizers may go either to the end users such as the oil-palm sector, the tobacco sector, the cotton sector and the large rice irrigation projects or through intermediary channels consisting

TABLE 16
Fertilizer imports

Year	15-15-15	Other compounds	Urea	MOP	AS	SSP/TSP & others	Total
	'000 tonnes product						
1997	19.2	17.9	1.9	5.5	10.7	1.1	56.3
1998	13.1	8.8	0.5	3.1	13.3	3.6	42.4
1999	3.2	0.4	0	8.1	4.8	5.5	22.0
2000	14.1	0.8	0.1	4.5	23.2	0.8	43.5
2001	31.8	17.5	2.5	4.1	22.6	2.3	80.8

Source: MOFA, 2003.

FIGURE 7
Fertilizer nutrient imports



Source: FAOSTAT.

of registered wholesalers/retailers, located in most of the regional capitals. These registered wholesalers/retailers distribute fertilizers through a network of rural shops dealing in agricultural inputs and located in the districts. Alternatively, farmers may buy fertilizers directly from the wholesalers or the rural retail shops, whichever they find convenient. There are about 700 rural retailers of fertilizers spread throughout the country, with the highest concentration in the maize belt in the Brong Ahafo region.

FERTILIZER CONSUMPTION

Tables 17 and 18 give the apparent fertilizer consumption by type and nutrient in Ghana between 1995 and 1999. Compound fertilizers

TABLE 17
Apparent fertilizer consumption by type

Year	15-15-15	20-20-0	Urea	AS	KNO_3	Total
	('000 tonnes product)					
1995	9.3	0	4.3	9.0	2.2	24.8
1996	5.9	2.8	1.0	5.3	0.9	15.9
1997	19.2	17.9	1.9	10.7	1.1	50.8
1998	13.1	8.8	0.5	13.3	3.6	39.3
1999	3.2	0.4	0	4.8	5.5	13.9

Source: MOFA, 2003.

TABLE 18
Apparent fertilizer nutrient consumption

Year	N	P_2O_5	K_2O	Total
	(tonnes)			
1995	5.6	1.4	4.1	11.1
1996	3.2	1.4	4.1	8.7
1997	9.8	6.5	9.7	26
1998	7.3	3.7	6.8	17.8
1999	2.3	0.6	6.2	9.1

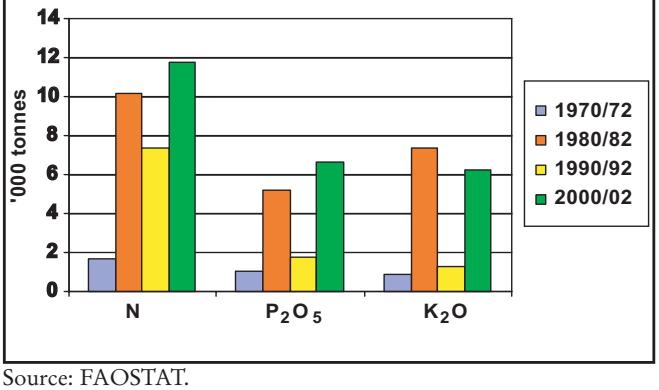
Source: MOFA, 2003.

accounted for 48 percent of the total amount of fertilizers consumed during that period.

The relatively high proportion of potassium is due to its use in oil-palm production. Nitrogenous fertilizers (urea and AS) accounted for 30 percent of the total fertilizers consumed.

Figure 8 illustrates the development of fertilizer consumption since the early 1970s.

FIGURE 8
Fertilizer nutrient consumption



Source: FAOSTAT.

During the 1970s fertilizer consumption increased ten-fold with a peak of about 31 000 tonnes total nutrient in 1977. The FAO Fertilizer Programme was very active in Ghana and this probably contributed to the increase. However, this level still represented a low average rate of fertilizer use per hectare of cultivated land. From 1984 onwards fertilizer consumption fell following the introduction of the Structural Adjustment Programme and the removal of most agricultural support, including fertilizer subsidies. It increased in the second half of the 1990s following an improvement in the national economy but fell again as a result of renewed financial problems and depreciation of the Cedi. Nevertheless, in 2002 it recovered to the level of the early 1980s. However, at about 5 kg per hectare of cultivated land it is at half the level of sub-Saharan Africa and at a quarter of the level of Africa as a whole.

Considerably more plant nutrients are being removed and lost than are being applied, with a consequent progressive impoverishment of soils. Traditional, soil exhausting cultivation practices are still used extensively (Gerner *et al.*, 1995).

Almost all the crop balances in Ghana show a nutrient deficit, i.e. the difference between the quantities of plant nutrients applied and the quantities removed or lost (FAO, 2004). This represents a loss of potential yield and progressive soil impoverishment. According to the estimates, cassava and yams account for almost 20 percent of the cropped area but

37 percent of the nitrogen deficit. These crops remove large quantities of nutrients and their soils are prone to erosion during harvest. The highest depletion rates are in the southeast and the central west parts of Ghana, which correspond to the cassava area. Cocoa accounts for 28 percent of the cropped area but for only 15 percent of the nitrogen deficit. The quantity of nutrients removed with the harvested crop is limited and the erosion risk is low, since the land is covered by vegetation and litter and the soil is well anchored by the root systems. The coconut crop accounts for only 1 percent of the land area but for 15 percent of the nitrogen deficit.

