DECLARATION.

This project is my own original work and to the best part of my knowledge it has not been presented for a degree in any University or educational Institution.

Signature .....

L.J. KIBIEGO

This project has been submitted for examination with my approval as University supervisor.

Signature 16/9/88

J.A.M. OTTIENO PhD.

IMPLICATION OF POPULATION GROWTH ON FOOD PRODUCTION: A CASE STUDY OF THE DEMAND AND SUPPLY FOR MAIZE AND BEANS IN KENYA (1980-1990) BY PROVINCE.

BY

LEAH J. KIBIEGO

This project is submitted in partial fulfilment of the requirement for the degree of the post-graduate diploma in Population Studies of the University of Nairobi.

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CONTENTS.

SECTION ONE:

GENERAL INTRODUCTION.

1.1 INTRODUCTION.

Man's demand for food has increased enormously in the recent years. This is due to rapid Population growth in the world which is expected to be about six billion by the year 2000.
Food is one of man's basic needs, as such therefore, there has always been a need to balance population and food supply. In the process however, there have been problems. In the developing countries in particular, the situation has been more serious. The population has been growing rapidly and the countries have been faced with unfavourable conditions of food production because of unavailability of advanced technology and high densities in the more agriculturally productive areas. This has led to low levels of food production therefore an imbalance in food supply and demand. Kenya is one of the countries with very high population growth rates. At the same time there has been shortages of food from time to time and from region to region. This study will analyse the trends of population growth in the recent past and future and determine whether balance of food, in particular maize and beans, is possible.

1.2 STATEMENT OF THE PROBLEM.

It has been stated that Kenya has one of the highest population growth rate in Africa. The rate of population growth and the rate of food production however are not even. Whereas the

rate of population growth has been rising, the rate of food production has been fluctuating. Basing the population growth rate on the censuses, the 1962 census gives the rate at 3.0 percent. By 1969 the growth rate had increased to 3.3 percent. It increased further to 3.8 percent by 1979 census. According to 1984 United Nations report, the growth rate was about 4.0 percent. Growth rate of food on the other hand, has been fluctuating and far below the natural growth rate of population. Between 1974 and 1979 for example, the annual production rate fluctuated between - 0.5 percent and 9.2 percent. The average growth rate within the period was 2.4 percent.

It is a known fact that the land area doesn't increase, it is only its utilization which needs intensification. It is also known that Kenya's productive land is limited being 8.6 million hectares out of the total land area of 44.6 million hectares.This is brought about by the fact that the ability of land to produce food is determined by such factors as soil, climatic conditions and use and management applied to the land. Such factors lead to low or high production of crops such as maize and beans. It is for the same reason that high population densities are to be found in high potential agricultural areas in almost all the provinces. The factors determining land productivity and population densities bring about the differentials in production of these crops in relation to demand. Research is therefore necessary on the relationship between production of these crops and demand to see the differences existing in the country between the provinces.

1.3 OBJECTIVES OF THE STUDY.

(i) To examine the production of maize and beans from 1980 to 1990 per Province (Supply).

(ii) To project the demand for maize and beans for the period (1980-1990) based on the population located in the various provinces in Kenya.

(iii) To relate the supply to demand.

(iv) To recommend necessary action to ensure balance of crops within the provinces.

1.4 JUSTIFICATION OF THE STUDY.

When analysing the production of maize and beans in connection with population growth, the supply of crops will be compared to demand by provinces. Research has been done on implication of population growth and maize demand in the country. In the study, projection of maize and population is made from 1980 to 2000. In this study the projection will be between 1980 and 1990. The supply of maize and beans and their demand will be analysed to determine whether there is balance or imbalance of food. It is hoped that the findings will indicate which provinces have enough, high or low production of the crops. The findings will also show the relation between population growth and the crop production. It is also hoped that such findings will help the policy makers identify provinces with high production of the crops, so as to distribute to those with less in an attempt to

balance population and food production.

1.5 SCOPE AND LIMITATION.

The study covers six provinces. Nairobi which is mainly a consumer province is left out. North Eastern is not covered because data is not available. Secondary data is used in the study. Data on crops is obtained from the ministry of agriculture district annual reports . Limitation here is that some districts do not submit their reports or do not indicate the quantities of crops for some years. As such therefore, estimates have been made for the years without data by averaging or projecting. Such estimation is not always accurate but an approximation. Population data is obtained from 1979 census report and projected to cover the period under study. Such data is affected by under and over enumeration or coverage and content errors. In estimating the level of consumption of maize and beans, recommended diet for East Africa has been used. This is very general and may not be applicable to all ethnic groups.

SECTION TWO

2. LITERATURE REVIEW.

Many scholars have studied the relationship between population growth and food production. The earliest study on this relationship dates back to the work of Malthus (1878). Malthus looked at the population problem as a race between population growth and the growth in food supply. He said that population increases at much a faster rate than food production and that unless some control is imposed on population growth, the consequences will be disastrous. He said that to improve the food availability the rate of increase in food production should be higher than that of the population. According to Malthus, the food supply is the limiting factor for population growth while agricultural development is assumed to be the result of autonomou inventions.It suggests that from time to time,food supply increas due to inventions independent of population change. Improvement in food situation lead to decreased mortality, the population expands until it reaches the subsistence limit. If it increases beyond, it is controlled by increased mortality.

According to Kulkevini (1981 and 1983) the relationship between population and agricultural development is important not only because it concerns one of the human basic needs, but becuase no plan of overall economic development can be successful on precarious balance between population and agriculture. It is stated that in the developed world, industrialization was proceeded or accompanied by agricultural development.

Agricultural development, apart from providing raw materials led to increase and more regular supply of food, and it played an important part in bringing about mortality decline, which together with other factors helped to bring about a decline in fertility.

Kulkevini's article goes on to say that in the developing countries (like Kenya), the problem is whether agricultural productivity will match the requirements of the demographic situations in these countries. It says that as the population explosion in these countries is of a larger magnitude than the one experienced in the developed countries,the challenge of these countries is not only to increase agricultural productivity, but to increase it by adopting such a strategy that it will create enough work for the people.

According to World Bank Publication (1985) it is stated that enough food is available worldwide to satisfy the nutritional requirements of everyone. In the past decade, the global capacity to produce food has outstripped the growth of population and kept pace with global demand. With over two hundred million tons of grain in reserves, the world's overall supply of food in 1984 was greater than had been for decades. These reserves were sufficient to meet twenty percent of the current world wide consumption needs. But the purchasing power with which to acquire food is very unevenly distributed both among and within countries. The fluctuation in domestic production and in the supplies and prices of imported cereals however can substantially alter the amount of

food available for domestic consumption as can exchanges in the availability of foreign exchange with which to purchase food imports.

The article goes on to say that the experience in many countries has shown that once demand for food increases, the supply side generally responds appropriately. However, it is not always a quarantee and specific actions may be necessary to remove constrains on production. Similary, food must be available in the right form, at the right place and at the right time to meet demand, including emergency demand resulting from such factors as drought.

Boserup (1965) argued in the same lines as the above article. She said that the economic development can come about as a result of an adjustment process to population pressure. She states that in an essentially rural environment, population growth forces cultivaters to give up existing extensive and often leisurely methods of cultivation and adopt modern methods which lead to high yield. Boserup's opinion is that demographic pressure may have been a factor in the transition from the pre-agricultural stage to agricultural stage as well as in the subsequent development in agriculture throughout the world. Any kind of modernization to her is due to demographic pressure, may it be economic, technical or social changes. High population growth according to Boserup therefore is condusive to development, agriculture included, which leads to sufficient production of food.

Kenya National food Policy (1981) states that the rapid expansion growth of population and shortage of unexplioted arable land in the main high potential areas, are beginning to expose a potentially dangerous imbalance in the relationship between the national supply of and demand for food. Its objectives in connection with supply and distribution of food include maintaining a position of broad self-sufficiency in the main food-stuffs, achieving a calculated degree of security on food supply for each area of the country and ensuring that these food-stuffs are distributed in such a manner that every member of the population has a nutritionally adequate diet. The policy also states that to be self-sufficient, in maize by 1989 production capacity need to expand by 4.9 percent from 1980.To be sufficient in beans the production growth should be 10.5 percent.

Current Development plan (1983-1988) indicates that since Independence, production of major food items in Kenya has grown considerably. However, this doesn't imply that every family is adequately fed. There are many families in which nutrient intake is below the required standard. This is due to poverty, inefficiency in food production and food habits.

Mukasa (1983) states that country's rate of growth and the improvement in the standard of living will continue to depend, for many years to come, primarily on developments in the agricul-cultural sector. It generates over 60 percent of foreign exchange earnings and comprises over 30 percent Gross National Product. Quoting from Bondestan's work the foreign control of Kenya's

population, Mukasa states that the population pressure on land in Kenya has less to do with high birth rate but more with uneven ownership and lack of peasants control over their produce.Control of land is biased, and the big landowners are not always interested in increasing production. The small landowners do not produce sufficient and just a small fraction is reached by agricultural credit institutions.

Ominde (1981) states that although there are still policy options that will enable agriculture to contribute to the basic needs of the country, the problem of rapid population growth in the rural areas must be faced. He says that Kenya must give urgent attention to the moderation of the rate of population growth and eventual stabilization of the population as a permanent solution to the threat of declining living standards.

The world bank paper (June 1981) entitled 'Kenya Country Economic Memorandum,' states that the high rate of Kenyas population means that agricultural development especially food production, must achieve a growth rate exceeding that of population growth. It also means that the agricultural sector has to provide employment opportunities for most of new labour and that Kenya's already limited surplus of good quality arable land will come under increasing pressure and a definitive land policy will be necessary for continued agricultural growth.

This study is designed to show the relation between population growth and food production and to indicate where

intensification is possible in the country according to provinces.

SECTION THREE

3.1 THEORETICAL STATEMENT.

The study will be based on Ester Boserup's theoretical work about the relation between population and food. She stated that population growth forces cultivators to give up traditional ways of subsistence farming and intensify land use with improved technology resulting in an increase in total output. Boserup's study will therefore be tested in this study by relating population growth and production of maize and beans from 1980 to 1990. It can therefore be stated that:

(a) As the population increases, the production of food (maize and beans) increases.

(b) Eating habits of different groups of people or communities affect the production of maize and beans.

3.2 OPERATIONAL HYPOTHESIS.

(i) Kenya's population growth will continue to rise.

