

CLOSING THE WORLD'S NUTRITIONAL GAP -

With Animal or Vegetable Protein ?

The World's Food Crisis has been fairly well publicized, and its main features are beginning to stand out clearly. Population practically everywhere is rising. Food production is barely keeping pace. In the most populated areas of the Far East, the Near East, Africa and Latin America, increases in population prevent increases in per capita income and in per capita food consumption. In the U. S. production is being held in check, so as to keep surplus food production from piling up. In Europe food production is increasing faster than population, and we are witnessing there an increase in the so-called quality of the diets, that is, an increase in livestock production. But in the areas that need both more food and more general economic development, most of the progress of the past decade or two is being eaten away by population increases, with generally no real improvement to brag about.

As these facts are becoming more generally recognized there is developing a greater awareness of the help that must come from the food technologists to supplement the uphill work of the agronomists and agricultural economists. Those who look at the world food crisis in terms of decades, see the dire consequences of a doubling of the world's population in the next 30-40 years.

Those who look at the world's food imbalance as of today and tomorrow, generally agree that the most important aspect of the World's food shortage is the lack of protein in the diets of the poor in the underdeveloped countries, and that this lack is most serious among the young and their mothers. It manifests in malnutrition, physical and mental disorders, in high infant mortality and in poor health and low economic productivity in those who survive childhood malnutrition.

Under- and malnourished and starving children cannot wait for the purchasing power benefits from inevitably slow general economic development. There must be more extensive and speedier ways of helping these populations now; and while many food technologists in private and government laboratories and agencies are deeply involved, it is my impression that a much more vigorous effort is necessary to make fuller and speedier use of what food technologists and nutritionists can contribute on the basis of present knowledge and on the basis of what agricultural economists already know as to the relative protein efficiency of vegetable versus livestock sources.

The view of the World's food shortage that I want to present stems from a bit of indoctrination I received during brief spells of work with the U. S. Food For Peace Office, and with the international organizations of UNICEF and FAO, but these organizations are not responsible for any lack of knowledge and exaggerated views and hopes on my part.

The latest estimates of the U. S. Department of Agriculture give a concise measure of the magnitude of the World food deficit, in calories, protein and fat.

(Table I)

WORLD FOOD DEFICIT, 1959-61 (Million Metric Tons)

	World Total	Communist Asia	All Other Countries
<u>Calories</u>	87.1	55.5	31.6
Wheat	14.5	8.1	6.4
Rice	54.5	36.1	18.4
Other grains	18.1	11.3	6.8
<u>Protein</u>	20.3	11.9	8.4
Animal	10.8	7.2	3.6
Vegetable	9.4	4.7	4.7
<u>Fat</u>			
Vegetable Oil	6.9		2.2

Source : U. S. D. A.

Table Ia - Available Food For 100 Persons Per Day
(Average amounts at retail level)

Food	Developing Countries 1 (70% of world's people)	Developed Countries 2 (30% of world's people)	USA & Canada only 3 (6.6% of world's people)
Cereals, flour and bread	85.0 lbs.	71.7 lbs	40.4 lbs.
Starchy roots	42.8 lbs.	68.7 lbs.	29.5 lbs.
Sugar	6.6 lbs.	19.2 lbs.	24.7 lbs.
Pulses (beans) and nuts	10.8 lbs.	3.6 lbs.	4.2 lbs.
Vegetables and Fruits	40.4 lbs.	80.2 lbs.	113.4 lbs.
Meat	6.6 lbs.	33.1 lbs.	54.8 lbs.
Eggs (weight with shell)	0.6 lbs.	6.6 lbs.	12.1 lbs.
Fish	2.4 lbs.	4.2 lbs.	2.4 lbs.
Milk and cheese (express as milk)	8.7 quarts	62.7 quarts	91.7 quarts
Fats and oils	2.4 lbs.	10.8 lbs.	12.7 lbs.
Calories (per Person)			
%of total calories from	2150	3050	3110
cereals, starchy roots and sugar	78%	57%	40%
Protein-Total per person	58 grams	90 grams	93 grams
Protein-animal per person	9 grams	44 grams	66 grams

1. Far East, Near East, Africa, Latin America except for Argentina, Uruguay and Paraguay.
2. North America, Europe, Australia, New Zealand, Argentina, Uruguay and Paraguay.
3. U. S. and Canada, also included in Developed Countries column. (Adapted from Third World Food Survey, Food Agriculture Organization, Rome 1963.

If we set aside Communist China for the present, the food deficit may be summarized in three simple figures. The calorie shortage consists of about 32 million tons, 60% of which is here expressed in rice, 40% in wheat and other grains. The protein shortage is something over 8 million tons, about half derived from animal, half from vegetable sources. The shortage of fat as vegetable oil amounts to over 2 million tons.