FERTILIZER USE BY CROP

Food crops

There are no recent data on the use of fertilizers on crops in the different regions.

Export crops

Fertilizer use is primarily on cash crops. It is possible that some quantities destined for cash crops are in fact applied to food crops (Table 19).

Despite its importance as an export crop, fertilizer use on cocoa has been negligible, due partly to the low farm prices that have prevailed. The Cocoa Research Institute of Ghana (CRIG) has introduced a special grade of fertilizer called *Asase Wura*. The formulation comprises: 0-18-22 + calcium, sulphur and magnesium. This fertilizer increases the yield of cocoa significantly. It is anticipated that the use of fertilizers on cocoa could more than double in the near future.

FERTILIZER USE BY REGION

The average sales of fertilizers between 1988 and 1990 for the geographical regions of Ghana are presented in Table 20.

Using these percentage sales by region, estimates of fertilizer consumption per region were derived from the total national fertilizer consumption for the period 1997 to 2001. These estimates are given in Table 21. The Upper Regions represented by the Upper East and the Upper West Regions constitute the regions with the highest fertilizer consumption. This is due partly to the production of vegetables such as tomatoes and onions under irrigation during the dry season in the Upper

TABLE 19
Crop fertilizer use (tonnes)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	1990–94	1995–99	Growth %
NPK	1 275	n.a.	4 350	3 000	3 912	2 790	1 761	5 769	3 917	961	12 537	15 198	
Urea	2 010	n.a.	0	0	0	425	95	185	50	0	2 010	755	
MOP	0	n.a.	200	1 000	1 250	1 700	2 250	2 725	1 548	3 253	2 450	11 476	
Oil-palm	3 285	n.a.	4 550	4 000	5 162	4 915	4 106	8 679	5 515	4 214	16 997	27 429	5
share	0.1		0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.2	0.1	0.2	
NPK	638	n.a.	2 175	1 500	1 956	1 395	881	2 885	1 959	480	6 269	7 599	
AS	2 500	n.a.	11 500	7 600	8 500	9 000	5 320	10 700	13 265	4 800	30 100	43 085	
Urea	16 080	n.a.	0	0	0	3 400	760	1 480	400	0	16 080	6 040	
Other NPK	17 000	n.a.	3 000	0	0	0	2 830	17 850	8 800	400	20 000	29 880	
Cotton	36 218	n.a.	16 675	9 100	10 456	13 795	9 791	32 915	24 424	5 680	72 449	86 604	2
share	0.8		0.6	0.5	0.4	0.5	0.5	0.6	0.6	0.3	0.6	0.5	
NPK	1 488	n.a.	5 075	3 500	4 564	3 255	2 055	6 731	4 572	1 121	14 627	17 731	
KNO	0	n.a.	0	560	20	2 190	900	1 083	3 597	5 531	580	13 301	
Urea	2 010	n.a.	0	0	0	425	95	185	50	0	2 010	755	
Tobacco	3 498	n.a.	5 075	4 060	4 584	5 870	3 050	7 999	8 219	6 652	17 217	31 787	6
share	0.1		0.2	0.2	0.2	0.2	0.2	0.1	0.2	0.3	0.2	0.2	
NPK	850	n.a.	2 900	2 000	2 608	1 860	1 174	3 846	2 612	640	8 358	10 132	
MOP	0	n.a.	200	1 000	1 250	1 700	2 250	2 725	1 548	3 253	2 450	11 476	
Pineapple	850	n.a.	3 100	3 000	3 858	3 560	3 424	6 571	4 159	3 893	10 808	21 608	7
share	0.0		0.1	0.2	0.2	0.1	0.2	0.1	0.1	0.2	0.1	0.1	
Total	**43 850**		**29 400**	**20 160**	**24 060**	**28 140**	**20 370**	**56 164**	**42 317**	**20 439**	**23 494**	**33 485**	**4**

Source: MOFA, Crops Services and WienCo.

TABLE 20
Average sales of fertilizer by region

Region	Average sales, 1988/90 (tonnes)	Percentage of the total
Ashanti	2 554	9.2
Brong Ahafo	3 760	13.5
Central	803	2.9
Eastern	507	1.8
Greater Accra	610	2.2
Northern region	7 535	27.1
Upper regions	7 681	27.6
Volta	4 209	15.1
Western	170	0.6
Total	**27 829**	**100**

Source: Adapted from Bonsu, Ofosu and Kwakye, 1996.

TABLE 21
Average sales of fertilizer by region

Region	1997	1998	1999	2000	2001
			(tonnes)		
Ashanti	5 167	3 893	2 023	4 046	7 438
Brong Ahafo	7 582	5 712	2 969	5 937	10 914
Central	1 629	1 229	638	1 275	2 345
Eastern	1 011	762	396	792	1 455
Greater Accra	1 236	931	484	967	1 779
Northern	15 220	11 467	5 960	11 917	21 910
Upper Regions	15 501	11 679	6 070	12 137	22 314
Volta	8 481	6 390	3 321	6 640	12 208
Western	337	254	132	264	483
Total	**56 164**	**42 317**	**16 593**	**43 975**	**80 846**

Source: MOFA.

