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HELEN C. FARNSWORTH

DETERMINANTS OF FRENCH GRAIN PRODUCTION, PAST AND PROSPECTIVE*

Grain policies of the European Economic Community (EEC) put emphasis on control of grain prices as a tool for achieving major agricultural economic goals. This raises important questions about the prospective effects of the Community's planned harmonization of agricultural prices on grain and livestock production in member countries. Both inside and outside of the Community, interest centers on France, the member with the lowest grain prices, the largest expanse of convertible pasture and unused farm land, and a past record of growing grain surpluses. How can French farmers be expected to respond to increases in EEC grain prices, to prospective improvements in the nation's agricultural structure, and to continuing technological advances of all sorts?

To answer these questions requires study of the role that prices have played in determining past trends and shifts in French agriculture and grain production. The purpose of the present study is to provide this empirical foundation and to suggest the general magnitude of its implications.

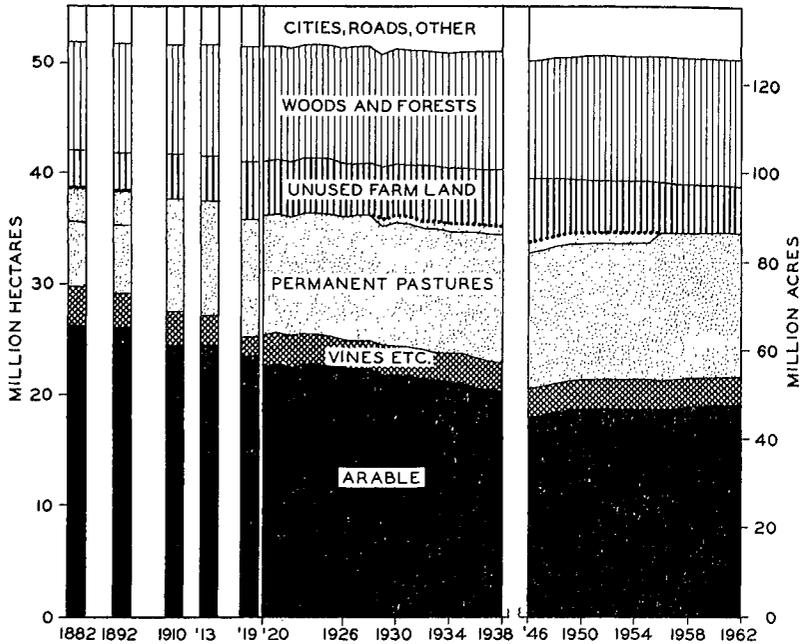
NATIONAL CHANGES IN LAND UTILIZATION SINCE 1882

Chart 1 shows the major changes in French patterns of land use since 1882. Despite recognized deficiencies in the data, the underlying trends are clear. As in most other western European countries (4, pp. 479-97; 5, pp. 61-134), farmers in France have used a declining amount of land for agriculture (including pasture and unused farm land); and until 1946 their "arable" land declined even more sharply.

In relation to the reported areas of 1882 supplemented by rough allowance for Alsace-Lorraine (then a part of Germany), the French statistics suggest declines by 1962 of some 4 per cent in the total agricultural land and as much as 27 per cent in arable, the latter including all rotation crops and fallow. If similar comparisons could be made with 1862, the declines would be larger still. Even if

* This study is a slightly modified portion of a forthcoming book on *French Grain and the Common Market*. I want to express my appreciation for the helpful suggestions made by colleagues and others who kindly read and commented on an earlier draft, including Karen Friedmann, M. K. Bennett, J. O. Coppock, W. O. Jones, P. E. O'Donnell, and R. E. Vickery. I am indebted also to the Office Statistique and Direction Générale de l'Agriculture of the European Economic Community, and to the Economic Research Service and Foreign Agricultural Service of the U.S. Department of Agriculture for making available to me useful reports and data. For all interpretations and conclusions in this study I am, of course, solely responsible.—H. C. F.

CHART 1-A.—USE OF TOTAL LAND AREA, 1882-1963*



* Data (here adjusted to include approximations for Alsace-Lorraine during 1882-1919) are from France, INSEE, *Annuaire statistique de la France: Retrospectif 1961*; and France, Ministère de l'Agriculture, *Statistique agricole 1962* and earlier issues, and *Cahiers mensuels de statistique agricole*, Supplement, December 1963.

Incomparabilities of various sorts exist in these data, partly due to changing definitions for the various categories. The larger area for permanent pastures indicated by the dotted line for 1882, 1892, and 1929-55 represents our rough attempt to adjust for the most distorting incomparabilities in the official figures.

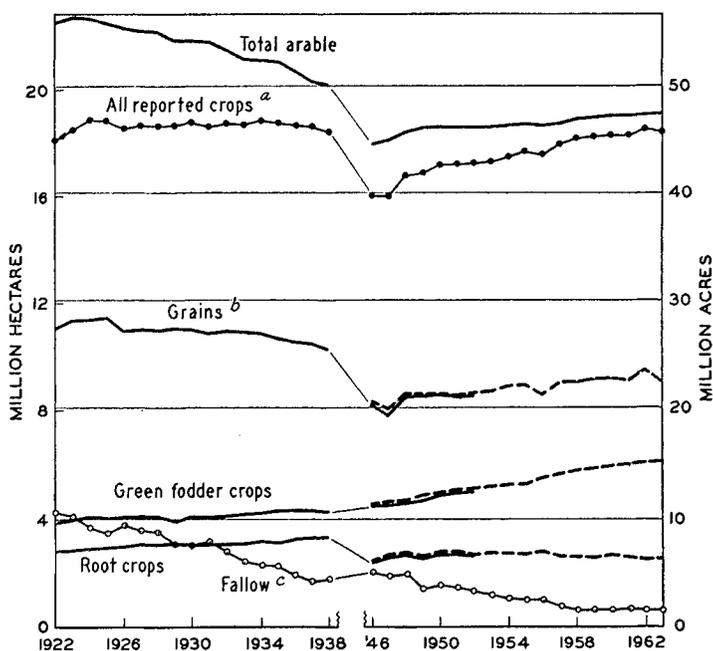
these figures exaggerate the true reduction, there can be no question that the decline was large, particularly so in arable land, that it persisted through World War II, and that it has since been arrested if not reversed.

For the present study, the long decline and recent stabilization and upturn in the arable area are of particular interest, since grain has continued to claim more arable land than any other crop. One of the first questions to be asked, therefore, is what the outlook is for the total arable area of France over the coming decade. Analysis of the factors responsible for past changes should help answer this question.

Chart 1-A shows that the land lost to arable farming during the six decades ending in 1946 went mainly into permanent pastures, including rough grazing. Smaller increases of around a million hectares each were officially reported for (1) woods and forests and (2) cities and other non-agricultural uses; and our adjusted figures suggest an increase of the same size or larger in "unused farm land."¹ The dotted line at the top of the pasture sector in Chart 1-A reflects an

¹ From time to time, the Central Statistical Office of France has grouped part of the pasture and idle land in different ways in the published statistics, making it impossible to obtain comparable historical series for "fallow" land, temporary pasture (both classified as "arable"), permanent pasture, rough grazing land, and idle farm land (the three latter categories classed as non-arable). In 1956

CHART I-B.—USE OF ARABLE LAND, 1922–1963*



* See note to Chart I-A.

^a Here approximated for 1922–38 as the sum of the areas of all officially reported arable crops; estimated for 1946–63 as the difference between the officially reported arable land and the area reported as “fallow.”

^b Includes buckwheat and all reported grains except rice (the latter too small to show on the chart prior to 1950).

^c Here approximated through 1938 as the difference between total arable land and the sum of the areas under all reported crops; data since 1946 are official estimates.

effort to adjust the earlier official figures for unused farm land and permanent grassland to levels more comparable with the data reported since 1956.