I want to dwell on these protein shortages and to use them to make two points. The first is that the separation between animal and vegetable protein seems to me misleading. It leads to placing undue emphasis on livestock production in underdeveloped countries. The second point is that if this fact were more generally recognized, it would help to speed up expansion in the supply of protein food, for it would shift some of the emphasis from costly, wasteful livestock production in the surplus producing countries as well as in the protein deficit countries to the more immediate potential increases in vegetable protein.

Up-to-date nutritionists now tell us that protein does not have to be supplied partly from animal and partly from vegetable sources. Babies, as well as adults, can thrive on properly balanced vegetable protein alone. The current widely misplaced emphasis on animal protein is being buttressed by the fact that the diets of highly industrialized countries favor livestock products. This leads to what, for me, is a questionable conclusion, namely, that the chief way to lift the nutritional levels in underdeveloped

countries is to raise their economic levels. This, it is argued, would produce the necessary increased consumer purchasing power to pay for the more expensive protein from livestock sources, meat, dairy products, and poultry.

The logic of this is understandable (See Chart I) but the facts are that general economic levels do not rise easily and American and European experience, and I suspect not even Japanese experience, is today applicable to the poverty areas of South Asia. For India to double its present per capita income of less than \$100 would have to be accompanied by a transformation of its economy so that 55% of its labor force is employed in agriculture instead of 75% as at present. At best, without drastic action, such a transformation would take about 15-20 years.

Even if by some miracle the poor of India now living on \$50 a year were to earn \$100 or \$150 per capita, the difference in the amount of animal protein in their diet would rise from 2-3 grams per day to 7-8 grams and total protein from about 35 grams to 50 (among urban families). It would take some years to develop a domestic livestock industry and a meat eating culture. An average income of \$100 or \$150 per capita would hardly support a vigorous expansion of domestic animal protein sources.

The U. S. Department of Agriculture realistically sees almost no increase by 1970 in India's present intake of 7 grams of animal protein, nor in the 11 grams in Ceylon and Pakistan nor in the average of 7 grams for the other East Asia countries (excluding Japan).

There are more compelling reasons why for India, Pakistan and similar countries the advice they receive from experts trained in U. S. or European feed grain and livestock production may not be wise or sufficient. In the first place a substantial increase in the livestock share of the Indian diet would require more land. Where land is limited, a shift to livestock would feed fewer people. As it is, India's meager food resources have to provide for two populations, human and animal. Does it make sense to undertake herculean efforts to check the human population and at the same time to imitate wasteful North America and Northern Europe by increasing the animal population that eats three times as much as it gives to the human population. Why use protein in feeding animals to obtain protein for one human when, if used as food, the same quantity of protein would supply the protein needs of three or four persons.

There is another form of waste that is indulged in by countries producing oil seeds. India and Brazil are examples of countries wasting vegetable protein food resources. Brazil produces close to a million tons of oil seed cake and meal, two-thirds of which is used for both feed and fertilizers. Much of this could be saved for food purposes by substituting more economical chemical feeds and fertilizers.

India produces over three million tons of oil seed cake and meal from peanuts and cotton seed, three-fourth's of which is used for fertilizer as well as feed. That much marketable meal has a commercial value of over \$150 million. If only a portion of this were replaced by commercial fertilizer and chemical urea substituted for meal in feeding cattle there would be substantial net savings, increased export earnings, and funds for further progress in protein food technology. Already India knows how to make flour and milk out of peanuts, just as we know how to make flour, milk and meat substitutes out of soybeans. This knowledge should be put to use.

Much of the world shortage of protein could, therefore, be met quickly by reducing the wasteful uses of oil seed cake and meal and by increasing their production.

In this World protein picture, the U. S. holds a most important position. It illustrates what underdeveloped countries should and should not do in their efforts to meet their protein requirements. It is engaged in a program of keeping acreage out of production--acreage that could completely cover the World's protein deficiency were World economic and political conditions such as to make full use of our idle acres.

(Table II)

U. S. A. CROP LAND REQUIRED FOR LOW, MODERATE, AND LIBERAL
COST DIETS; AND NUMBER OF PERSONS SUPPORTED ON 355 M. ACRES.

<u>Diet</u>	<u>Crop Land Required</u>		<u>Number of People Supported on 355 M. Acres of Harvested Crops (1941 - 1945)</u>		<u>Food Energy in Diet From Livestock</u>	
	<u>Acres</u>	<u>%</u>	<u>Number</u>	<u>%</u>	<u>%</u>	<u>%</u>
Low Cost	2.12	100	203	100	30	100
Moderate Cost	2.57	121	167	82	36	120
Liberal Cost	3.15	148	137	67	44	147

Source : U. S. D. A. Tech. Bulletin 963, October 1948 : Efficient Use of Food Resources in the U. S. - R. P. Christensen

When we examine the crop land required for low, moderate, and liberal cost diets in the U. S., the wastefulness and costliness of livestock as a source of energy and protein stands out sharply. For a low cost, low income diet in which only 30% of food energy is derived from livestock we need only two acres of crop land per person. For a liberal cost, above average income diet with 44% of food energy from livestock we need three acres per person. Thus a diet containing more livestock products requires more land and a given acre supports fewer people. (See Table II and Chart II).