East Region. The Upper East Region has two large irrigation schemes at Tono and Vea. Because of the high economic value of tomatoes and onions during the dry season, farmers are willing to purchase and apply fertilizers to these crops. The Western Region has the lowest consumption of fertilizers since the major farming activity is cocoa. It is only recently that fertilizer use on cocoa has attracted the attention of farmers.

FERTILIZER MARKETING

Marketing costs and margins

The farm price of fertilizer is determined by the import costs and the margins taken by the distribution sector. The costs include the CIF price, port charges and tariffs, loading and unloading, transportation, storage,

TABLE 22
Regional, wholesale and retail prices in 2001/02

Product	Unit	Wholesale price		Retail price	
		('000 Cedis/bag)	US$/unit	('000 Cedis/bag)	US$/unit
15-15-15	25 kg	51.0	6.9	60.1	8.1
15-15-15	50 kg	95.6	12.9	106	14.3
17-17-17	50 kg	112	15.1	120	16.2
20-20-20	50 kg	105	14.1	120	16.2
23-15-15	50 kg	94.3	12.7	104.6	14.1
AN	25 kg	45.4	6.1	49.9	6.7
AN	50 kg	75.7	10.2	85.8	11.6
MOP	50 kg	115	15.5	-	-
SSP	50 kg	96	12.9	92.1	12.4
TSP	50 kg	-	-	115.6	15.6
Urea	25 kg	60.4	8.1	62.8	8.5
Urea	50 kg	104.2	14.0	113.3	15.3

Source: IFDC, Africa.

interest on loans, insurance and other fees. The margins are the difference in price at each stage of distribution, between the manufacturer or importer, the wholesaler, the retailer and the farmer (or final end user). The regional wholesale and retail prices of fertilizers for 2001/02 are given in Table 22.

TABLE 23
Retail price of fertilizers in Ghana from 1988 to 1999 and 2002

Year	Retail prices of fertilizer (Cedis/kg)			
	15-15-15	Urea	AS	MOP
1988	46	n.a.	32	n.a.
1989	67	n.a.	47	n.a.
1990	84	84	62	76
1991	84	84	62	76
1992	140	84	120	200
1993	170	84	156	240
1994	347	322	262	300
1995	450	700	320	500
1996	620	700	500	700
1997	680	840	480	760
1998	780	860	440	760
1999	780	860	440	760
2002	2 404	2 511	1 995	n.a.

In the 1970s and 1980s subsidies on fertilizers were among the major incentives given to farmers by the government of Ghana. From 1987 onwards, subsidies were removed gradually. By 1989 all subsidies had been withdrawn. Since there were fertilizers in stock, the prices remained almost constant for two years (1990/91) and then started to increase. The retail prices of the four important fertilizers being used by farmers between 1988 and 2002 are given in Table 23. The 2002 prices calculated from Table 22 are presented for comparison.

TABLE 24
Cedi/US$ exchange rate

Year	Average annual Interbank rate Cedis/US$
1993	649
1994	957
1995	1 200
1996	1 637
1997	2 050
1998	2 314
1999	2 647
2000	5 322
2001	7 218
2002	7 869

Source: ISSER, 1999 and 2002.

The progressive increase in fertilizer retail prices follows increases in the exchange rate of the local currency (Cedi) with respect to the US$. The Interbank exchange rates of the Cedi with respect to the US$ from 1993 to 2002 are given in Table 24.

The wholesale prices of the different fertilizers vary from month to month. The variation in monthly prices partly reflects fluctuations in the exchange rate of the Cedi with respect to US$. The monthly variation in wholesale prices is presented in Table 25. The monthly variation in retail prices reflects the monthly variation in the wholesale prices (Table 26), while Table 27 shows price increases between January and December 2001.

TABLE 25
Monthly wholesale prices in 2001 ('000 Cedis per bag)

Month	15-15-15		AS		Urea
Bag	25 kg	50 kg	25 kg	50 kg	50 kg
January	47.4	89.3	73.3	91.4	86.8
February	47.9	89.4	73.5	91.4	86.8
March	49.4	89.8	74.1	91.8	87.2
April	50.5	89.7	74.6	91.6	87.1
May	51.1	89.8	75.7	91.7	87.1
June	51.7	90.3	76.1	92.3	87.9
July	52.1	90.9	77.5	92.9	88.6
August	52.4	90.5	77	92.4	88
September	52.3	89.9	77.9	91.8	87
October	51.8	91.3	78	93.3	89
November	52.4	93.6	81.2	95.7	91.7
December	53.2	94.1	82.5	96.3	92.4

Source: IFDC, Africa.

TABLE 26
Monthly retail prices of fertilizers in 2001 ('000 Cedis/bag)

Month	15-15-15		AS		Urea	
Bag	25 kg	50 kg	25 kg	50 kg	25 kg	50 kg
January	55.6	99.5	46.7	81.8	62.0	112.2
February	53.1	101.3	46.7	81.8	62.0	112.2
March	54.2	102.1	46.7	83.6	62.0	112.2
April	55.4	102.9	49.5	84.5	62.0	112.6
May	56.0	104.0	49.5	84.1	63.5	113.4
June	56.3	105.0	49.5	84.1	63.5	114.5
July	56.9	106.8	52.5	87.0	62.0	113.0
August	57.2	108.5	49.5	86.9	62.0	113.0
September	56.9	110.2	52.0	89.6	62.0	114.5
October	56.9	110.2	52.0	90.7	64.0	114.5
November	56.8	111.3	54.4	90.0	64.8	113.8
December	58.6	113.4	54.4	90.0	63.5	117.2

Source: IFDC, Africa.