A number of writers have interpreted the decline in arable land in France up to the 1950's as evidence that French farm land was being used less intensively because of inadequate remuneration of French farmers. In further support of this view they have noted that the arable land itself showed a similar shift in crop patterns, the area under grains contracting while green fodder crops expanded. And significantly, too, they have pointed to the decline in employment in agriculture and forestry from almost 60 per cent of all employed males in 1862 to 45 per cent in the mid-nineties, to 40 per cent immediately after World War I, to 35–36 per cent in both 1926 and 1936, and to 27 and 21 per cent respectively in 1954 and 1962 (*12*, p. 86; *16*, n.p.).

Before such an interpretation can be accepted, however, we need to look more

a major reclassification of land use resulted in a *statistical* shift of roughly one million hectares from the “unused farm land” category and a similar shift of 200,000 hectares from the “rough grazing” category, compensated by statistical increase primarily of the area in good permanent pasture (“herbage”), with a minor net transfer to the small arable category “temporary pasture” (*12*, pp. 97, 110; *7*, pp. 69–71). In Chart I-A and Map 1 all permanent pasture and grazing land are shown combined as a single category, referred to as “permanent pastures”; whereas “temporary pastures” are included in the “green fodder” group.

closely at the character and location of the indicated changes in land use: Were they, in fact, changes in the direction of less intensive cultivation? Did they really imply a reduced total input of productive resources or simply changes in form?

Too often overlooked in discussions about declining arable land is the important role played by fallow.² One of the most noteworthy features of Chart 1-B (p. 227) is the sharp decline shown in dependence on fallow as a means of maintaining soil fertility. Although the figures for the interwar period (estimated by the writer in the absence of official statistics) may slightly exaggerate the overall decline in fallow that then occurred, there is little question that the general order of magnitude can be trusted. Summation of the officially reported areas for individual rotation crops indicates that the total land under arable crops remained essentially unchanged throughout the interwar period and that, after a sharp decline during World War II, it has now been restored almost to the prewar level. The reported decline of 3.6 million hectares in arable land between 1923 and 1963 thus mainly represented a release of fallow that went into more intensive agricultural use, with the reduction in essentially bare fallow offset by net increases in permanent pastures and forests. These facts run counter to the view that French cropping operations were significantly curtailed during the interwar period.

It is more difficult to determine whether the trends in crop patterns prior to and after World War II represented intensification or extensification of French agricultural production. In both periods there was persisting expansion of the area under green fodder crops and/or permanent pasture, with a net gain in the two combined (Chart 1). Between 1882 and 1939 each successive decade also brought decline in the grain area, whereas the land devoted to root crops (sugar beets, potatoes, forage roots) tended to increase. After World War II, on the other hand, the area under root crops drifted slightly downward from a 1948-50 average that was already below any interwar average; and the grain area expanded moderately without, however, ever rising as high as its lowest prewar level.

Any interpretation of these complex trends in land utilization in such simple contrasting categories as "intensive" *vs.* "extensive" would be naïve. The concept of different degrees of intensification, however, is a useful one, for which a rough measure has been proposed by J. Klatzmann, based on estimated gross value-products per hectare of the major cultures in France as a whole. Klatzmann's generalized "coefficients of intensity" for the principal French crops are as follows, with the average value-product per hectare from land in pasture taken as 1.0 (26, pp. 110-11).

Although based primarily on value-of-product estimates for a single year described by Klatzmann as "fairly normal" (26, pp. 23, 110-11), the general order of magnitude of value-of-product differences among the designated crops has

² Fallow is technically distinguishable from "unused farm land" (shown in Chart 1-A) in that the former supposedly applies only to land left idle for a single year, usually as part of a planned cropping pattern, whereas "unused farm land" is left uncropped and theoretically even ungrazed for many years. In French crop statistics these definitions have generally been accepted, but by no means always followed, and both types of idle land have at times been confused or combined with permanent pasture or rough grazing land (see footnote 1, p. 226; 12, pp. 97, 110; 26, pp. 378, 382).

Arable land uses: overall average	2.0
Cereals	1.5
Green fodder crops	1.5
Dry legumes	2.0
Root crops	4.0
Major fresh vegetables	8.0
Arable and non-arable pasture and grazing.....	0.6-1.3
Vineyards	5.0
Market garden fruits and vegetables.....	10.0

probably been sufficiently stable over the past four decades to justify the use of these coefficients in the present context.⁸ Cautiously interpreted, they can throw light on the role that altered crop patterns have played in bringing changes in the intensity of land use in France since the early 1920's; and they can also be employed to indicate roughly whether the crop pattern of one region is more or less intensive than that of another (small differences being regarded as insignificant). Very broadly, too, they may be interpreted as indicative of the relative differences in productive resources devoted to the different cultures on a national average basis.

Particularly pertinent for the present study is the implication of Klatzmann's coefficients that green fodder crops absorb roughly the same amount of resource inputs per hectare as grain and that the resource inputs for pasture and grazing range from 40 to almost 90 per cent of the amount utilized for grain, with the national average something like 67 per cent. These relationships suggest that the historical tendency to expand green fodder crops partly at the expense of the grain area cannot properly be interpreted as a trend toward less intensive utilization of French land, and that shifts from grain to pasture have probably often involved only moderate losses in intensity of land use. Although the economic significance of shifts to permanent pasture depends on the location and type of pasture or grazing involved and the associated intensity of livestock raising, it is reasonable to suppose that such shifts are made mainly where, and under conditions assuring that, net value products per hectare are most similar.

In the aggregate, therefore, the substantial changes in patterns of land use during 1922-38 appear to have moved French agriculture in the direction of greater intensity of land utilization. Among the striking features of the period

⁸ Changes over time in the relative order of magnitude of such values per hectare are likely to be moderate in a long established and well developed nation like France, where the farmers of all regions operate within the same general market structure. Although machinery has been substituted for labor and increasing use of fertilizer has favored some cultures more than others, and although there have been significant changes in the "real" prices of some products and not others, several compensating factors have tended to limit the degree of change that would seem likely to show up in new coefficients of intensity calculated (by Klatzmann's method) for representative years in the 1920's, 1930's, and late 1950's.

Among such compensating factors, two deserve special mention. First, trend changes in *price relationships* between any two competing types of farm products normally reflect similar changes in their *cost relationships*, which often correlate negatively with concurrent changes in relative *yields per hectare*, which tend to compensate for the changing relative prices in calculations of gross value-products per hectare. Second, for competing crops important as animal feed—e.g., grain, green fodder, and pasture—essentially constant feeding value relationships tend to keep their relative prices within a limited range, pushing additional resource inputs per hectare into the production of that particular type of feed that can be produced at the lowest relative cost compared with its nutrient value.

were reduction of the area devoted to fallow, expansion of permanent grassland, increase of green fodder crops and roots on former grain land, and negligible change in the total area of harvested arable crops.

During World War II French agriculture suffered a serious, if only temporary, setback. Some cropland went out of cultivation; considerably more was allowed to revert to fallow or was added to pasture or woodland; and the area under root crops was cut to a level even below that of the early 1920's. At the end of World War II, therefore, the national pattern of land use was far less intensive than any witnessed in the interwar period.

Subsequent changes, however, moved French crop patterns back toward and perhaps beyond the highest levels of intensity previously reached. Chart 1-B shows that by 1962 fallow was at a record low level; the arable land actually cropped was once again close to that of the late interwar years; plantings of green fodder crops were unprecedentedly large, more than offsetting the reduced though increasing area under grain; and the area devoted to fresh vegetables, fruits, and certain other crops that require most intensive cultivation (the crops least adequately reported in the official statistics) was probably larger than ever before. No less important, the enlarged area under permanent pastures was supplying feed for a cattle herd officially reported to be 30 per cent larger than in 1938.⁴

National changes in land use tell only part of the story. Indeed, without supplementary information on regional crop patterns and their changes, the national coefficients of intensity here used could well be misleading. Such needed regional information is presented in the following section. It tends to confirm and strengthen the view that past changes in land use have moved French agriculture ever farther in the direction of intensification. The influence on intensity of cultivation of the declining labor force and of associated changes in resource inputs is reserved for later discussion.

