

The University of Manitoba

A GEOGRAPHIC ANALYSIS OF THE SUNFLOWER
INDUSTRY IN MANITOBA

by

CALVIN STEWART PATTLE

A Thesis

Submitted to

The Faculty of Graduate Studies

in Partial Fulfillment

of the Requirements

for the Degree

Master of Arts

Winnipeg, Manitoba

October, 1972



ABSTRACT

The principal objective of this study is to trace the development and growth of the sunflower crop in Manitoba from its introduction on a commercial basis to the present-day. Within this general framework, the more specific goals are:

- (a) To reveal the reasons for the introduction of sunflowers in Manitoba.
- (b) To ascertain the reasons for constructing a processing firm at Altona and relate the types of products it manufactures.
- (c) To determine the location of the sunflower acreage, and identify the climatic and physical conditions of this environment.
- (d) To survey the research being conducted to improve the sunflower plant.

The major conclusions of this study may be summarized as follows:

1. Sunflowers, as a commercial crop, were promoted in the Altona District of Manitoba in 1943 by the Government of Canada because of the critical shortage of oil-bearing crops during World War II. Although sunflowers did not

fulfill its anticipated role during the war, every year since there has been a fluctuating acreage with stabilization only being evident in the 1960 decade.

2. A few businessmen and leaders from the Altona district realized the implications of a sunflower processing firm and converted this notion into a reality by 1946. The firm has proved successful and is today an efficiently operated, financially-sound business, manufacturing quality products in the form of crude oil, refined oil and meal.

3. Research conducted by a number of agencies has been influential in the continuance of sunflowers in Manitoba. The Canada Department of Agriculture Research Station at Morden has played the dominant role by developing, testing and introducing varieties suitable to the local environment.

4. The Manitoba acreage is located in the southern portion of the province within the boundary formed by the Red, Assiniboine and Souris Rivers. The entire growing region is in the most advantageous position with respect to temperature, frost-free season, precipitation and soils.

Since 1970, the Manitoba sunflower acreage has increased markedly. This growth indicates that the role of sunflowers in the provincial economy is becoming more important.

ACKNOWLEDGEMENTS

The writer acknowledges and is indebted to all those persons who provided information through letters and interviews during the preparation of this study. Special recognition is extended to the following: Dr. H.L. Sawatzky, Department of Geography, University of Manitoba who supervised this project and offered constructive criticism during its progress; Dr. E.D. Putt, Director, Research Station, Canada Department of Agriculture, Morden whose background made all his recommendations invaluable; Mr. P. Bergen, Field Representative, Co-op. Vegetable Oils Ltd., Altona who responded generously to all requests for information.

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CHAPTER I

INTRODUCTION

In 1969 Manitoba farmers harvested 8.24 million acres valued at \$275,705,000.¹ An infinite variety of crops comprised this acreage, however, the "standard" crops of wheat, oats, barley, and flax accounted for 6.3 million acres.² Incorporated within these figures is the sunflower crop which on 48,000 acres had a harvested value of \$1,700,000.³ Although these latter figures, typical of recent years, are not very impressive in comparison to most other crops, the sunflower industry in Manitoba has an interesting history. The fact that it continues to exist in the provincial economy is primarily due to the preservation of the pioneering spirit which played a prominent part in surmounting hardships during the early development of western Canada.

The growing of sunflowers in Manitoba as a commercial crop began in 1943 as a response to the critical shortage of

¹ Manitoba Department of Agriculture, *Manitoba Agriculture 1969 Yearbook* (Winnipeg: Queen's Printer, 1970), p. 6.

² *Ibid.*

³ *Ibid.*

vegetable oils engendered by the Second World War. Since that time the yearly acreage has fluctuated from a low of 3,000 to a high of 65,000 with an average in excess of 40,000 in recent years. This erratic pattern is an indication of the problems which beset this crop in the Manitoba environment and also provides some evidence of the formidable task in getting the crop established.

The current stabilized acreage, although relatively modest, represents a notable achievement as sunflowers are basically marginal to the Manitoba environment. The initial acreages of this crop in the province, even though of limited success, did nothing to assuage the skepticisms of many farmers. These people pointed out that acreages of sunflowers would be seriously curtailed once the government support price was removed after the war. It was during this period, however, that a small group of dedicated men proposed the construction of a processing plant to counter the possible loss of such acreages. After a remarkable effort a plant was erected in Altona. Later a refinery was added and the facilities enlarged. These events have been important in assuring continuing production of sunflowers.