TABLE 27
Increases in fertilizer prices between January and December 2001

Fertilizer type	Bag	Increase	
		Wholesale price %	Retail price %
15-15-15	25 kg	12.1	5.4
15-15-15	50 kg	5.4	14.0
AS	25 kg	12.4	16.6
AS	50 kg	5.4	9.8
Urea	25 kg	n.a.	2.4
Urea	50 kg	6.5	4.4

Chapter 4
Manure as a source of nutrients

The two important types of manure being used by farmers are cattle manure and poultry manure. Cattle manure is popular in the savanna ecosystems where cattle raising are predominant. Poultry manure is popular in the forest zones where there are large commercial poultry farms.

In the savanna areas, cattle manure may be collected either from kraals where the animals are housed during the night or from animal droppings in the field. The nutrient contents of cattle manure collected from these two sources are given in Table 28. The nitrogen content of cattle manure from kraals is slightly higher than that collected from fields due to volatilization of N during exposure. However phosphorus and potassium contents are the same for the manure from the kraals and the field.

TABLE 28
Nutrient content of cattle manure, kraal and field

Source of cattle manure	Nutrient content (%)		
	N	P_2O_5	K_2O
Kraal	1.41	0.39	2.0
Field	1.17	0.38	2.0

Source: SRI - CSIR, 1999.

TABLE 29
Nutrient content of cattle manure, Upper East Region (Sudan Savannah Zone)

Region	Nutrient content (%)		
	N	P_2O_5	K_2O
Bawku East	1.45	0.40	3.3
Bawku West	1.12	0.28	1.7
Bolgatanga	1.30	0.30	2.0
Bongo	1.53	0.40	1.2
Kasena-Nankana	1.32	0.30	2.5
Builsa	1.33	0.30	1.3
Mean	1.34	0.33	2.0
CV (%)	28	29	23

Source: SRI - CSIR, 1999.

The nitrogen content of cattle manure collected in kraals from six districts in the Sudan Savannah Zone (Upper East Region) ranges between 1.12 percent and 1.53 percent, with a mean value of 1.34 percent, while the phosphorus content ranges between 0.28 percent and 0.40 percent with the mean value of 0.33 percent. The potassium content ranges between 1.2 percent and 3.3 percent, with a mean value of 2.0 percent (Table 29).

TABLE 30
Nutrient content of manures, poultry, cattle and sheep

Manure	Average nutrient content (percent by weight)				
	N	P_2O_5	K_2O	CaO	MgO
Poultry	2.20	1.80	1.10	2.40	0.70
Cattle	1.20	0.17	0.11	0.35	0.13
Sheep	1.55	0.31	0.15	0.46	0.15

Source: SRI - CSIR, 1997.

NUTRIENT CONTENT OF MANURES

Poultry manure comprises the dropping of chickens and wood-shaving litter. After some time, the wood-shavings with the chicken droppings are removed from the pen and allowed to decompose before being applied to the soil. The nutrient contents of poultry manure, cattle manure and sheep manure are given in Table 30. These relate to the Ashanti region of the Semi-deciduous Forest Zone. Of the three sources of manure, poultry manure contains the highest content of nutrients (Table 30). This is to be expected in view of the high protein content of poultry feed.

RESPONSE OF CROPS TO ORGANIC MANURE

Table 31 indicates that cowpea responds positively to poultry manure as well as to cattle manure in the Transition Zone and Sudan Savannah Zone respectively. However, in the Sudan Savannah Zone, the highest rate of cattle manure (10 tonnes/ha) slightly depressed the yield of cowpea compared with the rate of 5 tonnes/ha.

TABLE 31
Response of cowpea to manure

Source of manure	Application rate (tonnes/ha)	Yield (tonnes/ha)
Poultry manure	0	1.36
(Transition Zone)	2	1.61
	4	1.79
	6	1.88
Cattle manure	0	1.32
(Sudan Savannah Zone)	2.5	1.47
	5	1.61
	10	1.59

Source: Adapted from the 1997 Annual Report, SRI – CSIR.

In the Transition Zone, there was consistent increase in the yield of cowpea with increasing rates of poultry manure. In the Forest Zone, poultry manure is commonly used in the peri-urban vegetable production.

In the Guinea and Sudan Savannah Zones, cattle manure

is commonly applied to crops grown in the compound farms. Vegetables, early millet and sorghum are usually grown in these compound farms. Since the use of manure by farmers is sporadic, it is difficult to quantify the amount used by farmers in Ghana.

Chapter 5
Crop response to fertilizers

YAM

The response of two varieties of yam to fertilizer application in different locations in the Transition Zone of Ghana is given in Table 32. Compared with the control, yam responded positively to fertilizer application in all the locations. However, there was a considerable degree of inconsistency in the response with respect to treatments with missing nutrients and treatments with complete fertilization. Yam is now an exportable commodity. In 2002 Ghana exported 8 248 tonnes of yam (ISSER, 2003).

SWEET POTATO

Effect of imbalanced fertilization on the yield of sweet potato

Sweet potato has become an important food crop in Ghana. It is also gaining importance as an export crop in the Bawku East District of the Upper East Region. The farmers in the District normally export the crop to Burkina Faso, where good prices for the crop are obtained. The effect of imbalanced fertilization on yields and on the number of tubers in the Sudan Savannah Zone is shown in Table 33.