(ii) The amount of maize and beans production growth rate will increase.

(iii) The demand for maize and beans will outweigh the supply.

SECTION FOUR

4 SOURCES OF DATA AND METHODOLOGY.

4.1 SOURCES OF DATA

Data on the crops has been obtained from Ministry of Agriculture District annual reports. The reports provided the quantities of crops (maize and beans) of every district from 1980 to 1987. Estimates for 1988 have been provided by ministry's department in charge of crops. Projections have been made for 1989 and 1990. District quantities have been added up in every province to give the provincial figure of the crops. Projected population based on the 1979 census provided the demographic factor of population growth. The data on this has been obtained from the Central Bureau of statistics. The ministry of health provided data on the daily nutrient requirments of grains and pulses. The table below illustrates.

Recommended diet in East Africa where staple food is grain in grams.

Age group	Pulses	Grains
0-5 months	0	0
6-12 months	0	226
1-5 years	13	368
6-15 years	158	566
16-45 years	28	820
Over 45 years	37	510

4.2 METHODOLOGY.

4.2.1 Projections.

Demographic and agricultural projection techniques are used in the study. Projected Population from 1980 to 1990 is used. The projection is done basing on the 1979 census. In the projection, it is asumed that the levels of mortality and fertility are constant.

To obtain total amounts of crops per province district productions were summed up. This was done for all the years for every province.

i.e

Annual Provincial Production = Sum of annual Distict Productions

Projection for 1989 and 1990 productions has been done using linear Regression method of Analysis

$$Yi = a + bxi.$$

4.2.2 Percentages and Averages.

In the study, it was assumed that infants do not consume any of the crops under study. This is because even if they do, it is minimal. As such, infants were subtracted from total population for every province each year. The percentage of infants per province was calaculated. This has been done basing on the 1979 census. It was then assumed that such a percentage of infants

apply to all the years under study. Same percentage of infants was therefore subtracted from each years population of every province.

i.e

$$\frac{\text{Infants} \times 100}{\text{Population}} = \text{Infant percentage 1979 census}$$

Then other years will be:

Annual total − Above Infant = Population under study.
Population Percentage

The above calculation is done for every year in every province.

To obtain the demand, the average consumption of age groups was calculated,that is age one year and above. The Table above was used . An average of 59 grams was obtained for pulses and an average of 566 grams for grains.

Amounts of other grains were obtained for 1986 for all the provinces. This was used to calculate the percentage of maize in consumption of grains per province. The percentage obtained was taken to apply to all the years under study.

i.e. $\frac{\text{Provincial annual Production of Maize} \times 100}{\text{Total grain Production}} = \text{Percentage of Maize}$

Whatever percentage was obtained for maize was taken to be the consumption of maize in grams per person in a particular Province per day.

$$\text{i.e.}\quad \frac{\text{Percentage of Maize} \times \text{Average grain Consumption in grams}}{100} = \text{Recommended Maize consumption in grams or average daily allowance.}$$

For pulsas, beans were assumed to be representative of others. This is because other pulses are available in minimal quantities and in a few Provinces/Districts. In most cases, data on them is not recorded.

To obtain the amount of maize and beans consumed in a year in every province, the average daily allowance per person of the food concerned is multiplied by the total population and the number of days in the years.

i.e Population 1 year and above × Daily allowance in grams × Days in the year = Annual consumption in in grams

To reduce the figure to a manageable size it can be converted to kilograms,then to bags and finaly tons. This is done, by dividing by a thousand to kilograms, then by 90 to bags, and finally by eleven to get in tons.

$$\text{i.e}\quad \frac{\text{Annual consumption in grams}}{1000 \times 90 \times 11}$$

= Annual consumption in tons.

Averages have been used also to obtain quantities of crops for

years not recorded at district level. The quantity of crops for the year before the one not recorded and the year after have been added and averaged to get an assumed quantity of production for the year in question.

4.2.3 Tabulations

They have been used in the study since they give an orderly pattern of numerical data presenting population, production and consumption. This facilitate a better understanding of the data.

4.2.4 Multiple - bar diagrams.

They have been chosen to illustrate the production of crops vis-a-vis consumption in every province per year for the period under study. They demonstrate better the relation between production and consumption per year, and over the years under study. They also help in comparing production and consumption among provinces.

NB:

The following assumptions were taken in the study:

i) It was assumed that the infant population (0-1 year) do not consume any of the crops being studied.

ii) Percentage of production of other grains is assumed to be equal throughout the period of study i.e 1980-1990. Percentage is drawn from the 1986 crop production.

iii) It is assumed that beans is a representation of all pulsas and therefore the daily requirement of pulses in the diet is used as a multiplier.

SECTION FIVE.

FINDINGS AND DISCUSSIONS.

Generally, consumption of these food crops i.e maize and beans increase year after year. This is brought about by the growth in population which keeps increasing year after year. On the other hand, the production of the crops keep fluctuating from one year to the other. The fluctuation is due to soil deterioration, pressure on land as well as changes in climatic conditions. There is however, difference in production and consumption of the crops from one province to the other.

In this section, an attempt will be made to study the patterns, of production and consumption of maize and beans province by province. Tables and figures or charts will be used or referred as the findings of the study.

The tables show the projected population of each province per every year of the study. They also show the quantities of maize and beans production each year in tons. They will further show the consumption per year of every crop per province. Consumption of maize in every province is obtained by multiplying the required daily allowance (RDA) in grams - which differ from province to province depending on availability of other grains - by the total population of each year. Consumption of beans is obtained by multiplying RDA which is taken as 59 grams by the total population of each year. Results of both in grams is converted to tons. Charts illustrate the relation between production and consumption from 1980-1990.

5.1 RIFT VALLEY PROVINCE.

As far as production of maize is concerned, Rift Valley generally produces much more of the crop than it can be consumed by its population. It is observed that even in 1984 when there was shortage throughout the country the production of the crop was still more than what the population of the province could consume. It was only much reduced than other years, otherwise there was a surplus of the crop which could still be distributed to those provinces with shortages. It is further observed that in some years, e.g. 1987. surplus is much more than what is consumed. As stated earlier, the crop like other food crops fluctuate from year to year as shown by table 1a and figure 1a. What is clear however, is that more of the crop can be produced when the conditions for production are favourable. That is when there are enough machines for cultivation and when farmers, especially small holders are paid well for their produce. Land is still available. It is indicated by the fact that the production of the crop keeps increasing every year.

Production of beans like that of maize in the province keeps increasing with some fluctuations. The production, however, is by far less than that of maize. This is because it is not a main source of protein as the case is in other provinces like Central Province. In Rift Valley, animals (Beef and Milk) still serve as main source of protein. As such therefore, cultivation of beans is not emphasized. Like in the case of maize, it is observed that beans production was also affected by the 1984 drought. In the

year therefore, the least production of beans is observed. Right upto 1984, supply was less than the demand. Reason for this is as stated above that it was not consumed by the population in plenty and therefore no much emphasize in its cultivation. From 1985 to 1987 it is observed that there is a surplus in supply of the crop, and that the supply is generally increasing as shown by table 1b and figure 1b. It is possible therefore that the crop can even increase further. Its increase from 1985 is mainly for sale and to some extand for consumption due to changing habits in eating. Maize production has increased quite alot because, apart from consumption, it serves as a main source of income. With favourable conditions as stated above, farmers, including small farm holders will increase their production of both the crops leading to higher yield and therefore more surplus for distribution to other provinces with unfavourable conditions like Coast, Eastern, Nyanza and even Central.

5.2 NYANZA PROVINCE:-

Maize production in Nyanza province is observed to be flactuating quite alot within the period of study. Distinctly observed is the fact that the supply of the crop cannot meet the demand as shown in table 2a and figure 2a. One reason for this shortage is pressure on land. This is to say that the population is higher than availability of arable land. Another reason could be less use of fertilizers resulting in less yield of the crop.

Figure Ia

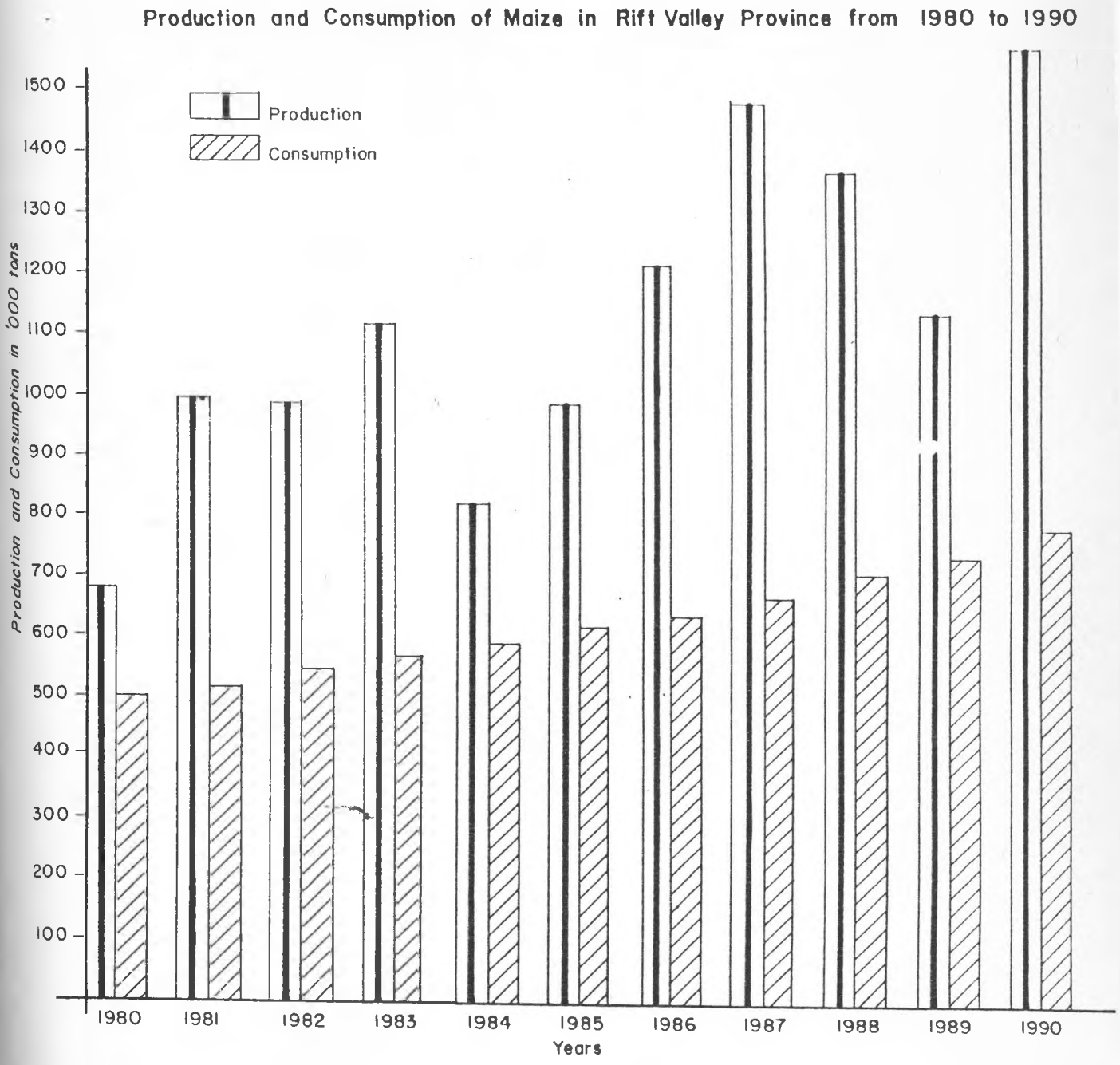

Production and Consumption of Maize in Rift Valley Province from 1980 to 1990
Production
Consumption
Production and Consumption in '000 tons
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
Years