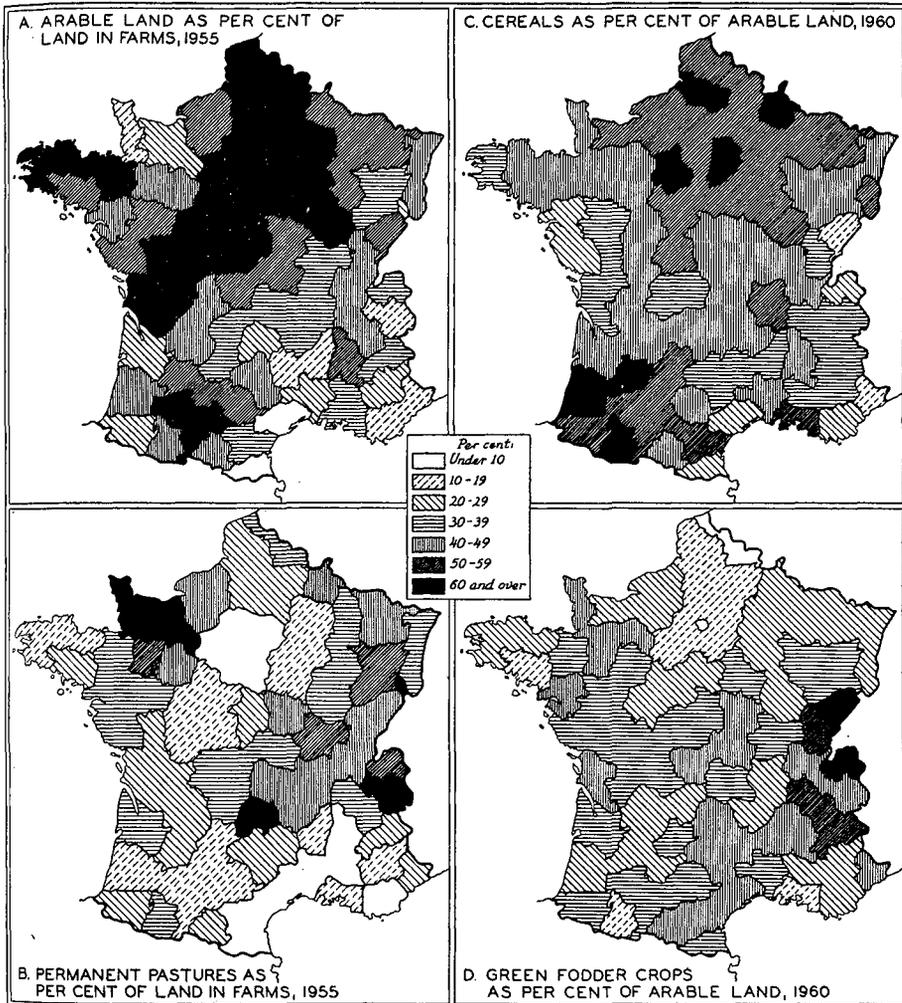
REGIONAL CHARACTERISTICS AND CHANGES IN LAND USE

The northern half of France, particularly the large northwest triangle set off by a line from Ardennes to the southern border of Charente (Gironde River), is the most productive area of the country for most crops and livestock products (see Map 3-B, p. 234, for location designations). This area has the largest proportion of arable land and the best pastures. It boasts the most advanced agriculture, the largest concentration of large farms, the greatest intensity of land cultivation, the largest number and proportion of good milk cows, and the highest milk yields per cow. Some of these facts are evident in Map 1, others in Map 2.

Only in the major vine growing districts on the shores of the Mediterranean, in the Rhône-Saône Valley, and along the Garonne-Gironde rivers are patterns of land use as intensive as in the arable farming districts around and north of the Paris Basin and in the Vendée region (Map 2-B). And only in the western Mediterranean area extending northward into the hills where pastures dominate are large farms as numerous (Map 2-A). In the vineyard areas, rotation crops

⁴ Although there is reason to believe that official reports exaggerate the magnitude of the increase, there is no question that it was large.

MAP 1.—MAJOR FEATURES OF LAND UTILIZATION IN FRANCE, 1955 AND 1960*

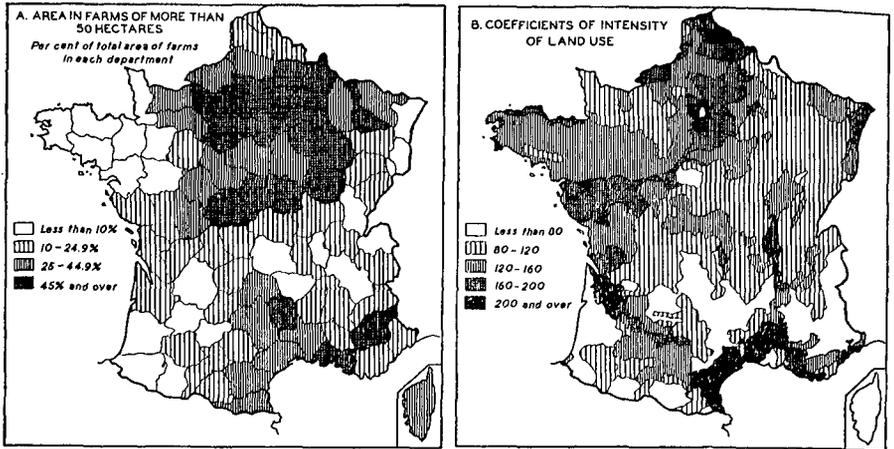


* Data for Maps A and B are from France, INSEE, *Annuaire statistique de la France*, 1957; for Maps C and D from France, Ministère de l'Agriculture, *Statistique agricole 1960*, pp. 26-27.

have great difficulty competing; and the bulk of the grains and fodder grown are produced to serve the needs of the grape growers and their animals. Grains have long been unimportant in these areas, and have declined further over time. It seems unlikely that the area devoted to them will expand significantly in the near future, except as hybrid maize may offer opportunities for higher net returns.

North of the Mediterranean vineyard area lies the huge Massif Central—the old worn-down central mountains that provide extensive pasture (including rough grazing) for a substantial part of the nation's cattle and sheep. In this area and also in the Alpine and Jura mountains of the east and in the Pyrenees highlands on the southwest border, intensive agriculture is practically non-existent except in small local valleys (32, pp. 47-52). Map 2-B shows that these

MAP 2.—REGIONAL DISTRIBUTION OF LARGE FARMS, 1955-56, AND KLATZMANN'S COEFFICIENTS OF INTENSITY OF LAND USE*



* Map A corresponds with the map shown in D. R. Bergmann, "L'Exploitation agricole," *Economie agricole française: Bulletin de la Société Française d'Economie Rurale* (Paris), Nos. 39-40, January-June, 1959, p. 72. Map B is a slightly modified representation of one published by Klatzmann (26, p. 115).

mountain areas, together with the heavily forested portions of the southwest departments of Gironde and Landes, are the least intensively cultivated in France. Neither wheat nor feed grain is produced on a substantial scale, though a sizable fraction of France's small rye area centers in the Massif Central, and maize has recently extended on the lower slopes of the western Pyrenees (Map 3). Outside of the wooded areas, natural grassland and green fodder crops dominate the scenery, with cattle and sheep raising the principal occupation.

In the highland areas the natural pastures show scant improvement over earlier decades. The varieties of grass grown remain essentially unchanged; little fertilizer is used; and hay-making practices are backward. Irregular rainfall and associated drought often cut grass and fodder yields sharply in the summer, and severe winters necessitate indoor feeding of cattle during four or more of the coldest months (33, pp. 71-85). With feed supplies both low and uncertain, cows in these areas are often underfed, and the calves are usually sold for slaughter at an early age, providing a major source of veal for urban markets. Because of the unfavorable conditions of topography, climate, and soil in the Massif Central and other highland areas, a large percentage of the farms—in most sections 45 per cent or more—have been left in the hands of tradition-tied elderly farmers. Operating with the aid of unpaid family help, a minimum amount of hired seasonal labor (14), and small cash reserves, these farmers have lagged far behind the farmers of northern France in adopting improved methods and techniques.