The yield of sweet potato is significantly depressed if potassium is missing. However, eliminating phosphorus does not affect the yield.

TABLE 32
Response of yam to fertilization in the Transition Zone, yield (tonnes/ha)

Rate (kg/ha)	Dente variety				Puna variety		
	Ejura	Atebubu	Sunyani	Wenchi	Ejura	Atebubu	Sunyani
0-0-0	10.7	12.1	14.1	9.7	15.7	12.2	14.0
0-75-75	22.0	17.1	26.4	24.3	23.4	26.4	27.1
75-0-75	23.1	37.0	26.6	21.6	29.3	26.9	30.9
75-75-0	21.1	31.7	30.4	28.9	23.7	32.8	30.4
45-45-60	19.5	32.7	34.7	25.7	25.0	29.0	34.7
75-75-100	16.1	31.1	32.6	28.8	26.7	32.4	32.6
Average	18.8	28.6	27.5	23.7	24.0	26.6	28.3

Source: SRI – CSIR, 2003.

TABLE 33
Sweet potato: response to nutrient balances

Treatment kg/ha	Yield of tubers (tonnes/ha)	Average weight per tuber (g)	Tubers per ha (thousands)
0-30-30	11.00	136.0	83.5
30-0-30	12.60	130.8	96.0
30-30-0	8.75	132.7	68.0
30-30-30	12.30	163.7	76.0

Source: SRI – CSIR, 2003.

The yield is also depressed slightly when nitrogen is missing. Balanced fertilization gives large tubers while the number of tubers harvested decreases.

a. ***Nitrogen***

When nitrogen levels are increased above zero, yield levels of sweet potato increase, but when nitrogen levels are increased above the optimum level of 30 kg/ha to 60 or 90 kg/ha, the yield decreases, relative to the optimum rate of 30-30-30 (columns 1 and 2, Table 34).

b. ***Phosphorus***

Increasing the rate of phosphorus fertilization does not increase the yield of sweet potato. In columns 3 and 4 of Table 34, the increase in the yield of the crop may be due to the increase in the level of potassium to 60 kg/ha.

c. ***Potassium***

Increasing the rate of potassium fertilization results in a significant increase in tuber yield (columns 5 and 6, Table 34). Potassium appears to be the most important nutrient in the production of sweet potato.

TABLE 34
Sweet potato: response to increasing nutrient rates

Nitrogen (kg/ha)	Yield (tonnes/ha)	Phosphorus (kg/ha)	Yield (tonnes/ha)	Potassium (kg/ha)	Tuber yield (tonnes/ha)
0-30-30	11	30-0-30	12.6	30-30-0	8.75
30-30-30	12.3	30-30-30	12.3	30-30-30	12.3
60-30-30	11.6	30-45-60	14.85	30-30-60	14.4
90-30-30	11.55				

Source: SRI – CSIR, 2003.

CASSAVA

Cassava is grown in the Forest, the Transition and the Guinea Savannah Zones. Under rainfed conditions in farmers' fields, an average yield of 11.8 tonnes/ha can be obtained (MOFA, 2003). According to a report on field crops prepared by SRI, cassava responds to fertilization in all the producing areas. Application rates of 68 kg N/ha, 45 kg P_2O_5/ha and 68 kg K_2O/ha are the recommended average rate of fertilizers required by the crop. Using the recommended technology an achievable yield of 28 tonnes/ha may be obtained (MOFA, 2003).

MAIZE

Phosphorus fertilization

Phosphorus is a major limiting nutrient in Ghanaian soils. In a trial on the yield of grain maize, in the Semi-deciduous Rain Forest Zone at Kwadaso, during the main growing season in 1999, triple super phosphate (TSP) at a rate of 200 kg/ha is compared with Togo rock phosphate (RP) applied at rates of 400, 600, 800 and 1 200 kg/ha, using two different methods of application (Table 35). As is well known in most tropical soils, incorporation of phosphorus decreases its availability compared to surface application, because of phosphorus fixation with the former method of application. However, in the case of RP, phosphorus availability improves with incorporation, at high rates of application. For low rates of application, surface application is more effective than incorporation.

For TSP, surface application is favoured. For high application rates of RP with incorporation, it is likely that, once the fixation capacity of the soil is satisfied, excess RP present may interact with soil organic matter. This should improve the solubility of the RP, thus making the phosphorus easily available.

TABLE 35

Grain maize: response to TSP and RP

Treatment	Application method	Rate (kg/ha)	Grain yield (kg/ha)
Control			3 949
TSP	Surface	200	5 135
TSP	Incorporated	200	3 176
RP	Surface	400	6 252
RP	Incorporated	400	3 868
RP	Surface	600	4 906
RP	Incorporated	600	5 203
RP	Surface	800	4 171
RP	Incorporated	800	4 652
RP	Surface	1 200	3 584
RP	Incorporated	1 200	5 577

Source: SRI – CSIR, 2000.

TABLE 36
Grain maize: on-farm response to cattle manure and fertilizer

Treatment	Rate/ha	Grain maize yield (tonnes/ha)
Control		0.23
Cattle manure	4 tonnes	0.53
NPK fertilizer	60-40-40 kg	1.37
Cattle manure + NPK	4 tonnes + 60-40-40 kg	1.67

Source: SRI – CSIR, 1999.