Table 1a

Consumption of maize in Rift Valley province daily average consumption of 424.5 grains.

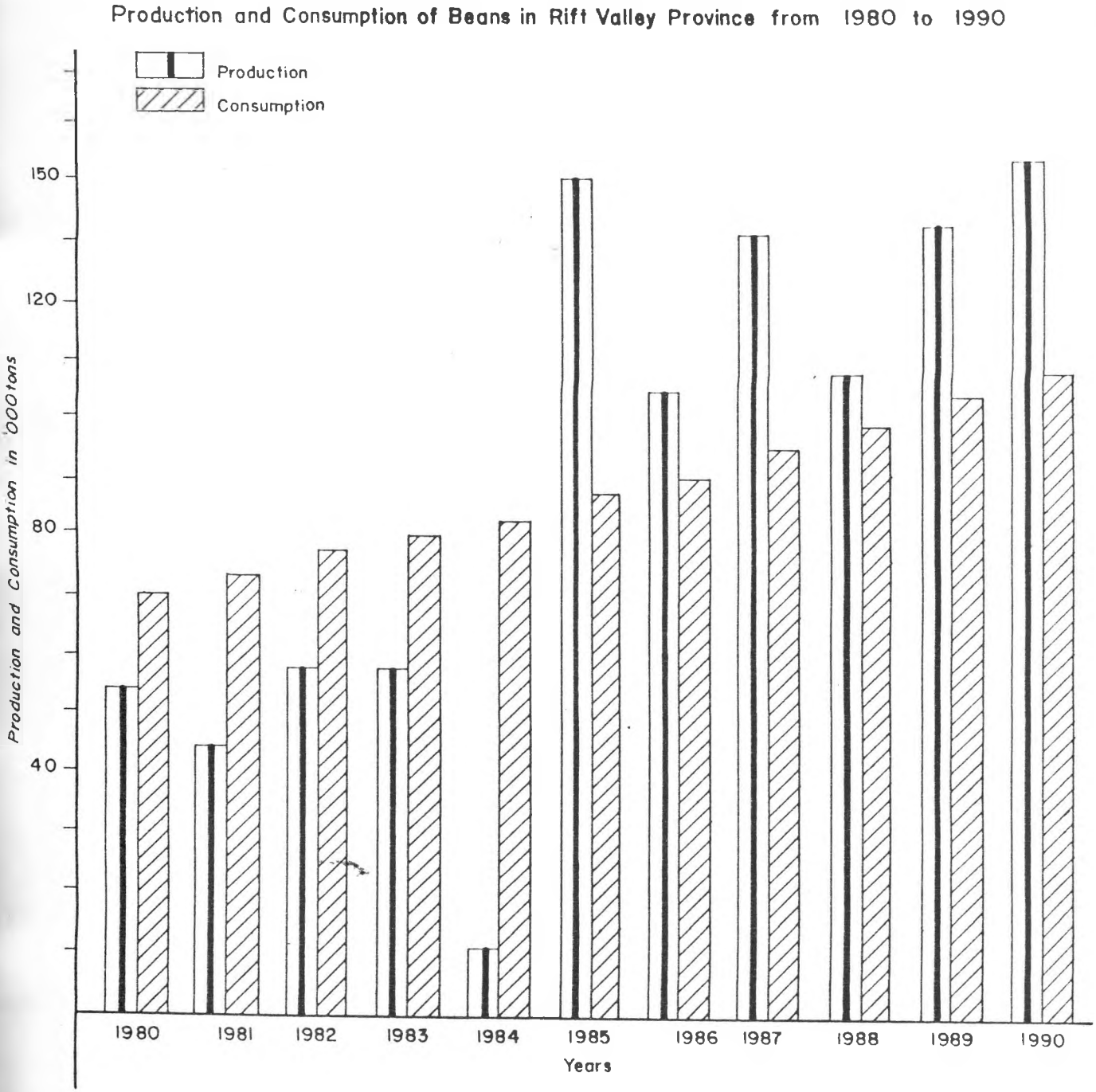
YEAR	POPULATION	PRODUCTION IN TONS	CONSUMPTION IN TONS
1980	3221472	679428	497864
1981	3362289	991842	519626
1982	3509055	983641	543408
1983	3662305	1109342	565993
1984	3822502	824750	590750
1985	3990506	978558	616715
1986	4165965	1206453	643831
1987	4349721	1474501	672230
1988	4542200	1355705	701976
1989	4743825	1129880	733137
1990	4955089	1564951	795786

Table 1b.

Consumption of Beans in Rift Valley Province.

YEAR	POPULATION	PRODUTION IN TONS	CONSUMPTION IN TONS
1980	3221472	53699	70287
1981	3363389	43677	73359
1982	3509055	57212	76561
1983	3662305	51831	79905
1984	3822502	11316	83400
1985	3990506	140953	87066
1986	4165965	104226	90894
1987	4349721	130844	94903
1988	4542200	108003	99103
1989	4743825	133129	103502
1990	4955089	144161	108111

Figure Ib


Production and Consumption of Beans in Rift Valley Province from 1980 to 1990
Production
Consumption
150
120
80
40
Production and Consumption in '000 tons
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
Years

It is also possible that the inhabitants have taken to consuming other crops like cassava which are also sources of starch. Another possibility is that they have taken to cultivating cash crops like sugar-cane and therefore less Cultivation of maize. Like in most provinces under study the production of maize in 1984 was quite low due to the drought. It is also observed that production seem not to be increasing at all which could be due to pressure on land as stated above. For this reason, importation of maize from provinces with surplus like Rift Valley is necessary.

Supply of beans in the province like that of maize is also below the demand. This too, necessitates importation from other provinces with surplus e.g Eastern. To note however is that beans production unlike that of maize has been increasing from 1980 to 1990 with slight reduction in 1983 and 1987. It can therefore be said that with intensification yield can increase. Comparing the supply and demand of the crop in 1980 and 1986. it can be seen that the gap was greater in 1980 and that it has reduced alot by 1986. (Ref: table 2b and figure 2b). One can therefore suggest that it is possible to match supply and demand if the trend of production continuous.

The increase in yield of beans could be due to changing habits of consumption. The inhabitants could be consuming more of beans in the recent years therefore more cultivation of the crop. It could also be that they are cultivating more for sale.

Less production than the requirements of the population of maize and beans in this province is attributed to the fact that the province still lack advanced technology. Cultivation is still done using traditional methods resulting in less yield - Tractors are quite few and therefore all the work is by hand including digging which is done by tractors in other provinces.