The concern shown by the Canada Department of Agriculture (C.D.A.) through its Research Station at Morden, Manitoba has also promoted the acceptance and success of this crop. Their research has developed rust-resistant varieties with earlier maturity and higher oil content as

well as improved cultural practices.

Sufficient interest has been generated since 1964 to foster the holding of several sunflower conferences in Canada and the United States. These sessions deal with current research and the problems which exist in growing sunflowers in the many nations represented. They also attempt to provide, through a common effort, solutions to the many challenges encountered by the participants. Further, they advance the personal exchange of information and ideas on sunflowers, an activity not previously undertaken because of the small acreage of the crop in North America. In turn, the information obtained is used by the processors of sunflower seed to attract new growers and increase total plantings.

In view of the many obstacles which had to be overcome before a degree of consistency in the Manitoba acreage had evolved, one may legitimately ask the reasons for such perseverance. Actually any crop, such as sunflowers, which compares economically with the cereal grains should be promoted as long as there is a market. Certainly the large grain surplus in Manitoba and other Prairie Provinces emphasizes the necessity of growing and experimenting with other crops. The major benefit to the farmer is the insurance inherent in diversification of operations.

The uniqueness of sunflowers in Manitoba has

stimulated the writer to present a thesis on this industry
The primary purpose of the thesis is to trace the
development and processing of this crop in Manitoba,
ascertain the physical environment in which the crop is
grown, assess its present importance and attempt to determine
its future prospects.

CHAPTER II

DESCRIPTION, HISTORY AND ECONOMIC VALUE OF THE SUNFLOWER PLANT

The commercial sunflower plant is unusual in appearance mainly because of its size. Growing approximately six feet high and seemingly crowned by an oversized head in relation to the stem, it has few, if any, rivals in such a remarkable yearly growth rate in temperate climates. Although its origins are somewhat obscure, the plant is today valued for its high quality oil. The purpose of this chapter is, therefore, to describe the physical appearance of the plant, trace its origins in history and outline its economic significance.

I. Plant Description

The cultivated sunflower, *Helianthus annus* L., is an annual. Many varieties of the annual species exist due to its adaptability to numerous types of soil and climate. As a result there are wide ranges of head size and plant height in both the wild and domesticated state. The following features characterize the commercial varieties

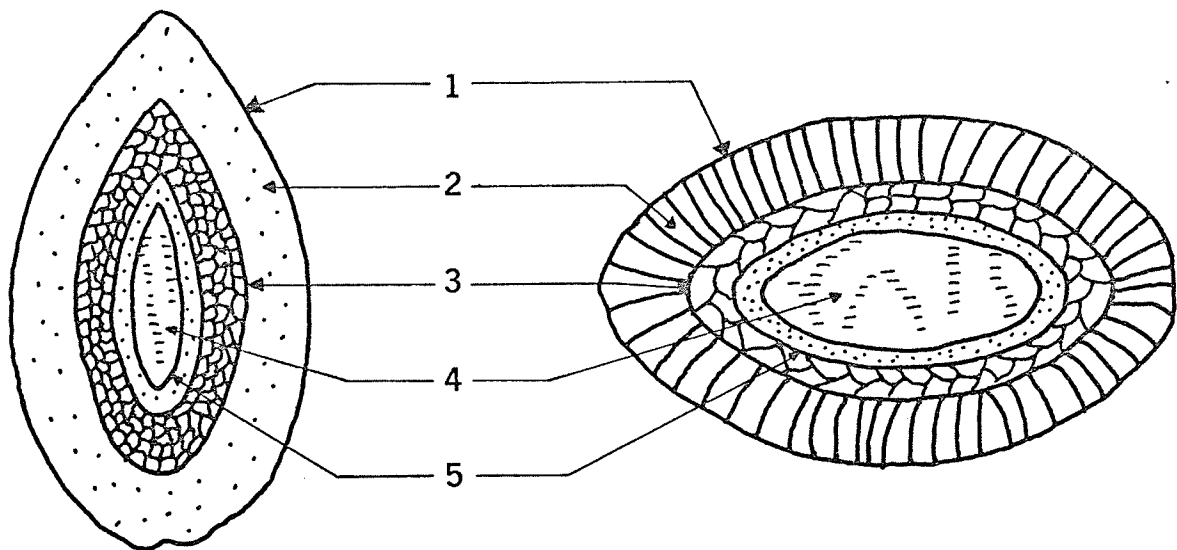
common in Manitoba.