Historically, grain—particularly wheat, rye, and in some places maize—was once much more important in the highland areas; and the area planted to arable crops was much larger (26, pp. 351-57, 380-91). During and after both World Wars, however, there was a marked exodus of population from these disadvantaged highlands as opportunities for employment increased in other parts of the

nation. Many small farms previously operated on a subsistence basis were then sold or abandoned; and grain areas were turned into pasture or left unused except for supplementary rough grazing. The possibility of reversing this historical process through official promotion of land consolidation and improvement, farm advisory services, and better credit facilities has received much attention from the French government in recent years. Even so, the natural features of the highland areas in southern and eastern France appear much more promising for well-managed pasture, green fodder crops, and increased livestock production than for grain except as high grain prices and new farm machinery and techniques strengthen the competition of maize, sorghum, and wheat for the flatter land in the narrow valleys and foothills.

On the plains north of the Massif Central, on those west and southwest of Brittany, and most clearly in Normandy and Lorraine, considerably better large-scale pastures exist, often in combination with arable farming. In 1954 an OEEC Mission observed that modern grazing techniques had only recently been introduced in Normandy and Lorraine, and that in other major pasture areas of France, grassland management practices remained backward, with fertilizer use universally too low. With respect to the northern half of the nation, the Mission stated that although the soil was generally excellent and the production of arable crops of an "exceedingly high order," the level of grassland production was "not nearly so good." Expressing the belief that a large increase in feed output could be obtained at reduced cost by greater integration of grassland and arable farming, the Mission concluded (33, p. 83):

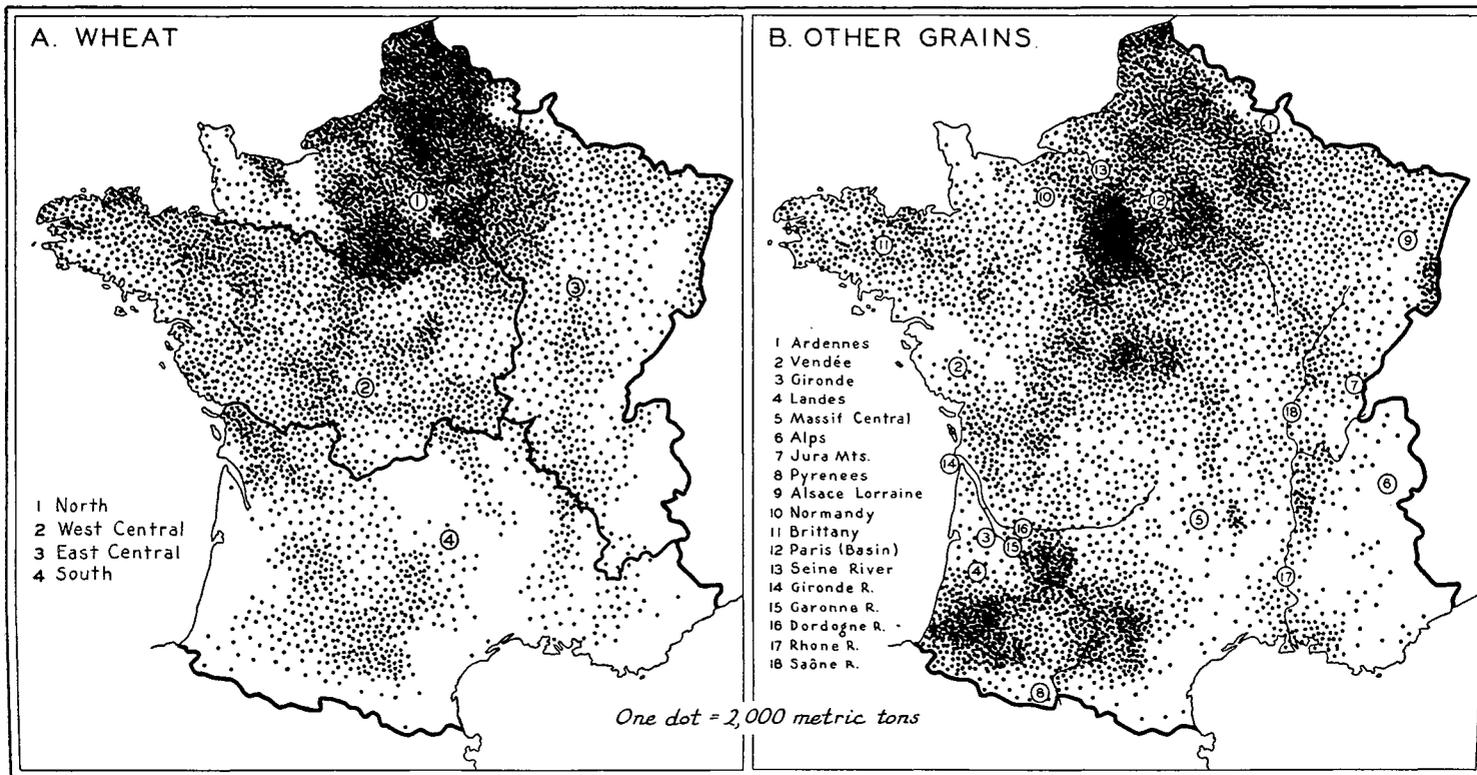
. . . In the opinion of the Mission, adequate fertilising alone would raise the average productivity of grassland by 50 per cent. If this were accompanied by renovation, ploughing and re-seeding, increases of the order of 100 per cent would be quite possible. Such improvements in grass production would mean not only an adequate supply of low-cost cattle feed in both summer and winter, but several million ha. of grassland could be released for growing wheat, maize, and other crops.

This significant 1954 appraisal of future crop potentialities left unresolved equally important questions about the speed with which such improvements could be introduced in a country as tied to traditional farming practices as France. It is particularly interesting, therefore, to look at the nature and magnitude of the area changes officially reported to have taken place since 1954. Because of official redefinition of "pasture" and other land-use categories in 1956, comparable statistics on regional changes in pastureland are currently available only for 1956-62. These are shown for the first and last years of the period in Table 1.

The reported changes are indeed noteworthy, both for their consistency and magnitude and also because they suggest a partial reversal of long persisting earlier trends in French farming patterns.⁵ Like earlier trends in French land-use patterns, those of 1956-62 were reflected in some degree in almost every sizable region. In all but one of the eleven regions represented the areas under grain and green fodder crops either increased or remained essentially the same between

⁵ Earlier regional trends are shown for four major subdivisions of France in Appendix Table II and in more detail for selected years in maps presented in sources 3, 13, 21, 23, 26.

MAP 3.—GEOGRAPHICAL DISTRIBUTION OF THE PRODUCTION OF WHEAT AND OTHER GRAINS IN FRANCE, 1960*



* Data from France, Ministère de l'Agriculture, *Statistique agricole 1960*.

TABLE 1.—REGIONAL DISTRIBUTION OF PERMANENT PASTURE, GREEN FODDER, GRAIN, AND CATTLE AND HORSES IN FRANCE, 1956 AND 1962*
(Million hectares and million head except as indicated)

Region	Pasture ^a		Green fodder ^a		Grain		Per cent pasture, 1962 ^b
	1956	1962	1956	1962	1956	1962	
MAJOR PASTURE REGIONS							
Total	7.38	7.24	1.65	1.80	2.06	2.16	65
Normandy	1.48	1.44	.23	.24	.43	.45	68
Lorraine .....	.66	.68	.15	.16	.32	.32	60
Jura and North Alps ^c	1.79	1.76	.60	.65	.52	.57	60
Southeast ^d	1.59	1.52	.29	.29	.30	.34	71
Massif Central ^e	1.86	1.84	.38	.46	.49	.48	66
ARABLE FARMING REGIONS							
Total	5.95	5.83	3.93	4.20	6.54	7.11	34
North ex-Normandy ^f .....	.74	.75	.50	.43	1.66	1.77	25
Northeast ex-Lorraine ^g.....	.78	.80	.33	.37	.71	.78	41
West Central							
Brittany .....	.52	.50	.34	.44	.67	.63	32
Other West ^h	1.24	1.18	.87	.91	.80	.89	40
Central ⁱ	1.21	1.22	1.02	1.09	1.41	1.49	32
Southwest ^j	1.46	1.38	.87	.96	1.29	1.55	35
ALL FRANCE							
Total	13.33	13.07	5.58	6.00	8.60	9.27	46