Figure 2a

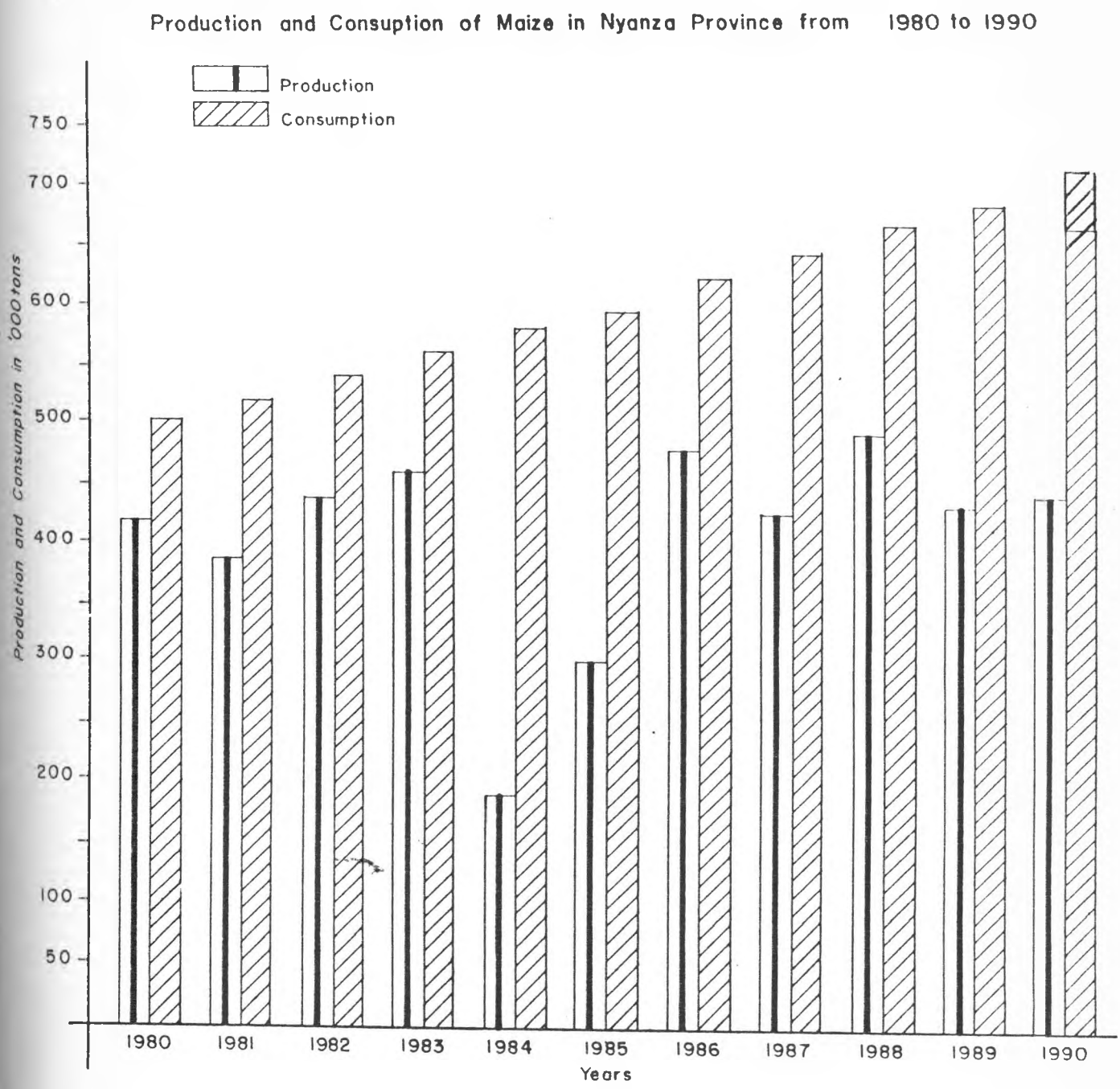

Production and Consuption of Maize in Nyanza Province from 1980 to 1990
Production
Consumption
750
700
600
500
400
300
200
100
50
Production and Consumption in '000 tons
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
Years

Table 2a.

Consumption of maize in Nyanza Province with daily average consumption of 481.1 grams.

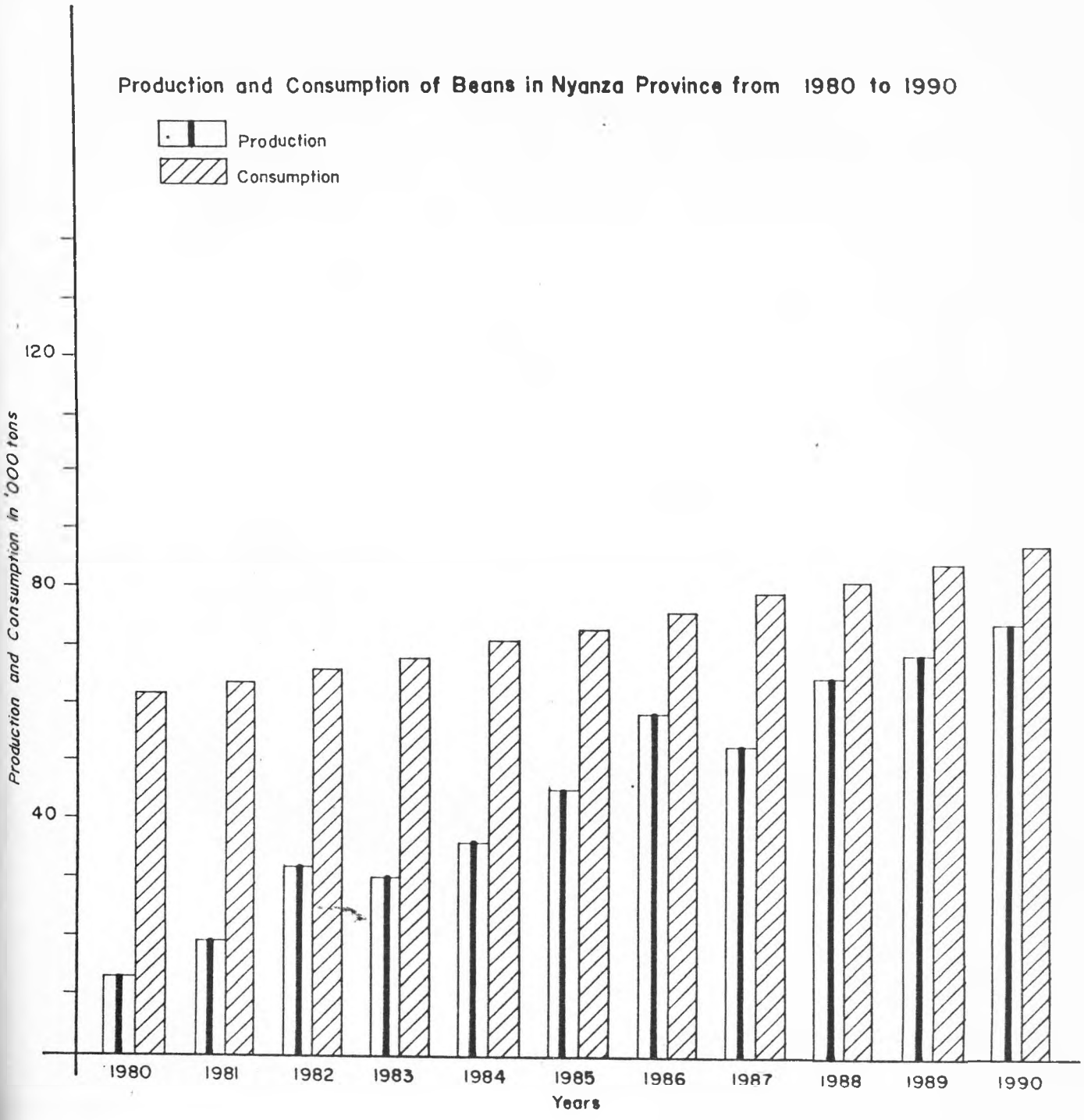
YEAR	POPULATION	PRODUCTION IN TONS	CONSUMPTION IN TONS
1980	2832435	415274	504688
1981	2936856	394293	520624
1982	3039526	436828	538825
1983	3135621	460240	555860
1984	3255924	194694	580146
1985	3359629	302168	595571
1986	3477869	454895	616531
1987	3600677	453755	638302
1988	3728252	493300	664307
1989	3860779	431318	684411
1990	3998484	437461	708822

Table 2b

Consumption of Beans in Nyanza Province.

YEAR	POPULATION	PRODUCTION IN TONS	CONSUMPTION IN TONS
1980	2832435	13341	61908
1981	2936856	18891	64077
1982	3039526	31960	66317
1983	3135621	29970	68414
1984	3255924	35913	71038
1985	3359629	45388	73301
1986	3477869	58918	75881
1987	3600677	57172	78560
1988	3728252	64967	81344
1989	3860779	68850	84235
1990	3998484	74400	87240

Figure 2b


Production and Consumption of Beans in Nyanza Province from 1980 to 1990
Production
Consumption
120
80
40
Production and Consumption in '000 tons
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
Years

5.3 WESTERN PROVINCE

Maize Production in Western Province like in Rift Valley has generally been increasing from 1980. Fluctuations are observed with reduction in production in some years. This can be seen in the case of 1986 and 1987 production. Tables 3a and figure 3a illustrate. It is also observed that except for the first four years of study the province has a surplus of the crop. Even within the first four years, the shortage in demand from supply was not so great. It is therefore possible for the province to increase the yield of the crop pressure on land being the only problem. Of interest is the fact that even in 1984 when there was a general, decline production of maize in this province was higher than for the previous year. The general increase can be attributed to the fact that maize is the stable food of the inhabitants. It also serves as a source of income .

Beans like maize has also kept increasing. This is because beans are planted together with maize i.e inter-cropping.

Figure 3a

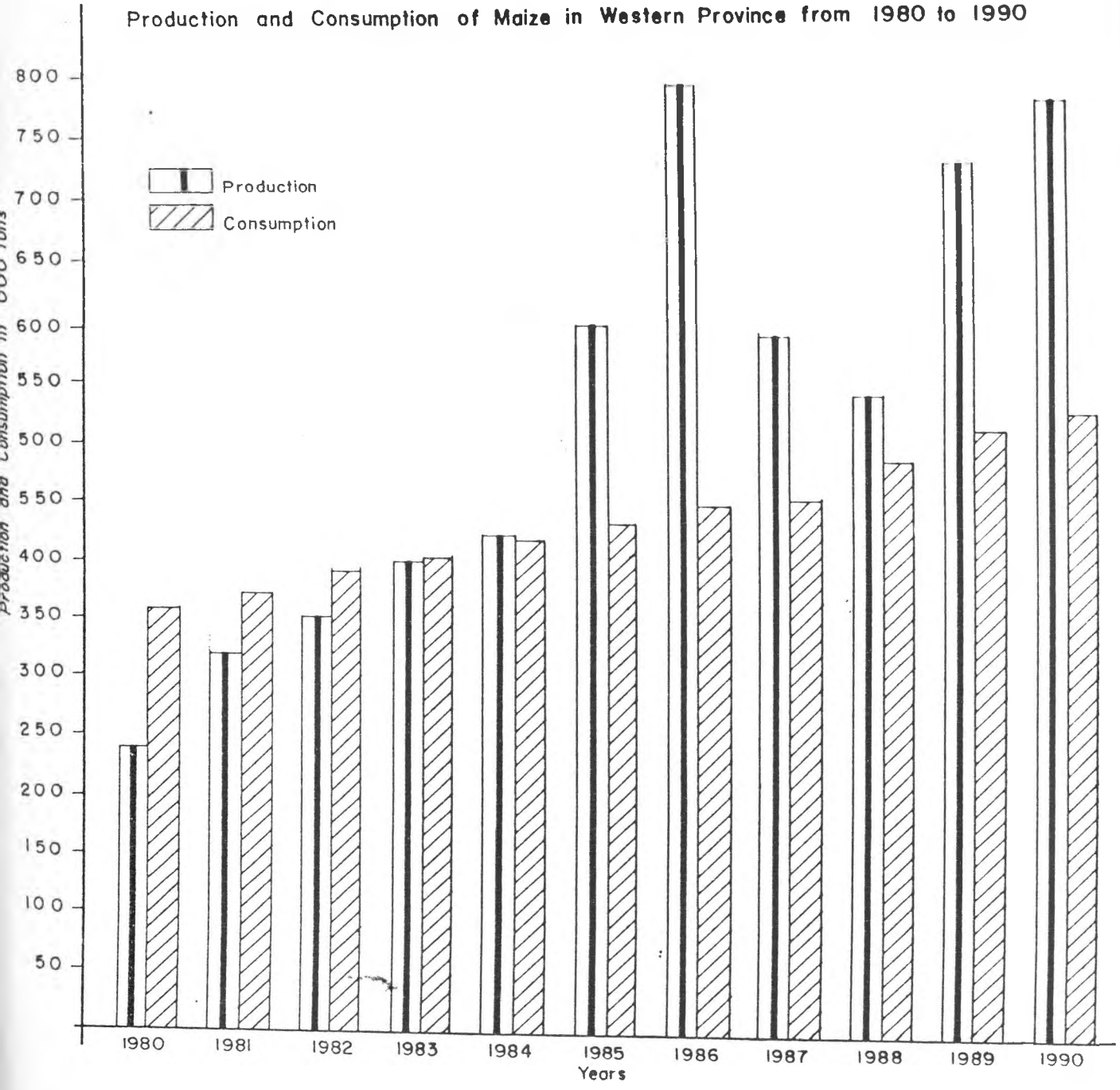


Table 3a

Consumption of maize in Western Province with daily average consumption of 543.4 grams.