In general, the plant is four to seven feet at maturity. The stalk or stem is hairy, strong, greenish in colour and cylindrical in shape (Figure 1). Large leaves grow alternately from the stalk and are covered with fine hairs. The dominating feature of the sunflower is undoubtedly the large, drooped, circular head which is most prominent as the plant matures (Figure 2). At this stage, the head is five to eight inches in diameter and is filled with a mass of dark greyish seeds. Brightly coloured yellow petals are set around the circumference of the head. These distinguishing features of the head result from the plant belonging "... to the largest natural order of flowering plants, the Compositae, which are characterized by the crowding together of individual flowers into heads."¹ This feature ensures the pollination of a maximum number of flowers by a single insect visit.

The ripened seeds which botanically are akenes or dry indehiscent fruits, vary in size and shape in the different varieties. Their colours also differ but the seed usually varies from grey to almost black with lighter longitudinal stripes on the surface. Some strains and varieties with white seed occur. Figure 1 illustrates the internal structure of the fruit. The actual seed consists

¹ E.F. Hurt, *Sunflower* (London: Faber and Faber Ltd., 1948), p. 47.

FRUIT



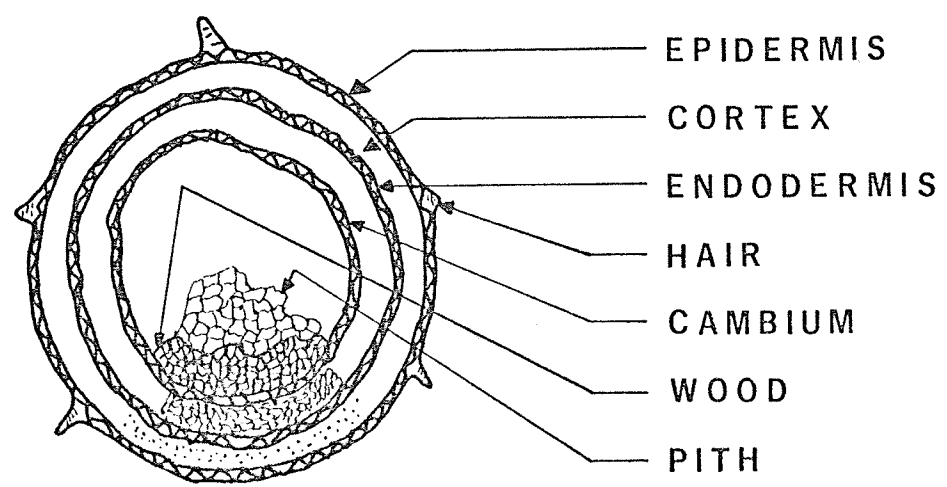
LONGITUDINAL

TRANSVERSE

- 1 - EPICARP
- 2 - MESOCARP
- 3 - ENDOCARP

- 4 - KERNEL
- 5 - TESTA

STEM



- EPIDERMIS
- CORTEX
- ENDODERMIS
- HAIR
- CAMBIUM
- WOOD
- PITH

SOURCE: HURT, E. F., SUNFLOWER

FIGURE 1

of the kernel and the surrounding testa.²

The sunflower plant is subject to nutation until the late bud stage. This peculiar process involves a bending and turning of the stems and petioles so that the bud and leaf blade face the sun throughout the day. This heliotropic behaviour ceases shortly before blooming commences. During the remainder of the life of most plants, the bud and later the flower and maturing head face east (Figure 3).³ The designation "sunflower" is believed to have resulted from this nutation phenomenon. However other authorities give credit for the name to the plant's bright yellow petals being compared to the rays of the sun.⁴

Therefore the sunflower plant, in many respects, is unique in its physical attributes. The major features contributing to its striking appearance are the phenomenal height and the large head which are most evident at maturity and the nutation process which occurs until blooming begins.