Region	Change in area 1956 to 1962			Number of cattle		Number of horses	
	Pasture ^a	Green fodder ^a	Grain	1956	1962	1956	1962
MAJOR PASTURE REGIONS							
Total	-.14	+.15	+.10	6.47	7.41	.62	.42
Normandy	-.04	+.01	+.02	2.15	2.60	.18	.11
Lorraine	+.02	+.01	+.00	.69	.86	.09	.04
Jura and North Alps ^c	-.03	+.05	+.05	1.75	1.97	.18	.14
Southeast ^d	-.07	+.00	+.04	.25	.26	.11	.08
Massif Central ^e	-.02	+.08	-.01	1.63	1.72	.05	.05
ARABLE FARMING REGIONS							
Total	-.12	+.27	+.57	11.23	12.86	1.44	1.10
North ex-Normandy ^f	+.01	-.07	+.11	1.71	2.08	.28	.19
Northeast ex-Lorraine ^g	+.02	+.04	+.07	1.03	1.31	.16	.09
West Central							
Brittany	-.02	+.10	-.04	1.78	1.90	.30	.24
Other West ^h	-.06	+.04	+.09	2.42	2.84	.32	.27
Central ⁱ	+.01	+.07	+.08	2.02	2.28	.24	.19
Southwest ^j	-.08	+.09	+.26	2.27	2.45	.14	.11
ALL FRANCE							
Total	-.26	+.42	+.67	17.69	20.27	2.06	1.53

* Departmental data from France, Ministère de l'Agriculture, *Statistique agricole 1956* and *ibid.* 1962. The geographical position of most of the designated regions are roughly indicated on Map 3, p. 234; the departments included are listed in footnotes ^{c-j}. "Major pasture areas" are here distinguished from "arable farming areas" on the basis of the percentage relationship between the hectareage under pasture and the hectareage under the major arable crops—green fodder and grain (see last column of top bank of the table).

^a "Pasture" includes all types of permanent and semi-permanent grassland. Temporary pastures, classified officially as arable land, are included under "green fodder."

^b Pasture as per cent of total pasture, green fodder, and grain.

^c Jura, Doubs, Côte-d'Or, Saône-et-Loire, Ain, Isère, Rhône, Savoie, Haute-Savoie, Hautes-Alpes.

^d Ardèche, Drôme, Aude, Gard, Hérault, Pyrénées-Orientales, Basses-Alpes, Alpes-Maritimes, Bouches-du-Rhône, Corse, Var, Vaucluse.

^e Aveyron, Cantal, Haute-Loire, Puy-de-Dôme, Loire, Corrèze, Lot, Lozère.

^f Nord, Pas-de-Calais, Aisne, Oise, Somme, Seine, Seine-et-Marne, Seinc-et-Oise, Eure-et-Loire.

^g Ardennes, Aube, Marne, Haute-Marne, Bas-Rhin, Haut-Rhin, Haute-Saône, Territoire de Belfort.

^h Loire-Atlantique, Maine-et-Loire, Mayenne, Sarthe, Vendée, Deux-Sèvres, Vienne.

ⁱ Cher, Indre, Indre-et-Loire, Loir-et-Cher, Loiret, Creuse, Haute-Vienne, Nièvre, Yonne, Allier.

^j Charente, Charente-Maritime, Dordogne, Gironde, Landes, Lot-et-Garonne, Basses-Pyrénées, Ariège, Haute-Garonne, Gers, Hautes-Pyrénées, Tarn-et-Garonne, Tarn.

1956 and 1962, and everywhere permanent pasture contracted or increased very slightly. This meant a continuation of the earlier trend toward increasing cultivation of green fodder crops, but a widespread reversal of earlier trends for grain and pasture.

One of the most interesting features of Table 1 is the contrast between changes in the major pasture regions and the arable farming regions. Although in both, permanent pasture yielded land to green fodder crops and grain, the percentage increase for green fodder was appreciably larger in the grassland areas than in the arable farming regions, whereas the percentage expansion of grain was much larger in the areas where arable farming—notably grain—had previously dominated.

It thus appears that although the land-use adjustments of 1956–62 represented a reversal of prewar trends that had forced grain areas down and permanent pastures up, the same basic regional patterns and relative regional tendencies remained. *As in earlier years the adjustments tended to increase the degree of regional crop specialization, bringing relatively greater concentration of grain growing in the major grain regions and greater concentration of green fodder (including temporary pasture) where grass had long had a relative economic advantage.* When grain prices and general economic conditions caused grain areas to contract, they tended to contract least in the high-yielding “bread basket” of the North and in the southwest “maize belt”; when economic incentives favored grain, the expansion was relatively greatest in those regions.

Considered alone, the changes in permanent pasture during 1956–62 might appear to run counter to the specialization “principle.” Although the long earlier encroachment of natural pasture on arable land had apparently been greatest in the major pasture regions, the contraction of permanent pasture in 1956–62 was not, as might have been expected, least marked in those regions. Indeed, on the average, such contraction was actually greater there, both absolutely and relatively. What appears more significant, however, is that the major pasture regions, like the arable farming regions, showed a strong tendency to substitute green fodder (temporary arable pasture in particular) for permanent grassland during 1956–62, thus providing more grass per hectare. This land-use shift, therefore, appears significant as a step in the direction of overall improvement and intensification of grass and fodder cultivation.

The final test of such improvement lies in evidence of increase in numbers and quality of the livestock fed. While the precise numbers cannot be trusted, cattle holdings obviously increased over the six-year period considerably more than horse numbers declined. Moreover, according to official figures, the combined net increase, shared by all regions except the Southeast, was slightly larger in percentage terms in the pasture regions as a group than in regions where arable farming predominated.

There is evidence, too, that the quality of the French cattle herd was substantially improved. The largest increases in cattle holdings during 1956–62 occurred in the best natural pasture areas and highest yielding crop areas of the country, where the cattle herd consists mainly of milk cows that are among the best in France (19, pp. lxxix, 297–305). It is in those northern areas that the greatest progress has recently been made in improving the milk-yielding quality of the

herds; and in the same areas improvements in grassland and green fodder management have been greatest. Moreover, even in the southern highlands and the West Central and Southwest regions, where less attention is given to milk production and the dual-purpose cow is more common, there is evidence of an increasing tendency to upgrade the quality of many dairy herds.

In spite of the substantial progress made in the grassland-fodder-livestock economy of France in the postwar period, however, the gap between current practice and economically feasible improvement remains large, especially by comparison with countries to the north and northeast. One indicator is the average annual yield of milk per milking cow, reported as follows for France and neighboring countries in 1961 (11, p. 220):

Country	Annual yield per cow (liters)
France ^a	2,360
Western Germany	3,430
Belgium	3,810
Netherlands	4,220
Denmark	3,710
Switzerland	3,250
Italy	1,940
United Kingdom	2,990

^a Includes milk sucked by young animals.