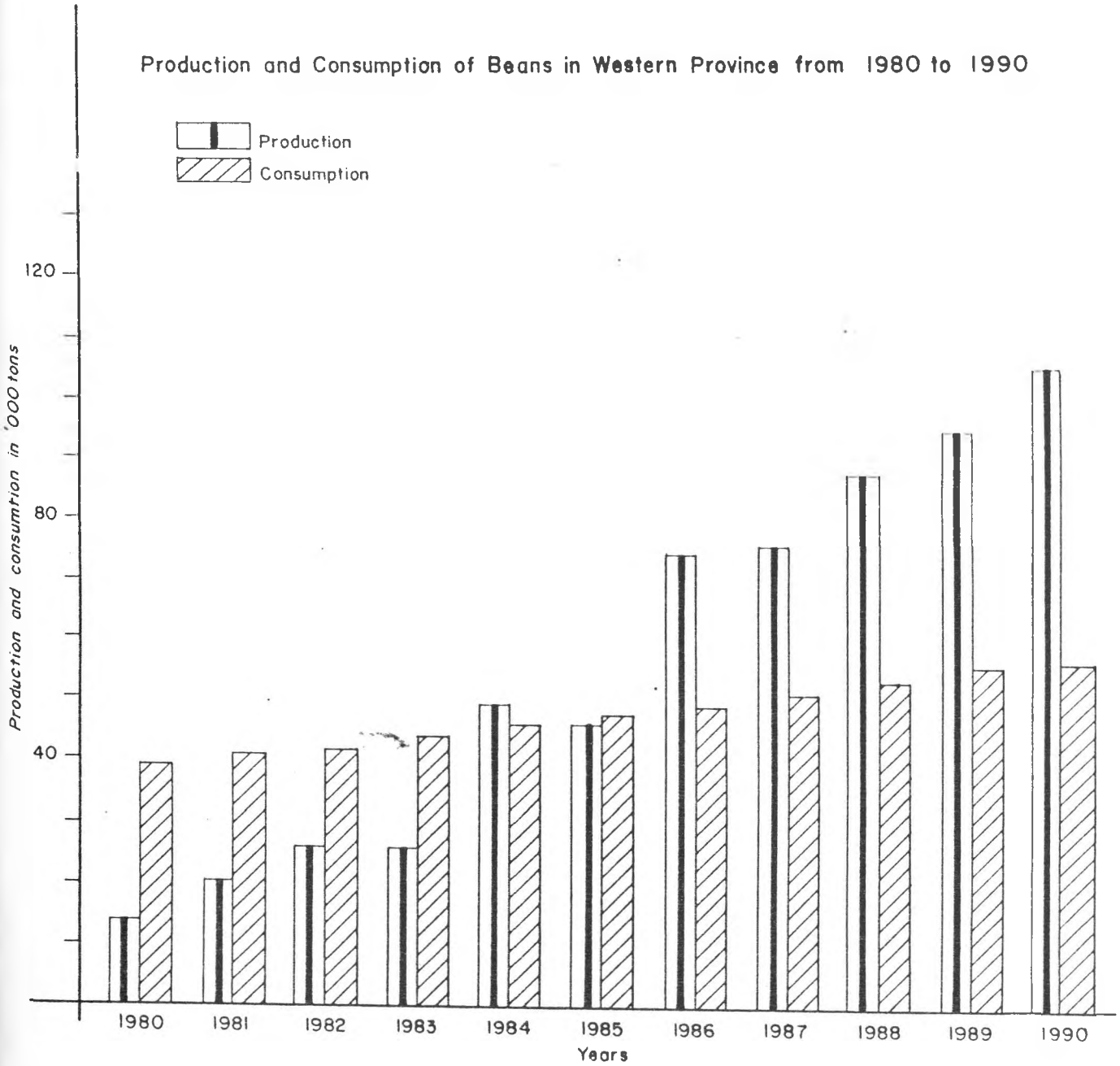
YEAR	POPULATION	PRODUCTION IN TONS	CONSUMPTION IN TONS
1980	1802793	242735	360559
1981	1870219	321942	374044
1982	1940055	348619	388011
1983	2012540	401248	402508
1984	2087872	424081	417574
1985	2166459	599315	433292
1986	2248044	799315	449602
1987	2333010	587700	466602
1988	2421517	540000	484303
1989	2513716	730699	502743
1990	2609785	782101	521957

Table 3b

Consumption of Beans in Western Province.

YEAR	POPULATION	PRODUCTION IN TONS	CONSUMPTION IN TONS
1980	1802793	13740	39334
1981	1870219	19626	40805
1982	1940055	26143	42328
1983	2012540	25647	43910
1984	2087872	49351	45554
1985	2166459	45659	47268
1986	2248044	73616	49088
1987	2333010	75177	50902
1988	2421517	86850	52833
1989	2513716	94039	54845
1990	2609785	103606	56941

Figure 3b


Production and Consumption of Beans in Western Province from 1980 to 1990
Production
Consumption
120
80
40
Production and consumption in '000 tons
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
Years

From 1984, surplus in supply of beans is observed. Before this year (1984) demand was higher. The increase in late years could be due to increased consumption as suggested of Nyanza as well as for income. It could also be due to the realization that beans do well when cultivated with maize and therefore its intensification. With more intensification, it is possible for the province to produce even much more of the crop. Ref table 4b and figure 4b

5.4 COAST PROVINCE.

Coast province has shortage of both the crops (maize and beans) throughout the period of study. It is observed that there is a decline in maize production from 1980 to 1985. Like in Western province there was an increase in production in 1984 than the year before inspite of the drought. The yield for 1986 to 1988 is more or less uniform. It is however projected that the yield might increase in 1989 and 1990 but not as to meet the demand. (Ref tables 4a and figure 4a.)

Unlike maize, production of beans has increased continuously from 1985. Otherwise before, production was very low ranging between one thousand tons and two thousand tons - Refer table 4b and figure 4b.

The low yield of these crops is due mainly to poor soil and secondly to eating habits of the people. Many people, especially in Mombasa and Kwale areas, consume alot of cassava. Cassava therefore can be said to be the stable food. Mombasa, being a town, consumes more and produces less. Coast province

Figure 4a

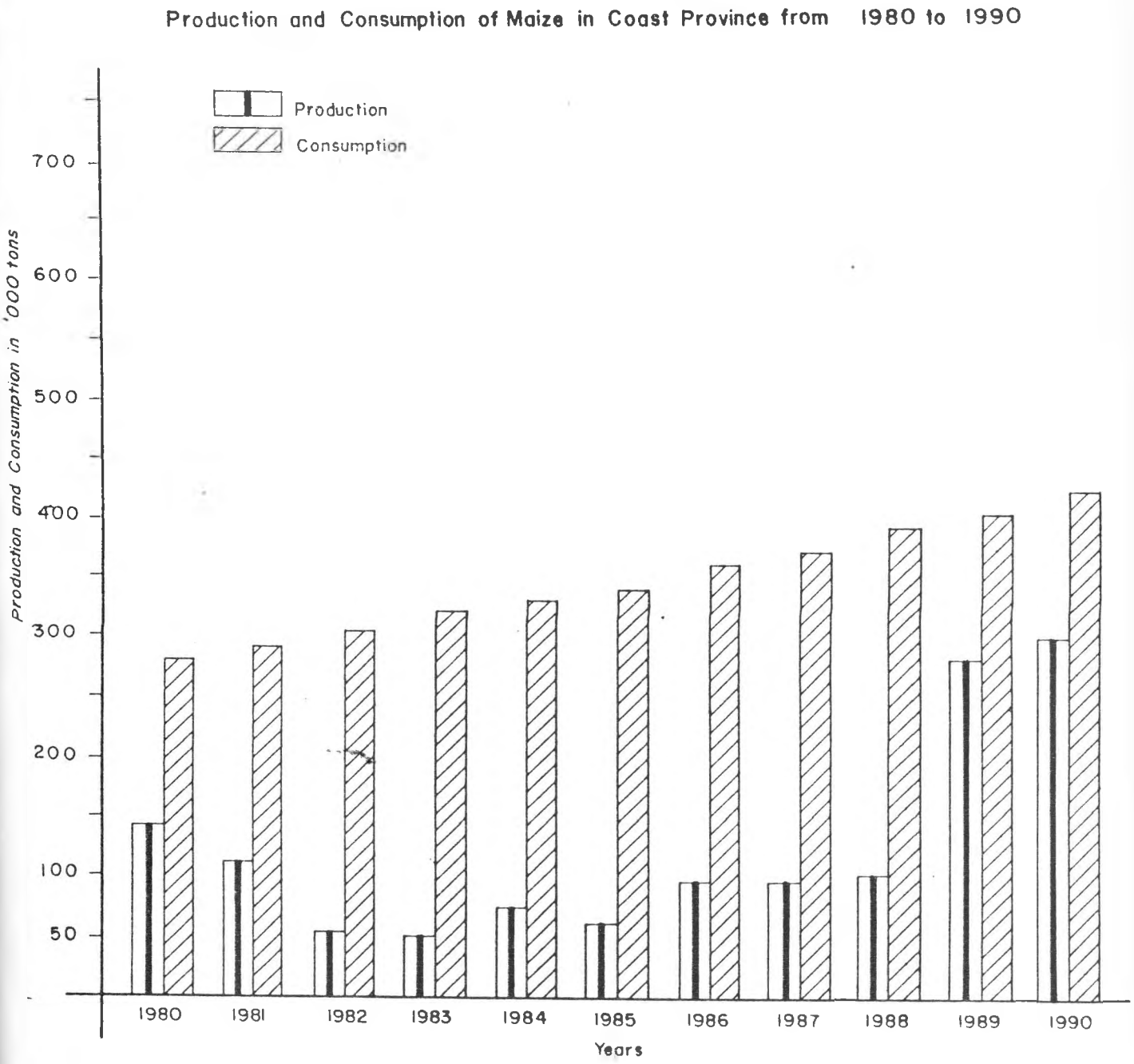

Production and Consumption of Maize in Coast Province from 1980 to 1990
Production
Consumption
Production and Consumption in '000 tons
700
600
500
400
300
200
100
50
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
Years

Table 4a

Consumption of maize in Coast Province with daily average consumption of 562.6 grams.