Effect of cattle manure and mineral fertilizer on grain maize yield

Soil fertility management in the soils of the Sudan Savannah Zone is critical because of the inherently poor fertility status of the soils, especially in organic matter. However, the yield of maize is far too low in the forest zones where organic carbon and rainfall are higher. The yield of maize in the Bawku East District in the Sudan Savannah Zone at different levels of fertilization is given in Table 36. The addition of 4 tonnes/ha of cattle manure increases the yield by more than 100 percent over the control. The use of compound fertilizer increases the yield of maize by more than 160 percent compared to 4 tonnes/ha cattle manure. The combination of cattle manure and the compound fertilizer improves the yield of maize by 22 percent over fertilizer alone. This is important in view of the improvement of soil structure as well which is likely to be associated with the addition of cattle manure.

PEPPER

This study was carried out at Kwadaso in 1997 and 1998, on a sandy loam Ferric Acrisol. In addition to the nitrogen treatment, basal applications of P_2O_5 as TSP and K_2O as MOP were made at 45 kg/ha. The results of the study for 1997 and 1998 are given in Table 37. Ammonium nitrate (AN) and potassium nitrate (KNO_3) gave higher yields than urea and AS. In

TABLE 37
Pepper: response to different sources of nitrogen

Source of N	Rate (kg/ha)	1997		1998	
		Yield (tonnes/ha)	VCR	Yield (tonnes/ha)	VCR
Urea	90	7.06	26.8	14.08	28.1
AS	90	7.73	18.9	14.03	19.6
KNO_3	90	10.60	6.3	17.00	6.4
AN	90	10.83	31.7	18.68	38.5

Source: SRI – CSIR.

terms of the value cost ratio (VCR), AN gave the best result followed by urea.

COCOA

It has been found that low soil fertility is among the major causes of decline in yield of cocoa on farmers' fields in Ghana in recent years. This has been confirmed through fertilizer use trials on cocoa farmers' fields by CRIG. Fertilizer use trials on cocoa by CRIG have identified the following fertilizer combination as ideal for cocoa fertilization: 0-18-22 plus calcium, sulphur and magnesium. This formulation has been tried on-farm and has been adopted by some farmers. It has more than doubled cocoa yields on their farms.

Table 38 shows the mean yield of cocoa for 20 farms, selected across the cocoa growing areas in the Semi-deciduous Rain Forest Zone of the Ashanti Region. The age of the plantations ranged from 9 to 27 years. The study was conducted between the 1991/92 and 1994/95 growing seasons. The fertilized plots received 129 kg/ha of P_2O_5 per year and 76.5 kg/ha of K_2O per year. Compared with the unfertilized plots, the average gross yields of the fertilized plots exceeded those of the unfertilized plots by 61.7 percent in the first year, 99.8 percent in the second year, 116 percent in the third year and 106.6 percent in the fourth year.

TABLE 38
Cocoa: on-farm response to fertilizer, Ashanti region

Treatment	Average yield (kg dry beans /ha)			
	1991/92	1992/93	1993/94	1994/95
Fertilized	807	1 033	1 124	1 457
Unfertilized	499	517	520	705
Difference	308	516	605	752
Percent over unfertilized	61.7	99.8	116	107
Pooled std. error	±146.57	±134.17	±177.88	±192.81

Source: Appiah *et al.*, 2000.

Chapter 6
Economics of fertilizer use

In this chapter, the optimum fertilizer requirements of some selected crops and their achievable yields are considered, using 2002 fertilizer and crop prices to compute the value cost ratios (VCRs) of the various crops. The VCR should be higher than 2 to secure a profitable return to the farmer. Under high risk conditions a VCR of about 3 is preferable. The optimum fertilizer requirements in terms of 50 kg bags per ha, the achievable yields with improved technology, the value of this yield at 2002 crop prices and the VCRs are provided in Table 39.

MAIZE

Maize grows best on well-drained sandy loam soils, in areas with a minimum rainfall of 1 016 mm per annum. The rainfall must be well distributed during the growing season. Maize is produced in almost all the agro-ecological zones. Based on the achievable yield, the optimum fertilizer requirements, and the prices of fertilizers and of the crop in 2002, the VCR for maize was 2.7. The major maize producing belt is the

TABLE 39
Optimum fertilizer requirements, maximum crop yields and VCRs

Crop	Fertilizer type	Bags/ ha	Fertilizer total cost ('000 Cedis)	Maximum yield (tonnes/ha)	Crop value ('000 Cedis)	VCR Col.6/col.4
Maize	AS	5	1 024	5.0	2 750	2.7
	SSP	5				
	MOP	1				
Rice	AS	5	718	6.5	7 150	10.0
(flooded)	TSP	2.5				
Cassava	AS	7.5	1 471	28	7 000	4.9
	SSP	5				
	MOP	2.5				
Groundnut	AS	1.5	661	2.0	2 400	3.6
	SSP	5				
	MOP	0.5				

Source: Adapted from MOFA, 2003; SRI (undated).

Transition Zone. This indicates that it is just economic to use fertilizer at optimum rates on maize, especially in the Transition Zone.