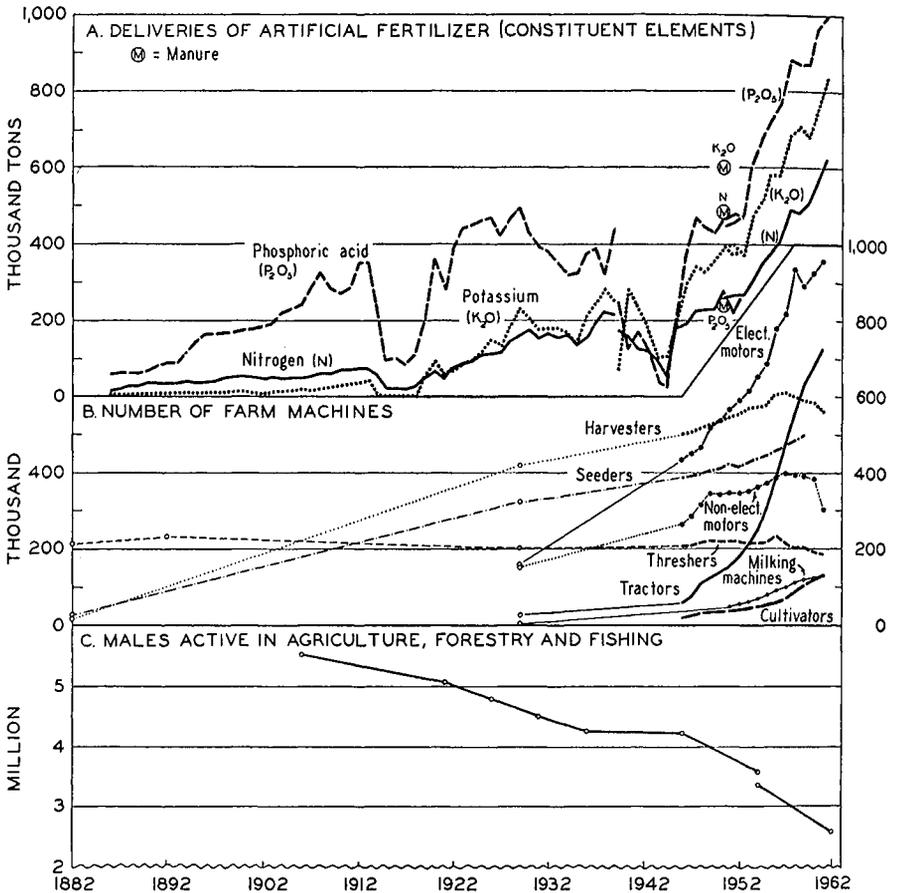
Although the climate of southern France and the proportionally large number of cattle located there militate against high milk yields, the room for improvement over present levels is large. Indeed, even in departments north of the Paris Basin, where milk yields are among the highest in France, they do not materially exceed 3,000 liters. Further substantial increase can be expected only as a result of more scientific breeding of cattle on the one hand and better feeding on the other. The land utilization trends shown in Table 1, if continued, should contribute to such improved feeding; but much is likely to depend on how intensively the land is cultivated. Some of the evidence presented in the following section provides additional perspective on this problem.

INPUTS OF FERTILIZER, MACHINERY, AND LABOR IN FRENCH AGRICULTURE

Changes since 1882 in two major forms of capital investment in French agriculture and in the number of male workers engaged in farming, fishing, and forestry appear in Chart 2. The most remarkable increases in both fertilizers and farm machinery have come since the end of World War II. Yet the earlier additions also were significant in their day, representing substantial expansion in the use of artificial fertilizers, mechanical harvesters, seeders, and electric motors.

At the end of the 1930's at least twice as much nitrogen and potassium was used in the form of artificial fertilizers as at the beginning of the 1920's; and a slight increase had been recorded for phosphoric acid (P_2O_5). By the early 1960's the phosphoric acid level of the late prewar period had more than doubled, and the nitrogen and potassium levels tripled. The absolute magnitudes involved were large. Until about 1950 French agriculture had depended more heavily on

CHART 2.—USE OF FERTILIZERS, MACHINERY, AND MALE LABOR IN FRENCH AGRICULTURE, 1882-1962*



* Data mainly from France, INSEE, *Annuaire statistique de la France: Retrospectif 1961*, pp. 86 and 99, and *ibid.*, 1962, p. 91, except as follows: for fertilizers, overlapping series beginning 1950/51 from EEC, *Statistique agricole*, 1962, No. 4, pp. 86, 90, 93; for farm machinery, figures for 1882 (presumably official) from Michel Augé-Laribé, *L'Évolution de la France agricole* (Paris 1912), p. 57; and for males active in agriculture in 1954 and 1962 (percentages) from France, Ministère de l'Agriculture, *Cahiers mensuels de statistique agricole*, June 1963.

animal manure (represented in the chart by a circled M)⁶ than on artificial fertilizers for nitrogen and potassium, but the remarkable subsequent increase in artificial fertilizers gradually reversed this relationship.

The sharply expanded postwar use of chemical fertilizers was due to several factors, including rapid growth of the European chemical industry, associated decline in the "real" prices of nitrogen and other fertilizer nutrients (Chart 4, p.

⁶ The OEEC estimate of nutrients supplied by manure was specifically designed to take account of existing farm practices that influenced their preservation and utilization. Since French practices were notably wasteful of liquid manure, no allowance for this type of manure is included in the estimate for France (31, pp. 14-15, 22-23).

248),⁷ spread of knowledge about the higher yields to be expected from scientific use of fertilizers (particularly in combination with better seed and better farm practices), and high government price supports for major agricultural products. Had agricultural prices been lower, substantial increase in fertilizer use would still have been economically warranted—perhaps in many areas about as much increase as actually occurred. But in the northern departments with the highest yields, where scientific arable farming had already made large strides and fertilizer (especially nitrogen) applications per hectare of agricultural land were heavier than in any other area (19, p. xxxvii; 6, pp. 65–69), the relationship between agricultural prices, fertilizer prices, and the quantities of fertilizer used were much closer and more important.

For agricultural machinery a postwar technical revolution brought a ten-fold increase in the number of tractors and a five-fold increase in electric motors. The quality of the farm machinery was simultaneously improved; and automobiles and trucks became increasingly important. The new machinery and transport facilities greatly reduced the need for farm labor, particularly in the production of crops, and made farm living conditions more attractive. It also permitted better and more timely preparation of seed beds and faster harvesting of ripened crops, thus increasing yields per hectare and reducing losses in fields and in storage. Such net gains in effective output were of considerable significance though of smaller magnitude than those attributable to increased use of fertilizers.

Although less spectacular and less quantifiable than investments in fertilizers and farm machinery, expenditures on the development and utilization of improved varieties of seed have contributed much to postwar advances in crop yields per hectare. For many decades the most progressive French farmers had saved their own best grain or purchased supposedly better for seed use. Yet on the eve of World War I, when Augé-Laribé wrote on the “evolution of French agriculture” (1), he made no reference to the contribution of seed improvement to French crop production. Since he gave considerable attention to many other factors, including fertilizers, farm machinery, irrigation, increased specialization, land consolidation, transport, better farm practices, etc., we may assume that up to that time the potentialities of seed improvement had not yet been substantially exploited or even adequately recognized. Moreover, although the interwar period witnessed significant improvements in seed quality (particularly of wheat), the prevailing economic and scientific atmosphere did not encourage heavy research and marketing expenditures for this purpose.

This situation was greatly changed during and after World War II. In 1941 *Secobrah*, an organization of brewers, dealers, and producers, actively began to encourage the development and use of improved strains of barley seed, especially those promising for use in brewing (17). Still more important was French legislation, which in 1952 provided for subsidized distribution of high quality seed of recognized varieties of all grains. Over the following decade distribution of improved seed was sharply expanded as farmers became more and more aware of

⁷ In France postwar reduction in “real” prices of fertilizer apparently came partly through removal of the heavy tax (17–18 per cent of the original value) reportedly effective as late as 1949 (27, p. 617, citing 29, p. 25).

the higher yields to be expected from combining good seed with heavier application of fertilizers and pesticides, and as they found it easy to take advantage of the government's annually renewed offer to exchange seed grain for deliveries of grain of standard quality. Under these conditions, the use of hybrid maize seed, in particular, was rapidly expanded. First introduced after World War II, it was planted on more than 50 per cent of the sharply enlarged maize area of 1959 (22); by 1963 the percentage was undoubtedly much higher.

These and other forms of intensified capital investment in agriculture, together with better farming practices, made it possible for French farmers to maintain and even increase their total output during 1900-63 with a declining labor force on a somewhat contracting cropped area. Chart 2 shows that by 1962 there were less than half as many male workers in agriculture as six decades earlier. Even these figures understate the decline in the amount of agricultural labor utilized, since they take no account of the trend toward part-time employment of farmers in non-farm work, or of the sharp decline in number of hours per day each active person spent on farm work, or of the large decline in the farm labor contributed by women and children, whose help on family farms was important in the earlier decades.