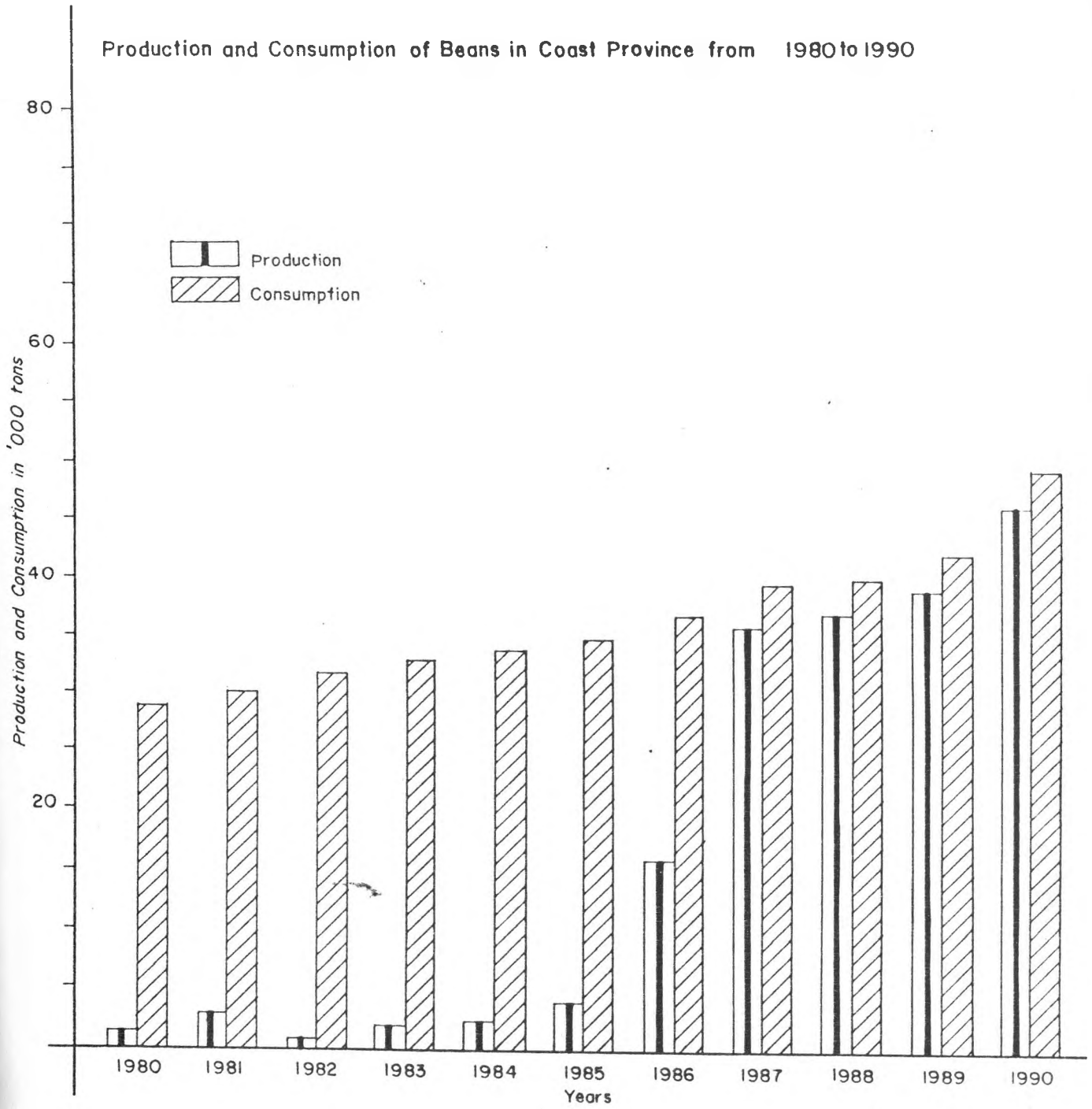
YEAR	POPULATION	PRODUCTION IN TONS	CONSUMPTION IN TONS
1980	1343081	142616	280826
1981	1397641	113630	292234
1982	1454337	51502	304089
1983	1513382	54151	316434
1984	1574944	76327	329306
1985	1639356	63473	342774
1986	1706445	97017	356802
1987	1776534	97483	371457
1988	1849768	98792	386770
1989	1926297	283677	402771
1990	2006288	297002	419497

Table 4b

Consumption of Beans in Coast Province.

YEAR	POPULATION	PRODUCTION IN TONS	CONSUMPTION IN TONS
1980	1343081	1425	29304
1981	1397641	2959	30494
1982	1454337	1100	31731
1983	1513382	1718	33019
1984	1574944	1748	34362
1985	1639356	4101	35368
1986	1706445	15999	37232
1987	1776534	35713	38761
1988	1849768	37379	40359
1989	1926297	39046	42028
1990	2006288	40712	43774

Figure 4b


Production and Consumption of Beans in Coast Province from 1980 to 1990
Production
Consumption
Production and Consumption in '000 tons
80
60
40
20
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
Years

therefore needs to import alot especially maize from those provinces which have surplus like Rift Valley and Western.

5.5 CENTRAL PROVINCE

Production of maize in Central province seems to have reached its maximum. That is, there is no increase in production at all as is the case with other provinces. This is shown by the fact that production of some earlier years e.g 1981 and 1985 are more than for later years of study. Refer table 5a and figure 5a. It is a known fact that use of advanced technology is more utilized in this province more than others. It is also known that the inhabitants practice cultivation widely. The stagnant production of maize in the province therefore is due to pressure on land. It can be said that maximum utilization of land has been practiced but that further expansion is impossible. As a result therefore, production is almost the same throughout the year of study. Here is a situation where demand is not only increasing but very high yet supply is constant and low. This province therefore has to import alot of maize from Rift Valley. It should also be noted that the inhabitants cultivate quite alot of potatoes which can be used in place of maize.

Production of beans on the other hand has been increasing. Infact, from 1986 onwards it is observed that there has been surplus in production. This is clearly illustrated by table 5b and figure 5b. Due to continuous increase it can be said that with further intensification higher surplus is possible. The

Figure 5a

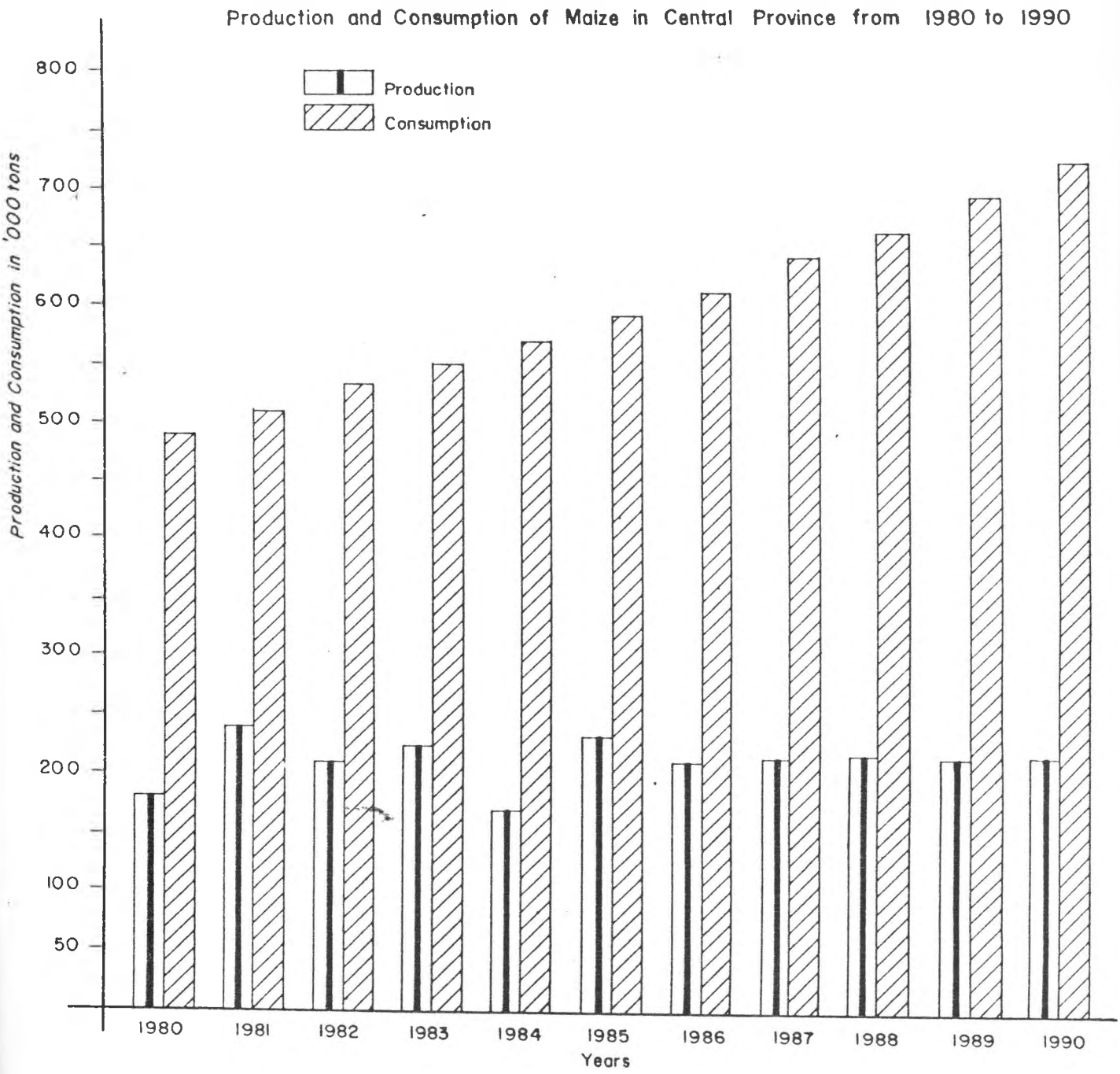

Production and Consumption of Maize in Central Province from 1980 to 1990
Production
Consumption
Production and Consumption in '000 tons
800
700
600
500
400
300
200
100
50
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
Years

Table 5a

Consumption of maize in Central Province with daily average consumption of 565 grams.