II. History

The exact origin of the commercial or cultivated sun-

² Hurt, *op. cit.*, p. 113.

³ Personal correspondence between Dr. E.D. Putt, Director, Research Station, Canada Department of Agriculture, Morden, and the writer, October 4, 1971.

⁴ Hurt, *op. cit.*, p. 47.

flower is veiled in history although it is known to be a native of America.⁵ More specifically, some authorities place its nativity in either of the regions bordered by the present-day countries of Peru or Mexico.⁶ From its cradle in the low latitudes, the plant apparently spread northward. Indians on Roanoke Island, off the coast of the state of North Carolina, were reported growing sunflowers for food in 1586 and for hair oil in New England in 1615.⁷ Today the wild or uncultivated sunflower and related subspecies are found in virtually all parts of the United States and the adjacent regions of the Canadian Prairies and Mexico.⁸

The sunflower was introduced into Spain before the middle of the 16th century by Spanish adventurers who came into contact with the plant during their explorations of Central and South America. From Spain the plant was quickly adopted by other countries - Bavaria in 1625 and France in 1787.⁹ Continuing to spread eastward, the plant became well ensconced in Southern Russia and from there radiated outward to the Danube region where the countries

⁵ John H. Martin and Warren H. Leonard, *Principles of Field Crop Production* (New York: The Macmillan Co., 1967), p. 933.

⁶ Hurt, *op. cit.*, p. 47.

⁷ Martin and Leonard, *op. cit.*, p. 933.

⁸ Charles B. Heiser, Jr., *et al.*, *The North American Sunflower (Helianthus)*, ed. T. Delevoryas, *Memoirs of the Torrey Botanical Club*, Vol. XXII, 3 (Durham: The Seeman Printery, 1969), p. 63.

⁹ Hurt, *op. cit.*, p. 47.

of Romania and Bulgaria became principal growers, with Hungary, Yugoslavia and Czechoslovakia being secondary.¹⁰

The improved European type was reintroduced into the Argentine as a commercial crop in 1870 and North America in the mid-1870's.¹¹ All commercial North American varieties have been derived from the European type or have this type as part of their parentage.

Therefore some three centuries after the wild sunflower was transferred from the New World to the Old World, a reverse migration took place with an improved variety being reintroduced into North America from Europe for commercial production.

III. Economic Value

The sunflower plant is grown primarily for its seed or fruit. The principal economic value of the seed is as a raw product to produce vegetable oil. Although there are many sources of vegetable oils, the most prominent in terms of production and international trade include: castor seed, copra, cottonseed, groundnuts/peanuts, hemp seed, oil palm kernels, linseed/flaxseed, olives, rapeseed, sesame seed, soya beans and tung oil.

¹⁰ William Van Royen, *The Agricultural Resources of the World*, Vol. I of *Atlas of the World's Resources* (New York: Prentice Hall, Inc., 1954), p. 160.

¹¹ Hurt, *op. cit.*, p. 47.

All vegetable oils fall broadly into one of three subclasses - edible, edible industrial, and industrial - depending on the composition and final application.¹² The oils within each of these subclasses as determined by export markets are as follows:¹³

Edible	Edible Industrial	Industrial
groundnut oil	copra	rapeseed oil
cottonseed oil	palm kernel oil	linseed oil
soya bean oil	palm oil	castor oil
sunflower oil		tung oil
sesame oil		
olive oil		

Vegetable oils have wide and varied applications from food products, to lubricants, to additives in paint and varnish. As a by-product of their production the meal may be used as an animal feed or fertilizer.

The major use of vegetable oils, however, is as a food product or edible oil. Approximately 70 percent of the total production is consumed in this form.¹⁴ This high consumption as an edible oil is related to an increasing world population, the spread of prosperity and higher living standards, all of which are creating an additional demand for fats.

¹² *The Shorter Oxford Economic Atlas of the World* (2nd ed.; London: Oxford University Press, 1959), p. 33.