If we now examine how much protein an acre of land produces, we find a vast difference in productivity and therefore a comparable difference in the cost of a unit of protein from the animal and vegetable sources. An acre of land producing feed for cattle, hogs, poultry, and milk can provide a moderately active man with his protein requirements for less than 250 days (beef cattle, 77, hogs, 129, poultry, 185, milk, 236) whereas an acre of dry edible beans will take care of his protein needs for over 1100 days, split peas, 1785 days and edible soybeans over 2200 days, a ratio of 10 to 1 in favor of soybeans over beef. The productivity of grain acres lies between these extremes. (See Chart III).

This spread in protein productivity per acre must of course reflect itself in costs. A pound of protein derived from beef at retail costs about \$4.44. At the other extreme is soyflour for food at 11 cents per pound of protein, again a very high ratio in favor of soyflour over beef. The cost of protein from grain products lies between these extremes. (See Chart IV. These figures, it should be noted, overstate the spread between costs of protein from livestock and vegetable sources for no credit is given for by-products other than protein.)

Table III - Number of Days Protein Requirements (For moderately active man).

	from	
	1 - Acre	\$100 Farm and
	1941 - 45	Non-Farm Resources
	<u>yields</u>	<u>(1943-54)</u>
1. Beef cattle (all)	77	380
2. Hogs (Pork)	129	280
3. Poultry	190	380
4. Milk	236	490
5. Corn Flakes	354	380
6. Oats (meal)	395	960
7. Rye (flour, white)	435	1250
8. Wheat (whole, flour)	527	1210
9. Rice (white)	654	420
10. Rice (brown)	773	410
11. Corn (yellow) meal	772	1110
12. Wheat (flour, whole)	877	1450
13. Beans, dry edible	1116	1390
14. Peas, split	1785	1690
15. Soybeans, edible	2224	1880

Livestock Products from acre of feed crops.

U. S. D. A. Tech. Bull. 963 (1948) : Efficient Use of Food Resources in the U. S. R. P. Christensen.

With the highest incomes in the World, the U. S. consumer can afford to disregard the extravagant use of land for feed grains and livestock when protein requirements from vegetable sources could be had at so much lower cost, but this is not an invitation to low income countries to go and do likewise.

The central features of the U. S. farm production programs also do not make sense in relation to the World protein shortage. Between 1949 and 1965, in view of greatly increased yields per acre, the harvested acreage of 58 crops has been reduced from 342 millions to 259 millions, a net reduction of 83 million acres. Soybean acreage has been expanded 25 million acres from 10 in 1949 to 35 in 1965, leaving a net reduction of 58 million acres. Much of these idled acres are productive corn, wheat and cotton acres, and they could be used for the production of soybeans, if there were some way to dovetail domestic food production with World protein needs. (See Charts V and VI).

This, of course, is easier said than done. But dovetailing the agricultural productive capacity of the surplus producing countries with the immediate nutritional requirements of the developing countries is the obvious necessity in international food policies and there is a growing interest in this direction. Let me, therefore, conclude with a supposition. Suppose that an international food purchasing and distributing agency were now in existence; suppose it had international financial means adequate to say to American farmers - "Double your soybean acreage - we will pay you the lowered cost of production and processing, and we will distribute to the poor of the World who, having no or little purchasing power are not now and for many years are not likely to be part of the World's regular commercial markets."

And suppose further that our farm production programs could be reshaped in the next 2-3-4 years to meet this international demand for the product of our idle land. The World shortage of proteins would disappear immediately and so would the shortage of fat in terms of vegetable oil.

We are now close to producing a billion bushels of soybeans and could readily double it in short order. This act alone would take care of the entire shortage of protein and vegetable oil for all countries excluding Communist China and a large part of her deficit in these two categories as well. The upward trend in U. S. soybean acreage and production is bound to continue and so is the progress of our private and government laboratories in converting high protein oil seeds into palatable low cost additives to starchy foods, palatable beverages and other livestock product substitutes. The record of production and demand for high protein feed suggests that our soybean production will be doubled by 1975-1980. The present need for high protein food calls for doubling our soybean production much sooner.

There is growing realization that a firm U. S. policy to produce high protein food sources for use in underdeveloped countries would represent only half of a world policy toward that end. The other half would have to be encouragement to increase the production and processing of high protein food in the needy countries as well. There is no inconsistency here, for rising populations and economic development will provide the mouths and the markets for increased supplies, both from the U. S. and in the developing countries.