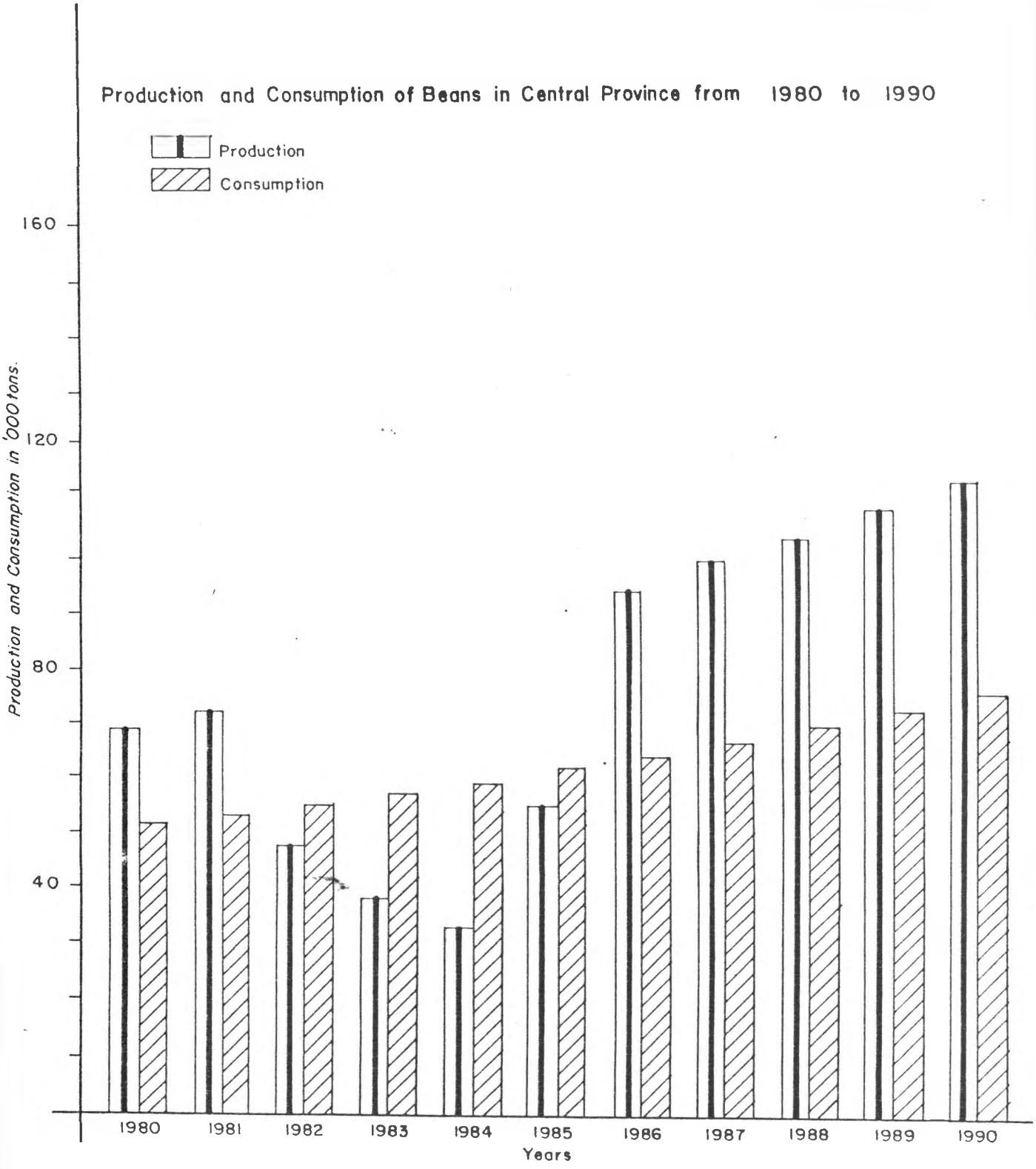
YEAR	POPULATION	PRODUCTION IN TONS	CONSUMPTION IN TONS
1980	2328116	178885	486788
1981	2418814	242744	505752
1982	2512913	205201	525427
1983	2610748	216540	545884
1984	2712590	166767	567178
1985	2818992	228914	589426
1986	2929637	209864	612561
1987	3045051	210822	636692
1988	3165465	211781	661870
1989	3291100	212740	688139
1990	3422219	213698	715555

Table 5b

Consumption of Beans in Central Province

YEAR	POPULATION	PRODUCTION IN TONS	CONSUMPTION IN TONS
1980	2328116	69076	50795
1981	2418814	72287	52774
1982	2512913	48075	54827
1983	2610748	38375	56962
1984	2712590	33479	59184
1985	2818992	55058	61505
1986	2929637	93603	63919
1987	3045051	98508	66437
1988	3165465	103414	69065
1989	3291100	108319	71806
1990	3422219	113225	74667

Figure 5b


Production and Consumption of Beans in Central Province from 1980 to 1990
Production
Consumption
160
120
80
40
Production and Consumption in '000 tons.
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
Years

increase of beans production can be attributed to its intercropping with maize. Since beans grow faster than maize the later can be planted more times in a year resulting in higher yield. Reduction in production of maize between 1982 and 1985 could have been due to unfavourable weather conditions since maize production was also fluctuating within that period. Central province therefore can export or distribute surplus beans to those provinces with shortages e.g Coast and Nyanza. To note also is the fact that central province feeds Nairobi which is a consuming province. Surplus beans therefore can be sold to Nairobi residents.

5.6 EASTERN PROVINCE.

Eastern province is the driest of all the provinces covered in the study. As such, fluctuation and reduction of food production is expected to be greater. Production is expected to be high when rainfall is sufficient otherwise production of food crops is always retarded by drought.

As far as maize is concerned,it is far below the demand throughout the years of study (Refer table 6a and figure 6a). As such therefore,the province relies on importation from other provinces.

Beans on the other hand does quite well in the province. Infact except for 1984, there has been surplus of the crop throughout the years of study. Ref table 6b and figure 6b. The increase however. is due to the fact that the type of beans

Figure 6a

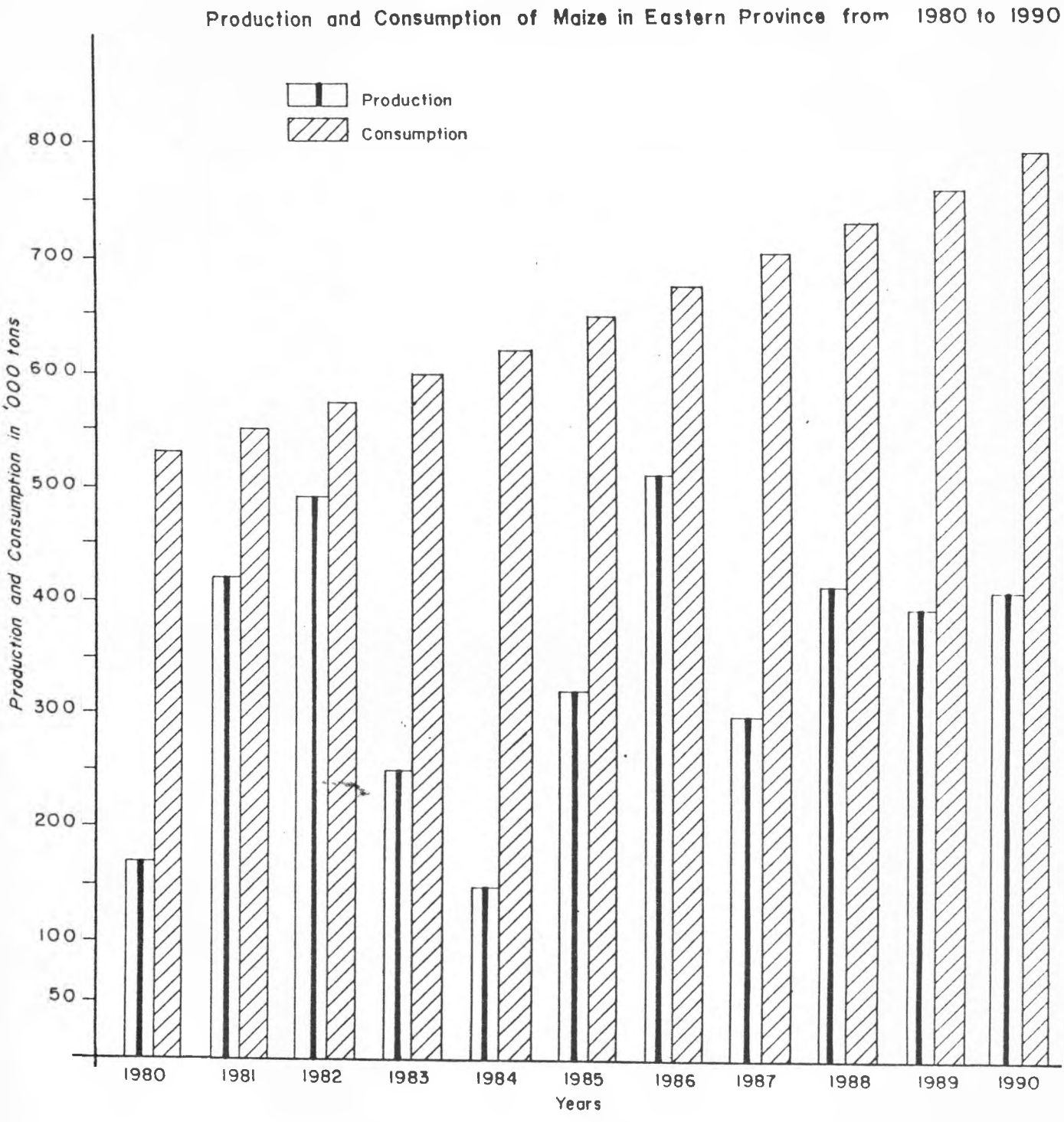

Production and Consumption of Maize in Eastern Province from 1980 to 1990
Production
Consumption
800
700
600
500
400
300
200
100
50
Production and Consumption in '000 tons
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
Years

Table 6a

Consumption of maize in Eastern Province with daily average consumption of 532 grams.