¹³ *Ibid.*

¹⁴ *Ibid.*

Prior to the beginning of the twentieth century, fats had been primarily supplied by animals but with the increasing demand for fats this source could not keep pace. A search for effective substitutes was therefore emphasized. In 1909 Crosfield invented the process of solidifying liquid vegetable oil by hydrogenation.¹⁵ This discovery was basic to the development and commercial production of the cheap butter substitute margarine. Lower priced vegetable oils could now be utilized, such as the palm oil of West Africa and coconut oil from the Pacific Islands.

World War II altered the availability of vegetable oils. Where possible, countries attempted to compensate by increasing the acreages of other oil-bearing crops. With the development of new technology it was now feasible to substitute one oil for another, thereby eliminating the reliance upon any one oil. Recently, scientific research has developed synthetics and new processes which have alleviated the dependence upon vegetable oils in some areas e.g. soaps. Regardless of these outstanding technological advances, it is an acceptable premise that the demand for edible oils will continue to increase as population expands.

Sunflower oil, as an edible oil, falls into the subclass which is in greater demand than either the edible

¹⁵ *Oxford Economic Atlas, op. cit.*, p. 32.

industrial or industrial. As mentioned previously, edible oils account for over 70 percent of the entire vegetable oil production. Of this percentage, sunflower seed oil is in fourth place in production after groundnut/peanut oil, cottonseed oil and soya bean oil, accounting for approximately ten percent of the total edible oil production.¹⁶

The value of sunflower oil is its exceptionally high quality. It compares well with both olive oil and cottonseed oil.¹⁷ Its fatty-acid composition is palmitic and stearic, oleic and linoleic. A major factor contributing to its desirability as a cooking oil is the almost complete absence of linolenic acid. This acid causes a change in flavour in salad oils, a fish taste in cooking oils and a yellowing of white and light pastel paints.¹⁸ Another noteworthy attribute is its high smoke point. In this respect it surpasses such rivals as corn oil, cottonseed oil and peanut oil and is therefore recommended for open vessel heating or frying.¹⁹ The sunflower meal, following extraction of the oil, is high in protein and may be used in non-ruminant rations. It compares well with soya bean and groundnut meal.²⁰

¹⁶ *Oxford Economic Atlas, op. cit.*, p. 33.

¹⁷ Eric D. Putt, "Sunflowers," *Field Crop Abstracts*, XVI, 1 (February, 1963), p. 1.

¹⁸ Cargill Vegetable Oil Division, *High-oil Sunflowers* (Minneapolis: [n.n.], [n.d.]).

¹⁹ Eric D. Putt, *Sunflower Seed Production* (Rev. ed.; Altona: Co-op. Vegetable Oils Ltd., 1952), p. 29.

²⁰ Putt, "Sunflowers," *op. cit.*, p. 1.

Therefore, in summary, most portions of the sunflower seed have an economic value which contributes to the highest possible return. For this reason, plus the indication of assured markets due to the demand from increasing populations, the sunflower industry has the potential of remaining a profitable enterprise.