RICE

Rice is grown in almost in all the agro-ecological zones of Ghana under either flooded or upland conditions. Flooded rice is normally produced on poorly drained Vertisols and Gleysols. In the interior Savannah and Transition Zones, rice is grown on Cambisols and Luvisols. A small percentage of rice is also produced under irrigation. In the Forest Zones rice is also grown under flooded conditions in the valley bottoms where drainage is poor.

In the Northern Savannah and Transition Zones, where extensive ground water Laterites (Plinthosols) occur, rice is produced on imperfectly to poorly drained soils under upland conditions. These soils, which are sandy to silty loam, occur over flat to gently sloping topography and become waterlogged at the peak of the rains.

Under irrigated or flooded conditions, 2½ bags of AS and TSP per hectare are recommended at pre-planting, later top dressed with additional 2½ bags of AS. Under upland conditions 5 bags of AS and 5 bags per hectare of SSP are recommended in split application. Under flooded conditions a VCR of almost 10 can be obtained, suggesting a high profitability associated with fertilizer use.

CASSAVA

Cassava is grown in all the agro-ecological zones, with the exception of the Sudan Savannah Zone (Table 36). The suitable soils are the Ferralsols, Luvisols, Acrisols, Nitosols and Cambisols.

The crop thrives best under rainfall of about 1 000 mm per annum, on well-drained, sandy loam soils. The recommended fertilizer requirements of the crop are equivalent to 7½ bags of AS, 5 bags of SSP and 2½ bags of MOP per hectare. Production of the crop with recommended fertilizer application rates gives a VCR of 5, which indicates good profitability.

GROUNDNUT

Groundnut thrives best with rainfall between 760–1 300 mm per annum. It requires coarse or fine textured sandy loam soils with good drainage.

The optimum fertilizer requirements, based on the 2002 prices for the fertilizers applied and the crop, are 1½ bags of AS, 5 bags of SSP and ½ bag of MOP per hectare. Based on the 2002 fertilizer and crop prices, a VCR of 3.6 can be obtained (Table 39). Groundnut is a major crop in the Guinea and Sudan Savannah Zones. It is also produced to some extent in the Transition Zone.

Chapter 7
Constraints to fertilizer use and outlook

The use of fertilizers by farmers in Ghana is constrained by several factors, especially:

- Insufficient credit support to the farmer.
- High lending rates by Commercial Banks for the agricultural sector.
- Problems with the marketing of agricultural produce.
- The dependence on rain for crop production.
- The dependence on donor sources for funding of agricultural projects.
- Improper use of fertilizers by farmers.

These factors will be considered in detail in the following sections.

INADEQUATE CREDIT

Credit support from Commercial Banks as loans and advances to agriculture, forestry and fisheries has been very low compared to the manufacturing sector (Table 40).

Since farmers are normally poor and the level of productivity is low in Ghana, the agricultural sector can grow at a faster rate only if the government introduces productivity-enhancing support. The government is attempting to do this through the President's Special Initiative on specific crops such as cassava and oil-palm.

TABLE 40
Percentage of credit support from Commercial Banks

Year	Agriculture, forestry and fisheries (%)	Manufacturing sector (%)
1997	3.2	27.5
1998	2.2	29.1
1999	1.6	32.4
2000	1.0	21.6
2001	1.4	21.0
2002	2.1	20.3

Source: MOFA, 2003.

HIGH LENDING RATES

The high lending rates for the agricultural sector deter

TABLE 41
Minimum and maximum lending rates from Commercial Banks (percent per year)

End of period	Agricultural sector	Export sector	Manufacturing sector	Consumer price inflation *
1997	35–49	35–49	39–49	28
1998	30–42	31–45	32–45	17
1999	30–40	31–40	33–40	23
2000	34–52	34–52	34–52	15
2001	39–55	38–55	39–55	25
2002	27–50	38–55	27–50	15

* Estimated.
Source: MOFA, 2003.

farmers from obtaining loans from the Commercial Banks, for the purchase of agricultural inputs such as fertilizers. The lending rates for the agricultural sector, the export sector and the manufacturing sector are similar (Table 41). Since the turnovers in the export and the manufacturing sectors are normally higher than those of the agricultural sector, investments are more likely to go into the export and the manufacturing sectors than into the agricultural sector.

AGRICULTURAL MARKETING DEFICIENCIES

The marketing of agricultural produce is a long-standing problem. Access roads to facilitate evacuation of farm produce from the producing centres to the market are either in a very bad condition or non-existent. Inadequate storage facilities and insufficient agro-processing plants hinder agricultural production. During the harvesting period, farmers are at the mercy of middlemen who purchase farm produce cheaply in the areas of production. The lack of good markets for their produce deters farmers from increasing production and hence using fertilizers.

INADEQUATE IRRIGATION

Crop production in Ghana is dependent on rainfall, which is mostly irregular and unreliable. The efficiency of fertilizer use relies on water availability and uncertainty in this respect reduces the farmers' incentive to use more fertilizers. At present the area under irrigation amounts to only 11 000 ha or 0.2 percent of the irrigated land. Many large irrigation schemes are underutilized.

INADEQUATE FUNDING OF AGRICULTURAL PROJECTS

Most agricultural projects depend on donor sources for funding. For example, in the 2002 budget of MOFA, the Government of Ghana's contribution was 33 percent and the remaining 67 percent was expected to come from donor sources. Donor funding is used largely to implement projects, while the government's contribution is used mostly to pay staff salaries, wages, travel allowances and other emoluments. The delay in releasing funds by donors often adversely affects the implementation of agricultural projects such as fertilizer use trials.