PER CAPITA INCOME and DAILY INTAKE of TOTAL and ANIMAL PROTEIN

GRAMS PER
CAPITA, PER DAY

(SELECTED COUNTRIES)

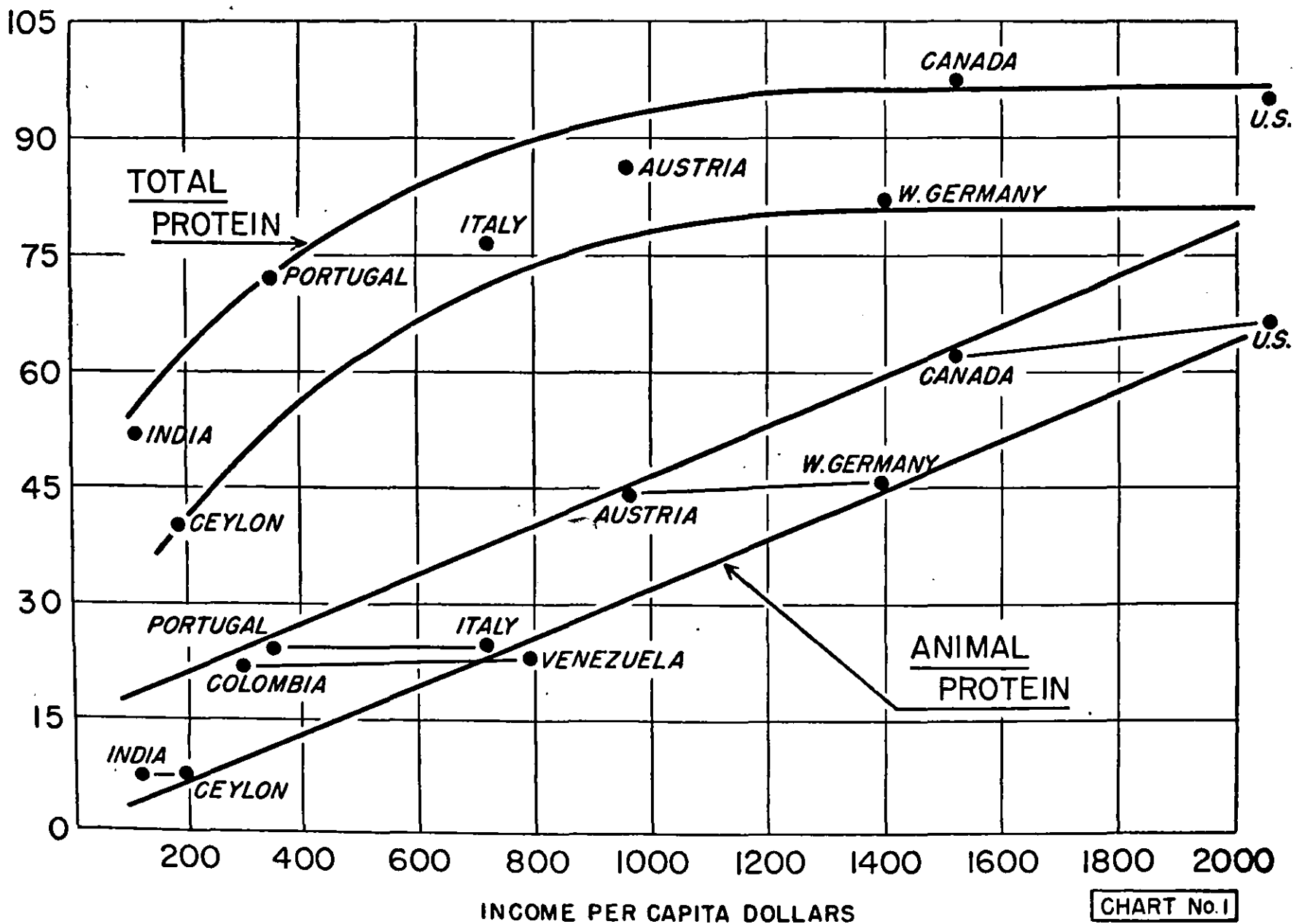