CHAPTER III

PRODUCING COUNTRIES OF THE WORLD

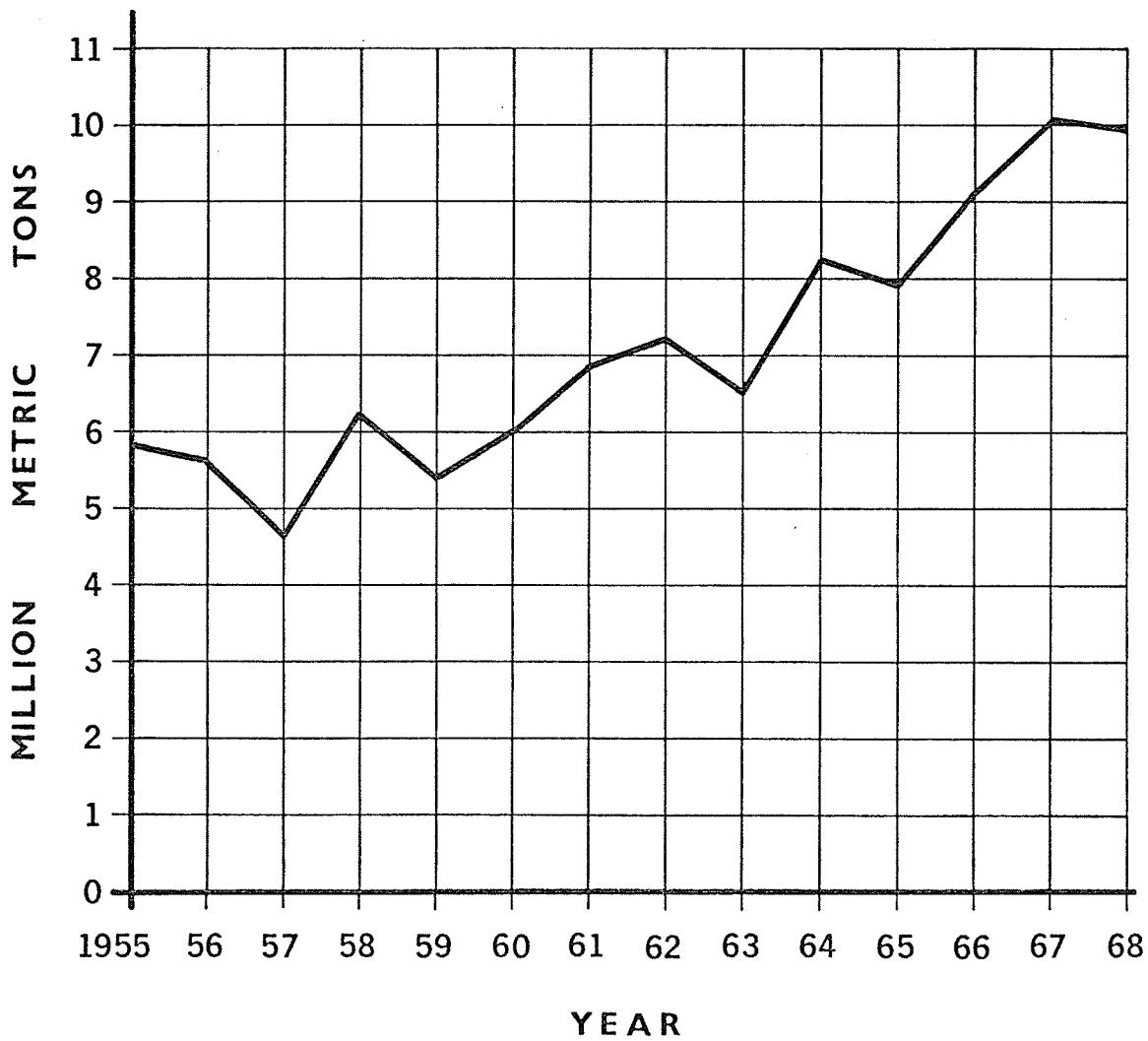
Although many countries in the world grow sunflowers, only a limited number are major producers. Of these, the Union of Soviet Socialist Republics (U.S.S.R.) produces more than the combined total of all other countries. In the United States and Canada, sunflower acreage is negligible in terms of total world production. This chapter will trace world production in recent years, indicate the producing countries and then focus upon North American growing regions with special emphasis on Canada.

I. World Production

The total production of sunflower seed throughout the world is depicted in Figure 4.¹ This graph represents a general trend of growth although substantial recessions are also evident in the years 1957, 1959 and 1963. The overall increase becomes discernible when the two extremes

¹ Data for the years prior to 1955 have been omitted as no figures are available for the U.S.S.R. Since the U.S.S.R. is the largest producer in the world, any data without their figures are invalidated.