Both absolutely and relatively, the greatest decline in agricultural labor has taken place since the end of World War II. This has been made possible by the unprecedented increase in the introduction and improvement of agricultural machinery and in associated advances in farm practices and general transport. All of this, combined with the utilization of more and better fertilizers, seems likely to be judged in historical perspective as the early stages of a remarkable agricultural revolution in France.

According to estimates of the Institut National de la Statistique et des Etudes Economiques (INSEE) the total number of man-hours directly devoted to French agriculture declined at an average annual rate of 2.5 per cent during 1949-61,⁸ and productivity per hour of work increased by roughly 4 per cent annually or, counting growth of animal numbers, by something like 6.5 per cent (36, pp. 438-39; 35, p. 129, n. 14). Even the lower of these two rates exceeds the corresponding increase of 3.4 per cent a year estimated for the non-agricultural sector of the national economy. As Vincent has pointed out (36, p. 439—free translation):

This is, without doubt, the first time in history that [French] agriculture progressed so rapidly over a period of twelve consecutive years. And it is also the first time that over so long a period its advance in productivity surpassed that of the non-agricultural sector of the economy and probably that of industry itself.

For present purposes this extraordinary agricultural progress needs little further explanation. The forces responsible for it have not operated in France alone, but have led to striking changes in agricultural practices and fertilizer use at different times and different rates over the past few decades in practically all highly

⁸ This approximation, made before the most recent census estimate of agricultural labor became available, was based on what then appeared to be a liberal allowance for annual migration out of agriculture (specifically put at 120,000). This figure was not only supported but actually exceeded by the census estimate.

developed countries. As Vincent noted, France had long lagged behind its northern European neighbors in introducing agricultural improvements (36, p. 439). The possibilities of agricultural progress had existed, but neither the French government nor most French farmers showed much interest in effecting needed changes until after the end of World War II.⁹ Then farmers became increasingly aware of the possibilities of reward associated with increased use of fertilizers and improved farming techniques at the very time that industry developed new, better, and relatively cheaper products that promised to raise yields and save labor. At the same time, too, the national economy was moving forward at an encouraging rate and urban consumers were able to buy more, and more expensive, farm products.

Finally, in agriculture as well as industry, postwar government efforts to promote modernization and productivity acted as an added stimulus to change; and relatively high agricultural prices and subsidies, together with the outlook for an expanding common European market for high-priced farm products, favored long-term investments in agriculture. The persisting annual rise in French farmland values that has characterized most of the postwar years (18, p. 205) provides conclusive evidence of the economic attractiveness of farming under such conditions.

If the broad picture of input and product changes outlined here is fairly indicative of the magnitude and timing of improvements in French agriculture over the past three-quarters of a century, if current estimates of the use of fertilizers, machinery, and labor in other Western European countries are fairly trustworthy, and if the official records of France and neighboring countries roughly indicate the comparative order of magnitude of historical changes in livestock numbers, yields of meat and milk per animal, and yields per hectare of major crops,¹⁰ three important conclusions appear warranted regarding France's agricultural development:

1. Although French agriculture showed a persisting tendency to advance during all peacetime decades of the past eighty years, the advance was slow prior to World War I. It was little if any better during the interwar period, and truly remarkable only since about 1950. Advancing technology has continuously been associated with increasing inputs of capital, reduction of labor, and more intensive use of the better (or economically better situated) lands, and less intensive use of the poorest.
2. Even at the substantially higher levels of cultivation reached by 1963, French agriculture remained backward in fertilizer use, power consumption, and general farming practices, as compared with other EEC members except Italy. Only in and to the north of the Paris Basin—the heart of the grain belt—has scientific farming advanced to a level closely approaching that of France's northern neighbors.

⁹ Absence of the stimulation of vigorous economic growth, and in the 1930's the serious economic problems associated with general deflation and the development of agricultural surpluses, tended to hold back public investment in agricultural research and advisory services. Private investment in new farm machinery and other improvements was, of course, discouraged by the declining prices associated with the Great Depression and by the great uncertainties that then existed regarding the future outlook for farming.

¹⁰ In addition to national official sources and other sources previously cited, pertinent information can be found in sources 11, 24, 28, 30, 37.

3. The potentialities for continued improvement in French agriculture remain great, and the forces that generated recent sharp advances are by no means spent. Whether the stage of acceleration of progress has passed is not clear; but there is every reason to expect large increases over the next decade, even if smaller than recently witnessed. This would be true even if grain and livestock prices should remain at current levels in the face of slow advance in general price indexes and if the rate of national economic growth were considerably lower than in recent years.

TRENDS IN GRAIN AREAS AND YIELDS

French farming still centers, as it did historically, around the production of grain, increasing amounts of which have been used domestically for animal feed and, more recently, for exports. Although regional crop specialization has become more important over the years and the use of pasture and green fodder as livestock feed has expanded, some grain was still produced on 98.9 per cent of the nation's farms in the mid-1950's, and 56 per cent of them had more than one hectare in grain (14, p. 86; 15, p. 206). Even so, the role of grain in French farming is very different today from what it was three-fourths—even one-fourth—of a century ago. Its geographical distribution, too, is different.

As the arable land of France declined from the early 1880's, the area under grains also declined. This was to be expected. It is the large magnitude of this decline that warrants attention. Whereas in the 1880's grain had occupied something like 55 per cent of the nation's arable land and probably well over 65 per cent of the area under rotation crops, by the early 1960's this had declined to 48 and 50 per cent, respectively. The accompanying table shows that although the loss of competitive advantage of grain continued throughout the interwar period and during and immediately after World War II, it has been arrested over the past decade.

The recent stability in the proportion of rotation cropland devoted to grain

TABLE 2.—PERCENTAGE OF ROTATION CROPLAND UNDER GRAINS AND THE ASSOCIATED SHARE OF WHEAT, SPECIFIED PERIODS 1922-62*

Period	Grain area as per cent of rotation cropland	Wheat area as per cent of	
		Rotation cropland	Grain area
1922-23	61.2	29.5	48.2
1924-28	59.9	28.8	48.1
1929-33	59.0	28.8	48.8
1934-38	57.1	28.0	49.1
1948-50	51.1	25.1	49.1
1951-54	50.5	24.9	49.3
1955-58	50.0	25.7 ^a	51.1 ^a
1959-62	50.3	24.2 ^b	48.1 ^b

* For sources and description of the basic data see notes to Chart 1-B, p. 227.

^a Excludes abnormally low figure for 1956, when winter freezes cut the wheat area to 31.9 per cent of the total grain area: if included, the corresponding 1955-58 average would be 23.2 per cent of cropland and 46.4 per cent of grain area.

^b Excludes abnormally low figure of 43.8 per cent for wheat in 1961, since plantings were seriously cut by prolonged autumn rains: if included, the 1959-62 average would be 23.6 per cent of cropland and 47.0 per cent of grain area.