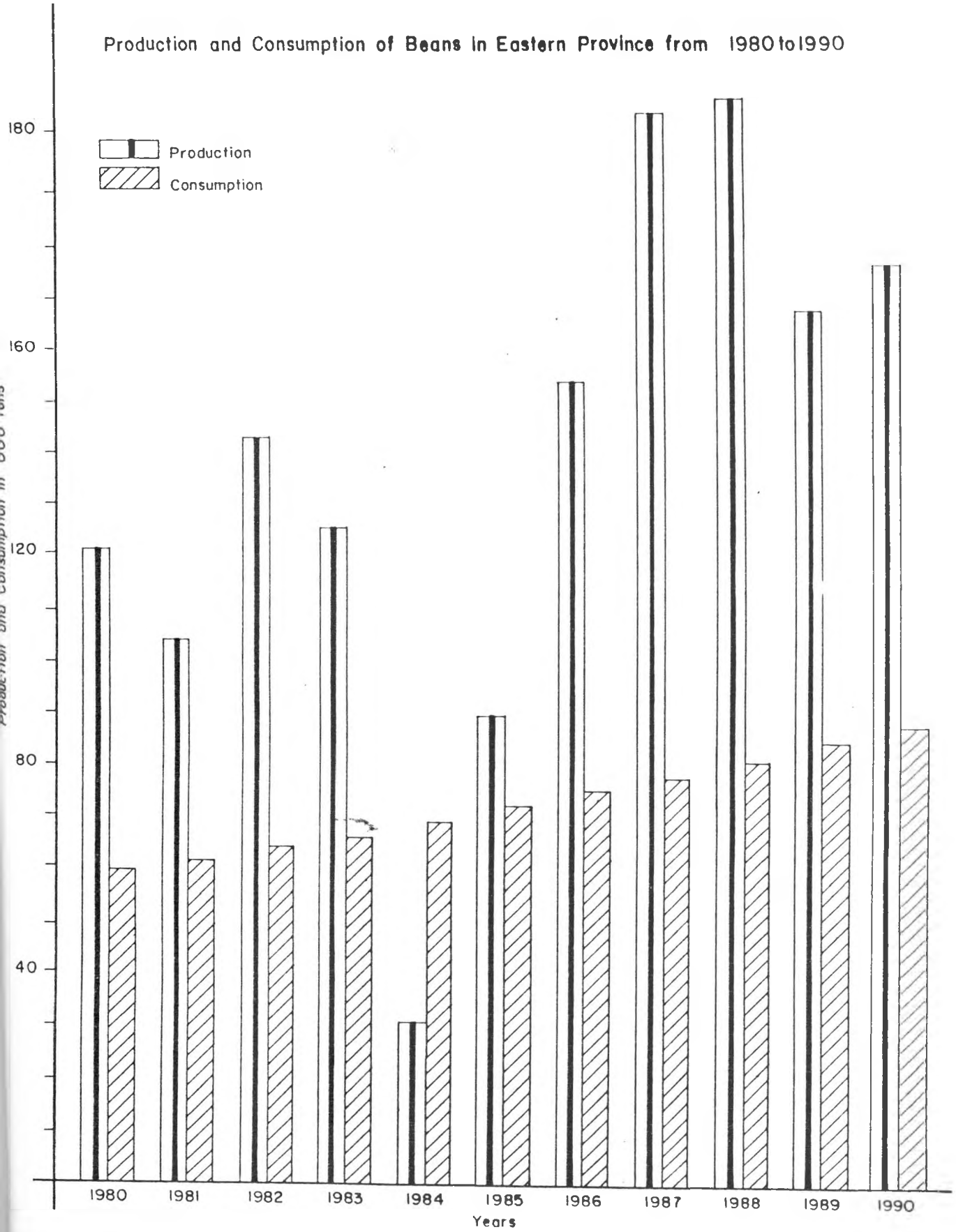
YEAR	POPULATION	PRODUCTION IN TONS	CONSUMPTION IN TONS
1980	2700659	168219	530311
1981	2811087	419933	551995
1982	2925886	486936	574538
1983	3045465	250787	598019
1984	3170169	145571	622506
1985	3300674	315827	648132
1986	3436642	506993	674832
1987	3578719	303458	702730
1988	3727210	410369	731889
1989	3882414	394593	762365
1990	4044677	406665	794227

Table 6b

Consumption of Beans in Eastern Province.

YEAR	POPULATION	PRODUCTION IN TONS	CONSUMPTION IN TONS
1980	2700659	121299	58923
1981	2811087	104193	61333
1982	2925886	143383	63838
1983	3045465	126120	66446
1984	3170169	30849	69167
1985	3300674	89638	72015
1986	3436642	153677	74981
1987	3578719	185036	78081
1988	3727210	188080	81321
1989	3882414	168066	84707
1990	4044677	176295	88247

Figure 6b


Production and Consumption of Beans in Eastern Province from 1980 to 1990
Production
Consumption
180
160
120
80
40
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
Years

cultivated in the province is one which can resist drought. The crop has been increasing in production. It is an indication that much more of the crop can still be produced. With its surplus production, Eastern province is the best in distribution of beans to other provinces where there is shortage or where there is no cultivation of the crop like in Nairobi province.

SECTION SIX

6.1 SUMMARY AND CONCLUSIONS

The main objective of the study as stated earlier was to examine the supply and demand of maize and beans province by provinces and to see whether food balance is possible. From the study, it is observed that there are differentials in supply and demand among the provinces. Rift Valley for example, produces more maize than its population can consume. Eastern Province on the other hand produces more beans than its demand. At Coast province there is a situation where the demand of both the food-stuffs is higher than the supply. The same applies to Nyanza Province. Central has shortages in maize production but surplus beans production.

It has also been observed that demand for the crops increases every year of the study. Supply however does not follow the same trend. For example, supply of maize in Central Province seems to be fixed.

It is noticed that the yield of beans in tonnage in all the six provinces covered is less every year than the production of maize. It has however,been increasing throughout the period under study. The increase is noticeable in all the provinces in 1985, 1986 and 1987. The production of maize is higher than that of beans for several reasons. One major reasons is that maize can be eaten (consumed) in several ways. It can be used in cooking of ugali or it can be eaten boiled or roasted in the case of green

maize. Maize is also used for brewing and for production of corn oil. As such, more maize is cultivated than beans. Another reason why maize is more is that an hectare of land yields more maize than beans. It is also known that not everybody in all the provinces consume beans. In such case, some beans is cultivated only for sale. Its (beans) general increase however, is an indication that there is room for further expanision.

The Ministry of agriculture though the extension officers should encourage farmers to cultivate more beans particularly in those areas where maize do well by intercropping. The ministry should research on and provide farmers with seeds which do well in different provinces as they have done for Eastern province. Its consumption should be encouraged by both the ministry of agriculture and the ministry of health (nutrition section) since beans is a good source of protein. Knowing that animals are no longer major source of the nutrient (protein) as they are expensive, more beans should be cultivated and eaten or consumed to prevent protein deficiency among many.

The study also reveals that Rift Valley and Western Provinces alone have maize surplus. These provinces should be encouraged to cultivate much more for sale to other provinces. Like in the case of beans, there is need to research and to find appropriate seeds for different provinces. Rift Valley for example, needs a type of maize seed which can be harvested more than once as the case is at present. This will lead to maximum untilization of land and higher yield.

Meanwhile, good incentives should be given to farmers e.g increasing the selling price of the produce to consumers. The government through the cereals board should ensure that all the produce is bought on time to avoid wastage after harvesting which really discourages farmers. Storage facilities should be sufficient. Construction of silos will go along way towards this end. It is essential to have storage facilities (silos) at the province of production as well as those province which import or buy the produce.

Intercropping has been mentioned earlier to be possible and necessary between maize and beans. This should be maximized. Research is necessary in this field to know which other crops can be intercropped with maize and/or beans so as to maximize the yield and yet leave the soil still arable. This should apply to all other crops not dealt with in this study.

In conclusion therefore, it can be said that it appears as if Kenya may not meet the nutritional needs of her population in some provinces. This rules out Boserup's theory that has population grows, development in all fields including agriculture follows, leading to high food supply. This is due to reasons given earlier which include pressure on land and lack of sufficient advanced technology. To be able to produce enough food intensification in cultivation especially of maize and beans is necessary. Idle land should be fully utilized which is found in provinces like Rift Valley. Modern technology should be employed in all the provinces. Irrigation techniques have to be practiced

or adopted in semi-arid areas like Eastern province and North Eastern province. Increase in yield has to be achieved through use of pesticides, fertilizers and improved seeds. High level managerial skills to distribute these commodities to farmers is essential. Use of machines like tractors for digging should be increased in all provinces where there is still room for cultivation like in Nyanza.

Food produce should be distributed with ease. This can be possible if transportation of foods e.g maize from one province to the other is not restricted. This will not necessitate buying only, but will also promote borrowing and lending of food-stuffs (which is African), where finance is a problem. In this way, nutritional status in all provinces can be improved.

Along side food production, family planning programmes should be strengthened. Many family planning centres should be increased especially in rural areas and more personnel recruited and trained to educate the population on the importance of small families and the practice of family planning. It can be summed up therefore that Kenya should give attention to food supply and its distribution. Attention should be paid to population also by trying to reduce it significantly to meet food demand.

FURTHER RESEARCH

The supply and demand of two crops have been looked at in this study, namely maize and beans. However, before drawing any lasting policies on supply and demand of food, further work on

other crops need to be looked into. Research on eating habits of different ethinic groups for example, is necessary. This will help to understand why certain foods are in plenty at one place and scarce at another. There is need for research also to see or investigate the balance between cash crops and subsistence crops. In some provinces, stress is on the cash crops and therefore shortage in subsistence crops, leading to imbalance in food and therefore nutrition.

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