WORLD SUNFLOWER SEED PRODUCTION



SOURCE: UNITED NATIONS FAO

FIGURE 4

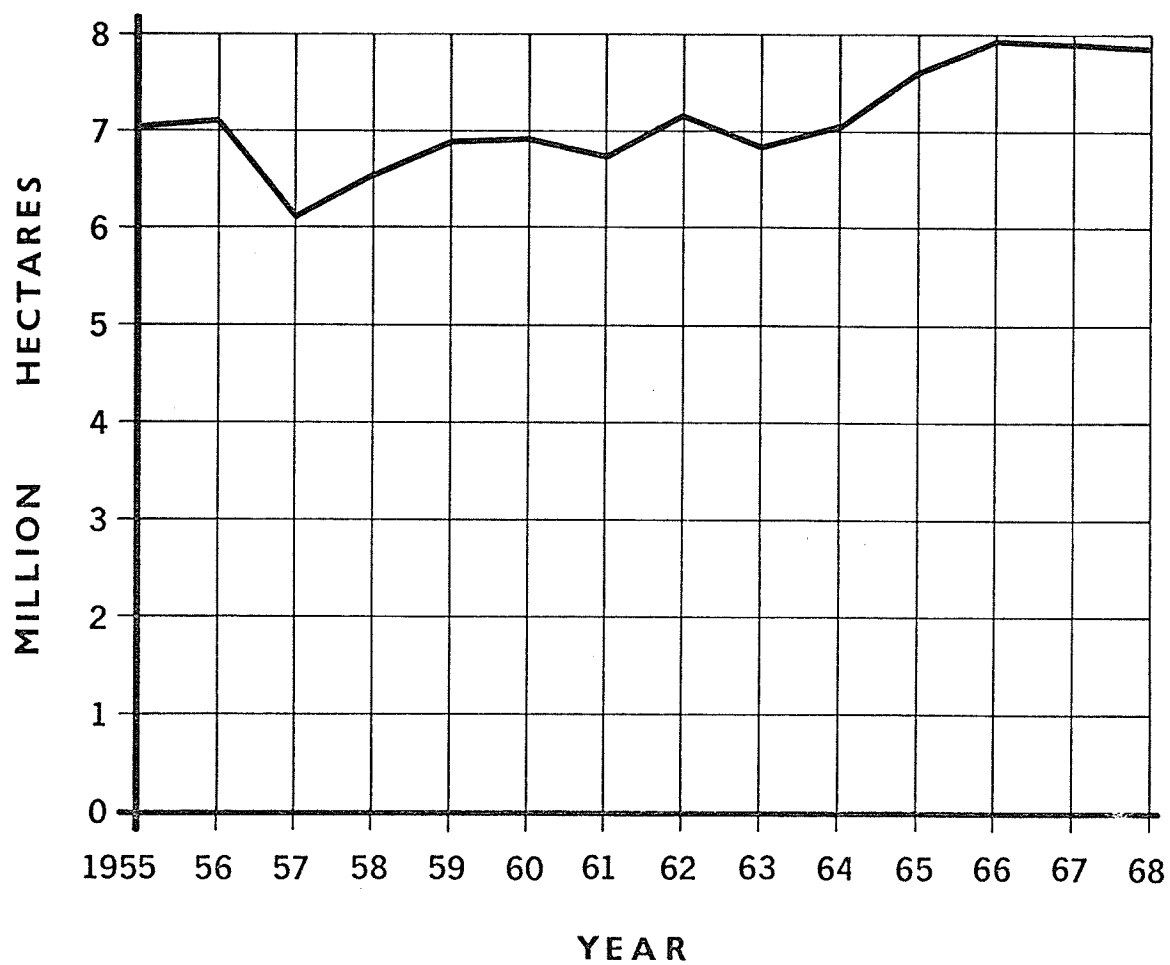
of this time period are compared. Commencing with a total production of 5.8 million metric tons in 1955, there is, by 1968, a yearly production of nearly 10 million metric tons or an increase of approximately 40 percent in 13 years.

Figure 5 illustrates the total area devoted to sunflowers in the world for the same interval as in Figure 4. It will be noted that throughout this 13 year span, the area has remained relatively stable. At the beginning of this period, in 1955, the area was 7 million hectares (one hectare equals 2.47 acres) and at the end, in 1968, the area was 7.8 million hectares or an approximate increase of 10 percent. Clearly the rate of increase in area is less than the rate of increase in production.

Figure 6 shows the world yields in kilograms per hectare for the same period as in Figures 4 and 5. There has been a marked increase in the yield from 800/kg/hectare in 1955 to 1,270 in 1968. This represents an increase of approximately 37 percent.

To summarize, the area planted to sunflowers has not increased to any great extent although yields and total production have improved. The major reason for the gain in yields and production is the research which has developed superior yielding varieties with improved oil content. It may be assumed that the area has not declined primarily due to the increased demand through a wider

WORLD AREA OF SUNFLOWER SEED



SOURCE: UNITED NATIONS FAO

FIGURE 5

AVERAGE WORLD YIELD OF SUNFLOWER SEED



SOURCE: UNITED NATIONS FAO

FIGURE 6