CHART No. 1

A Diet Containing More Livestock Products

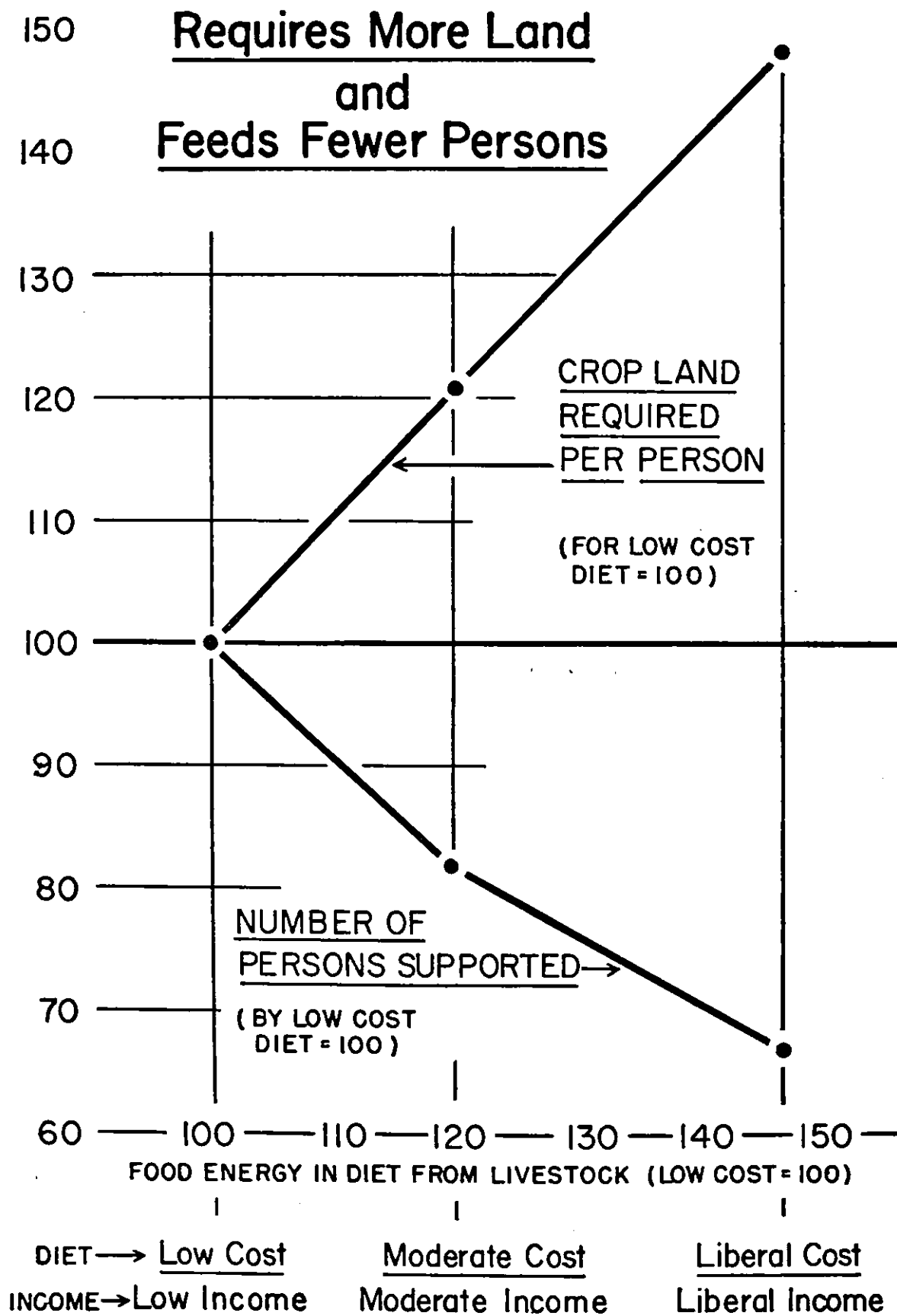
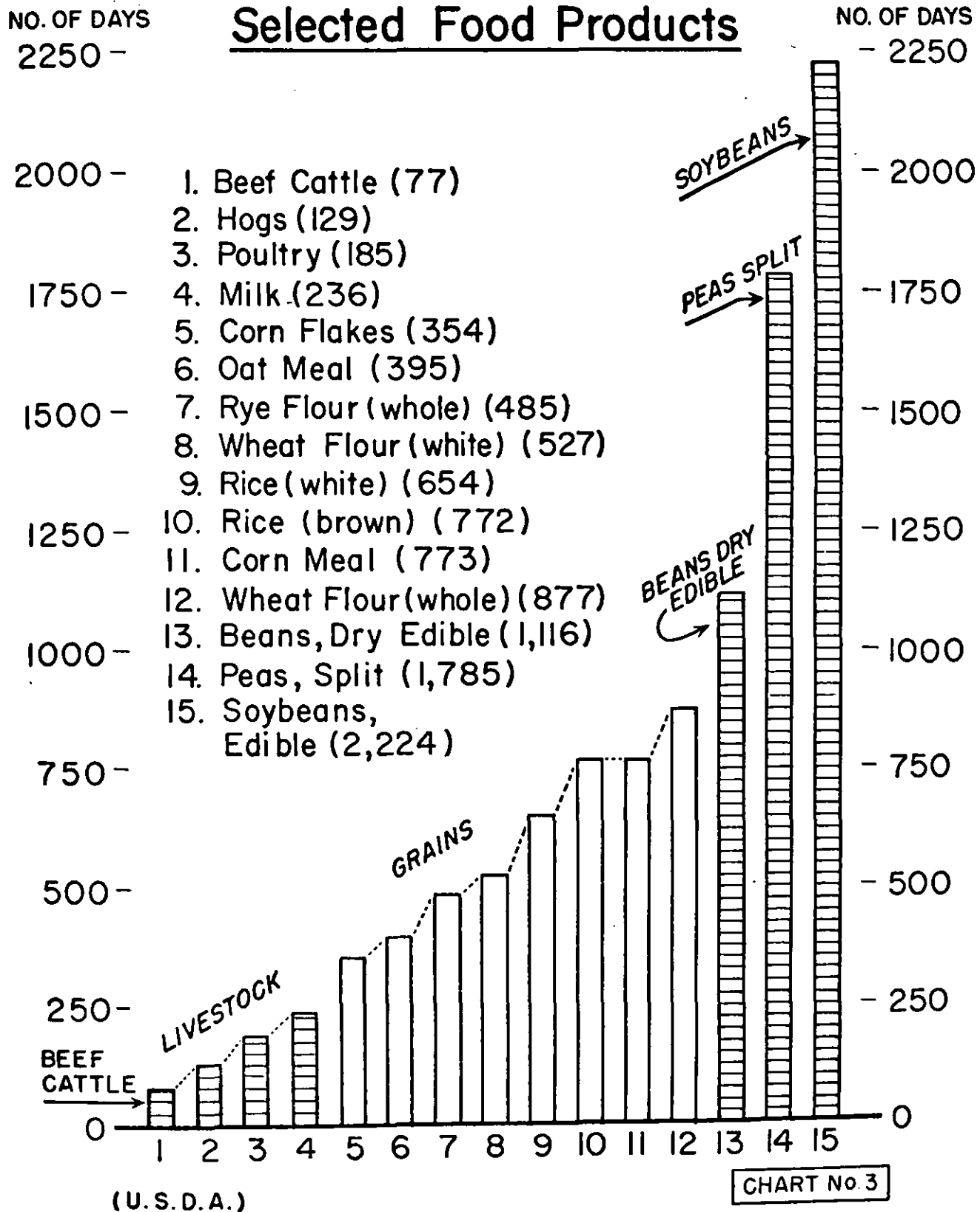