OUTLOOK

In view of the constraints identified concerning the use of mineral fertilizers in Ghana, there is an urgent need to develop programmes that encourage their application. Among programmes that have already been initiated are the President's Special Initiative in the production of cassava for starch export and of oil-palm. This Initiative is among the programmes of the Ghana Poverty Reduction Strategy (GPRS).

Another project that will boost fertilizer consumption is the expansion of fertilizer use on cocoa. Since the initial pilot scheme funded by the government, cocoa farmers have obtained a significant improvement in their output of cocoa beans.

Fertilizer consumption would be higher if the area under irrigation were increased.

The research/extension linkage should be strengthened in order to educate farmers on the proper use of fertilizers.

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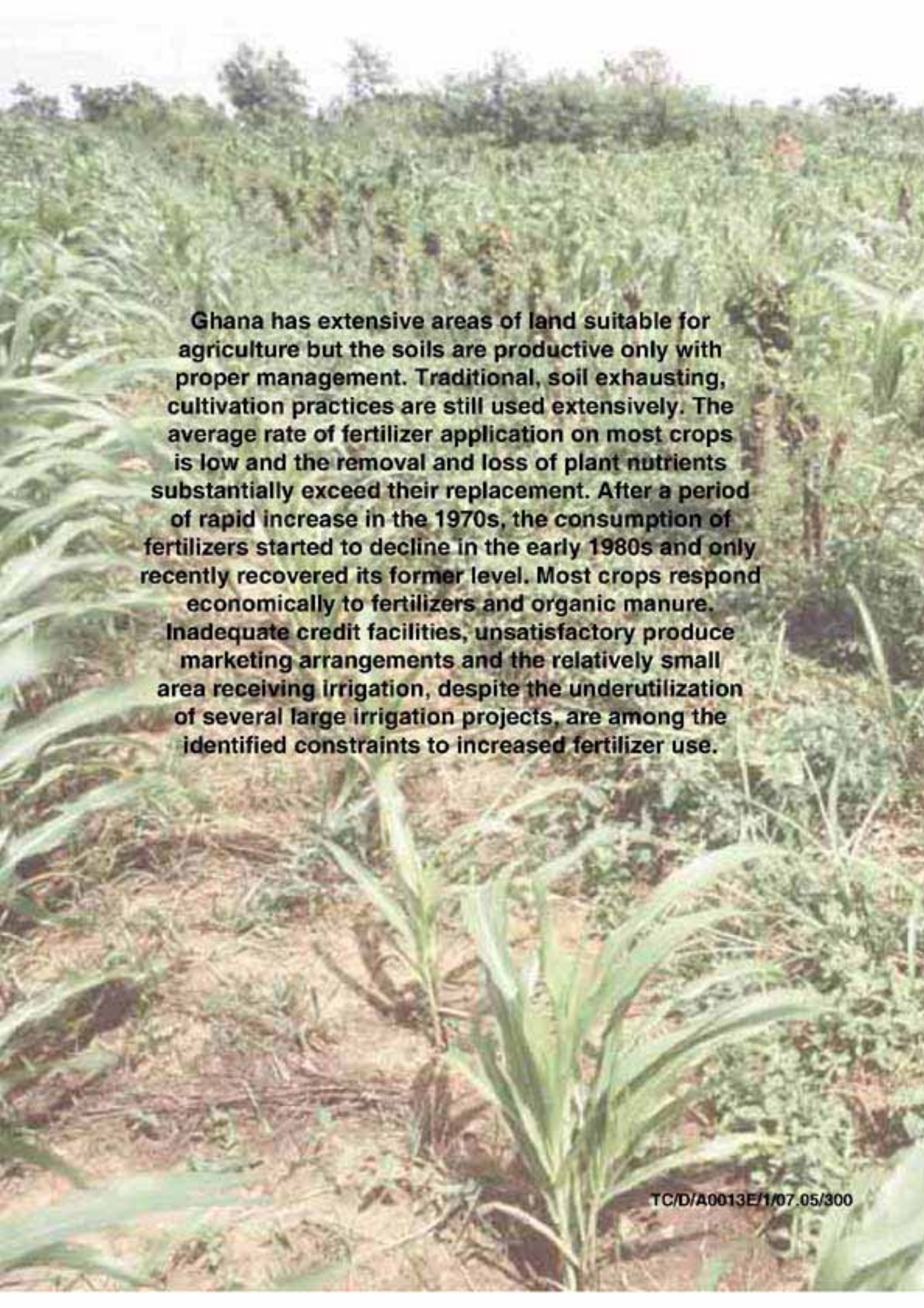

Ghana has extensive areas of land suitable for agriculture but the soils are productive only with proper management. Traditional, soil exhausting, cultivation practices are still used extensively. The average rate of fertilizer application on most crops is low and the removal and loss of plant nutrients substantially exceed their replacement. After a period of rapid increase in the 1970s, the consumption of fertilizers started to decline in the early 1980s and only recently recovered its former level. Most crops respond economically to fertilizers and organic manure. Inadequate credit facilities, unsatisfactory produce marketing arrangements and the relatively small area receiving irrigation, despite the underutilization of several large irrigation projects, are among the identified constraints to increased fertilizer use.

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