CHART No.2

Number of Days of Protein Requirements

(by a Moderately Active Man)

Produced by One Acre, Yielding



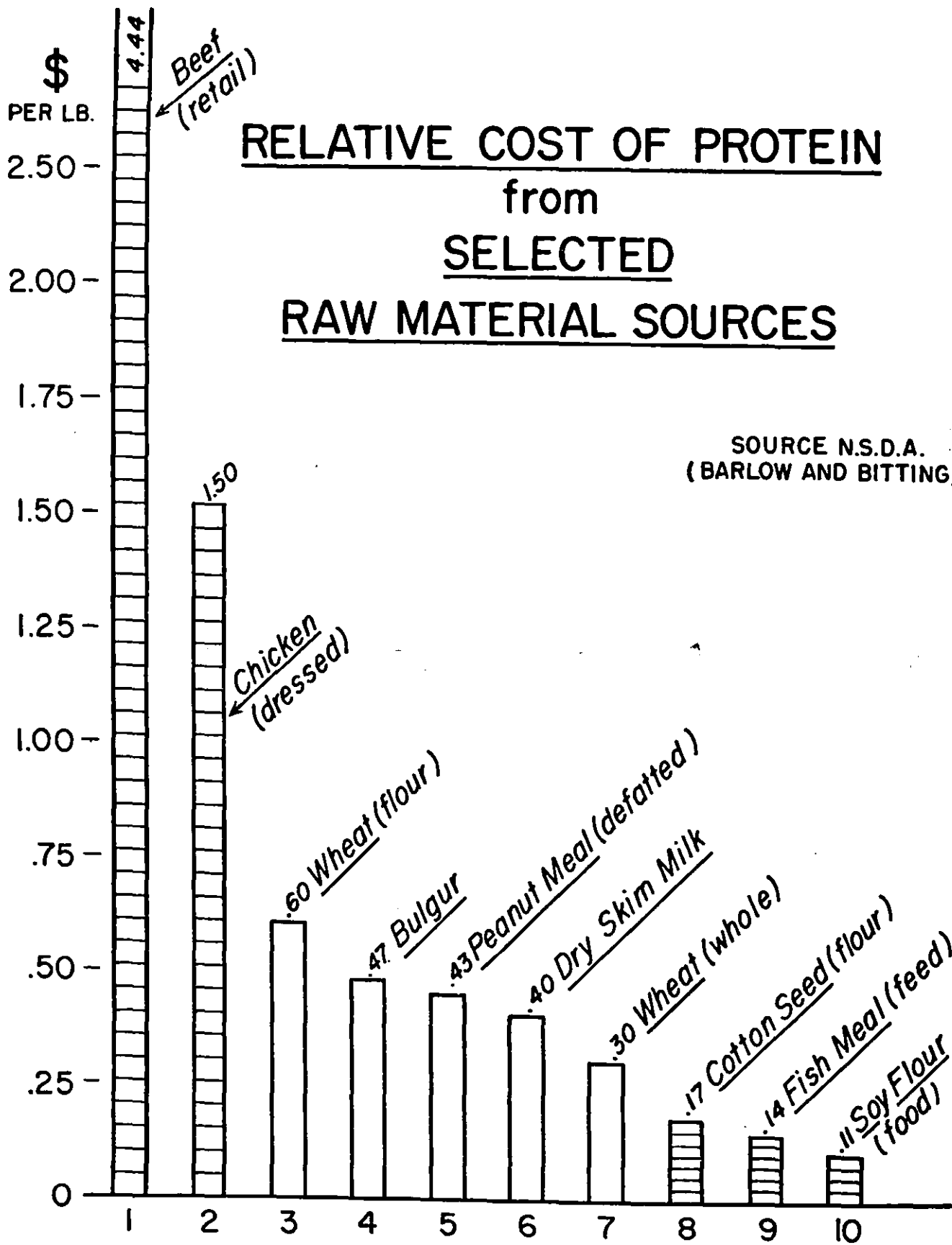
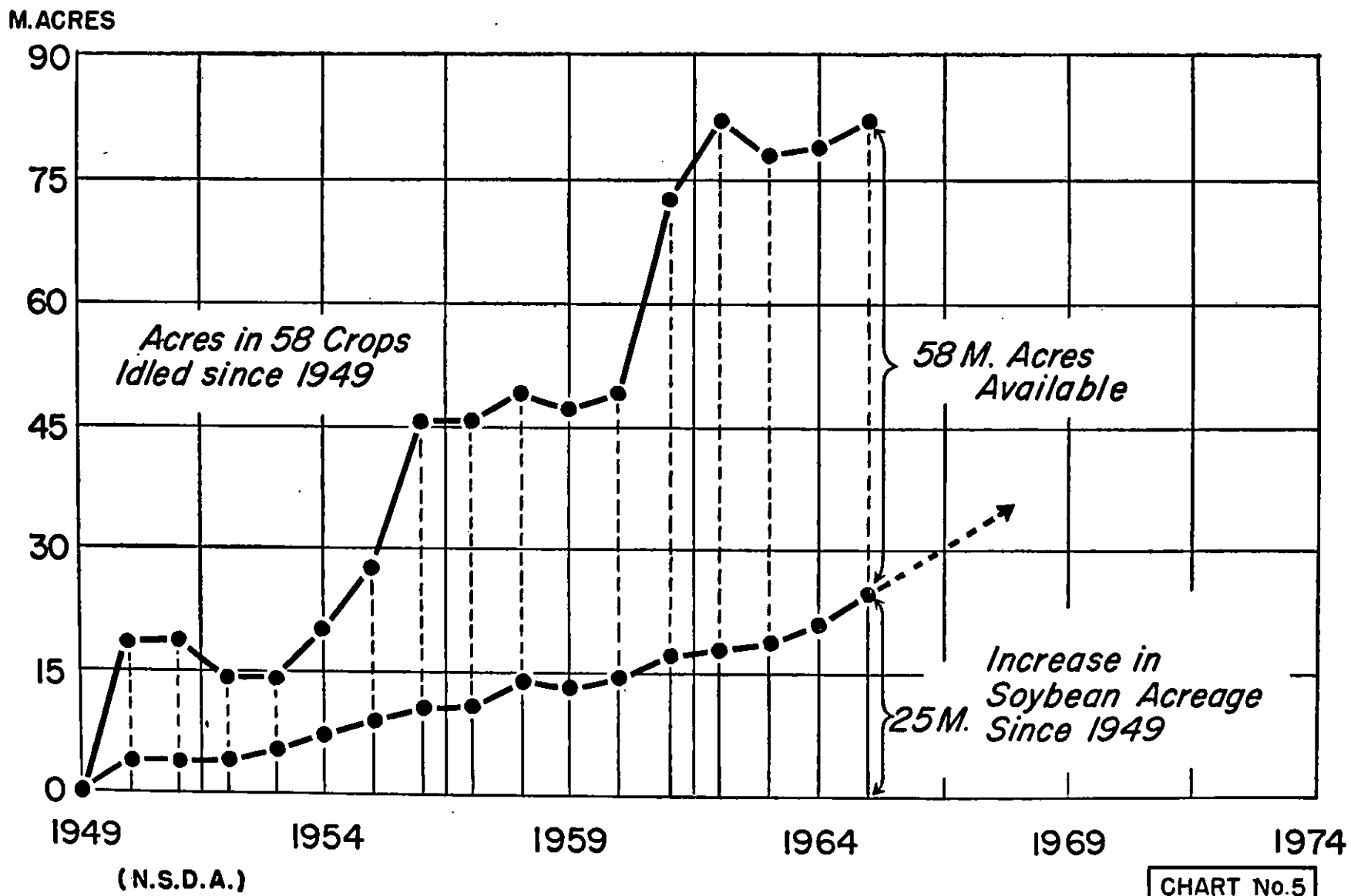


CHART No.4

U.S. - ACREAGE IDLED

58 Crops, and Increase in Soybean Acreage Since 1949



U.S. - ACREAGE HARVESTED 4 - Major Crops

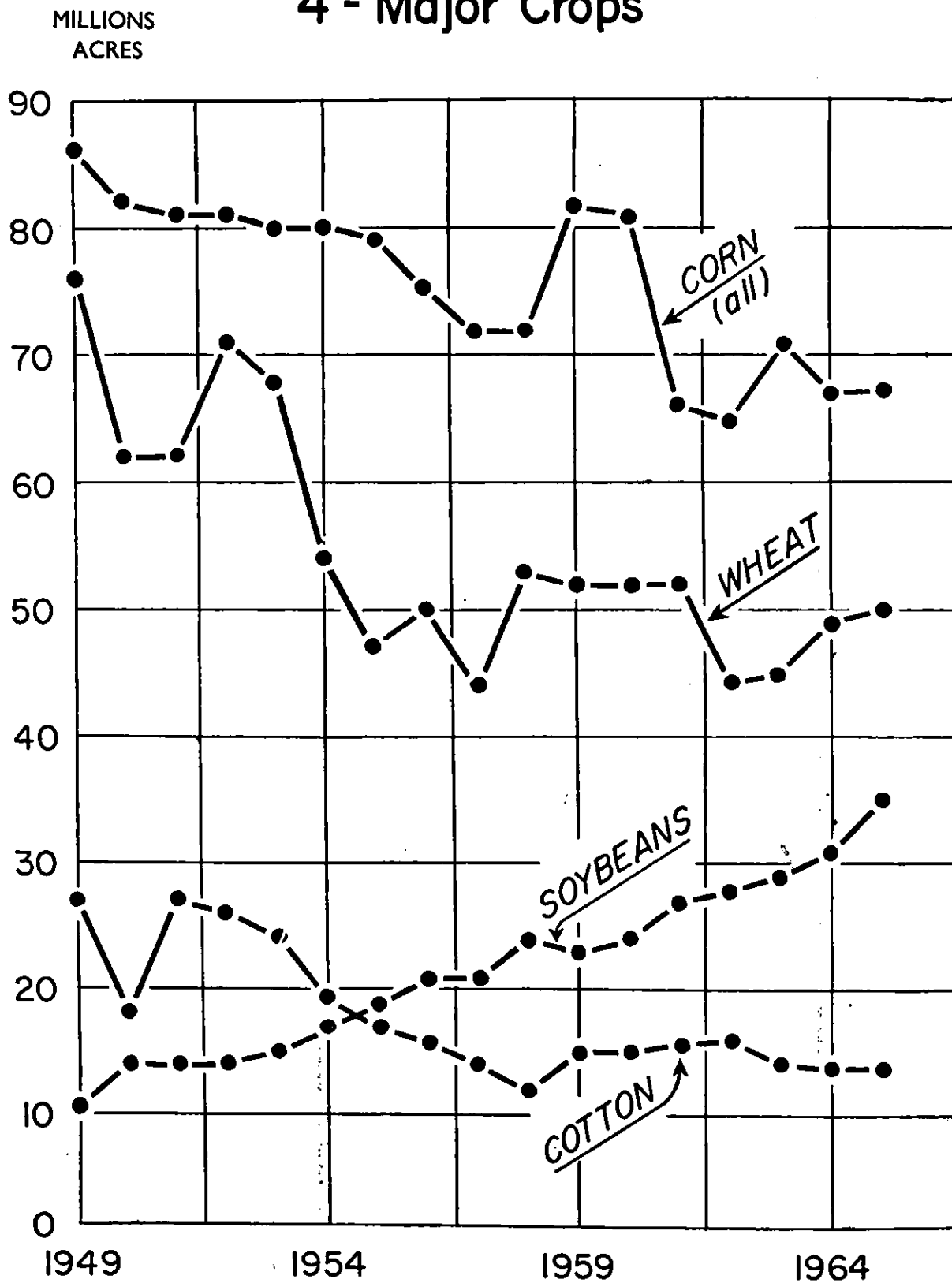


CHART No. 6