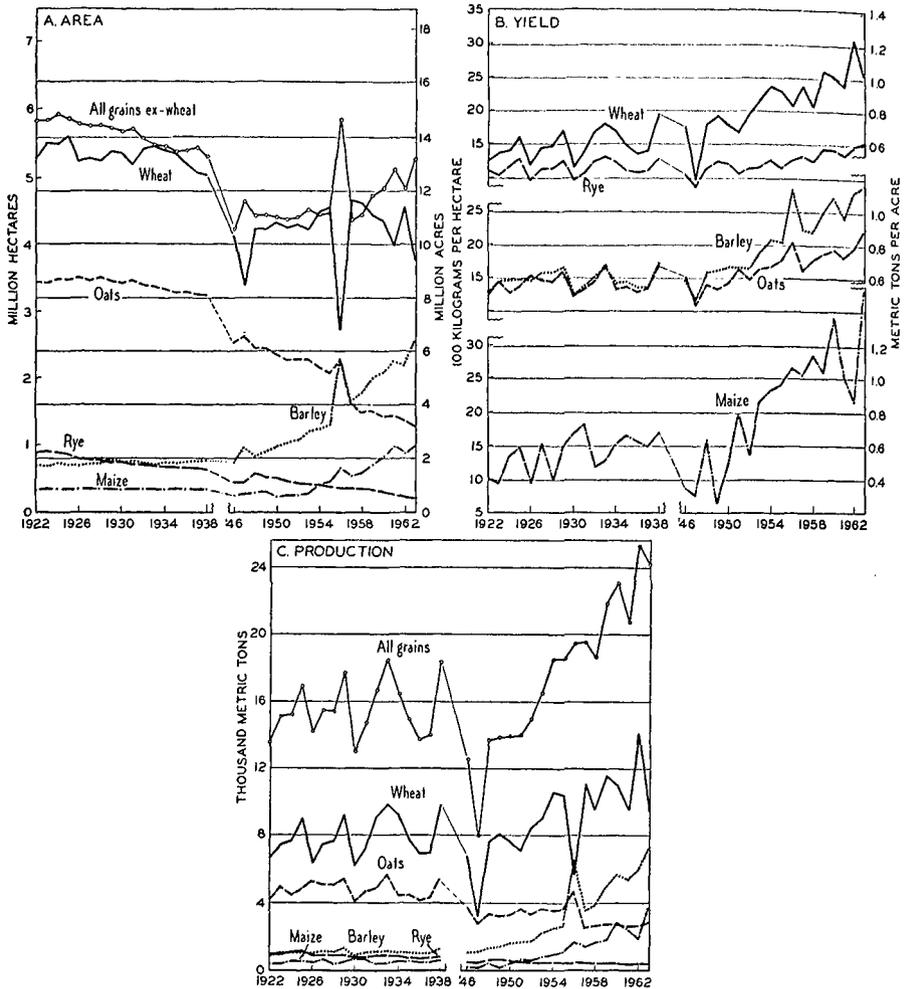
appears all the more remarkable since it occurred when the total cropland was rising—a reversal of its own long downward trend (Chart 1-A, p. 226). The most noteworthy feature is that for the first time in at least eight decades French statistics show a full decade of peacetime expansion of the nation's grain area. Although this amounted to over 700,000 hectares—roughly 8 per cent—even the peak grain area of 1962 was still some 9 per cent below the lowest recorded in interwar years. Both the sharp decline during 1880–1950 and the subsequent unprecedented reversal of the downward trend warrant careful inspection with reference to the specific grain crops involved and the timing of the area changes in relation to associated changes in yield, prices, and technology. In this section the outstanding facts relating to these changes will be summarized, with more extended consideration of the apparent “causes” left for discussion in the following section.

The areas planted to wheat and to feed grains have followed similar trends over the past eight decades (Appendix Table I and Chart 3, p. 244). There is little doubt that this similarity and also the persisting tendency for wheat to occupy an area almost equal to that occupied by all other grains (except when abnormal weather conditions intervene) are partly and perhaps mainly attributable to fundamental crop rotation patterns. Among the major grains only wheat and rye are sown primarily in the autumn. Since the rest are spring-sown, they tend to compete more strongly among themselves for land and labor. Moreover, insofar as spring grains take over land previously devoted to wheat and rye, there must be sufficient labor and machinery available to carry the extra work during the limited spring seeding period and also at the concentrated harvest time. Since labor shortage has long been and still is one of the most disturbing bottlenecks on French farms (34, pp. 230–34), there would appear to be little incentive to make such seasonal shifts except as peak-load pressures can be relieved by increased use of new and better types of farm machinery. Such mechanized equipment must have aided greatly in permitting rapid spring plowing and reseeding in 1956 and on a lesser scale in 1961 and 1963, when adverse weather resulted in heavy abandonment of wheat sowings. The phenomenal reseeding operation of 1956 would probably have been impossible a couple of decades earlier: certainly, the historical record shows no similar sharp increase in spring sowings of feed grain on land customarily devoted to wheat.

Striking changes have taken place over the past eighty years in the amount of land claimed by the different grains (Appendix Table I and Chart 3). Before World War I wheat and rye accounted for practically all of the decline in the total grain area. Until then the hectarage under oats, the preferred grain for horses, was not only maintained at its earlier high level (second only to wheat) but even increased slightly. During World War I and the interwar period, however, the oats area also contracted; and only barley recovered a small part of its earlier loss. World War II brought a drastic reduction in the total grain area, with oats showing the greatest decline as the new “machine age” made horses increasingly dispensable. On most of the best cropland, oats was replaced by barley, which was the only grain to benefit from World War II shifts; but in major grassland areas such as those of Normandy and northeastern France, the decline of oats was countered by expansion of pasture and green fodder crops.

The noteworthy reversal in 1950–62 of the long downward trend of the total

CHART 3.—AREAS, YIELDS, AND PRODUCTION OF MAJOR GRAINS, 1922-63*



* Data from sources given in Appendix Table I.

grain area brought still larger shifts in the relative positions of the different grains. Most of these, however, merely accentuated earlier trends. The hectareage under oats and rye continued to decline—oats much more rapidly than ever before—and barley showed a counter expansion, which also was much greater than ever before. The only new area trends were those for maize and wheat. For the first time maize showed an increasing ability to compete for land with other crops, actually tripling its 1950 hectareage by 1962. And wheat, which had led the preceding downward movement of the grain area, showed an unprecedented ability to maintain its absolute hold on cropland (with allowance for abnormal weather).

Table 3 shows the changes in percentage of the total grain area held by each grain in various periods of the past three-quarters of a century. Most striking over this long period were the large persisting losses in competitive power of rye and buckwheat, the sharp loss registered by oats since World War II, and the

TABLE 3.—PERCENTAGE OF INDIVIDUAL GRAINS IN THE TOTAL GRAIN AREA OF FRANCE, SELECTED PERIODS 1885-1962*

Period	Wheat	Rye	Oats	Barley	Maize	Other ^a	Total
1885-88	48.3	11.4	25.8	6.4	3.9	4.2	100
1909-13	48.8	8.9	29.6	5.6	3.5	3.6	100
1924-28	48.1	7.3	31.2	6.3	3.1	4.0	100
1929-33	48.8	6.5	31.1	6.7	3.1	3.8	100
1934-38	49.1	6.2	30.8	7.0	3.2	3.7	100
1951-54	49.3	4.9	25.6	12.9	4.2	3.1	100
1955-58 ^b	51.1	4.1	19.1	17.5	5.9	2.3	100
1959-62 ^c	47.0	3.1	15.5	23.1	9.1	2.2	100

* Based on data in Appendix Table I, with adjustments as noted in footnote ^b.

^a Includes buckwheat (the only other grain of real significance prior to World War II) and rice in all years, and various minor grains as increasingly reported since 1924.

^b Three-year average omitting the abnormal harvest of 1956. If included, the averages for wheat, oats, barley, and maize would be 46.4, 20.9, 18.3, and 6.3 respectively.

^c Wheat plantings seriously cut for 1961 crop by abnormal autumn rains. If the 1961 areas were omitted, the corresponding three-year averages for wheat and barley respectively would be 48.1 and 22.5.

contrasting gains of barley and maize. Before the end of the 1950's oats had lost its long-held second rank among French cereals, forced out by its own decline and the ascent of barley; and rye, initially in third position, had been displaced first by barley and later also by maize. Wheat not only retained its earlier premier position, but showed little sign of yielding any appreciable part of the scant half-share of the grain area it had held three-fourths of a century earlier. Indeed, this share was actually increased during 1949-58.

A clue to one of the factors partly responsible for these area trends and shifts may be seen in the yield figures in Table 4, Chart 3-B, and Appendix Table I. In 1885-93 the average yields per hectare of the major grains differed little, ranging between a low of 1.04 tons for rye and a high of 1.20 for maize. But over the ensuing half century, rye yields rose only 12 per cent, whereas wheat climbed by 34 per cent to top rank among the various grains (1929-38 averages). Although

TABLE 4.—RELATIVE YIELDS PER HECTARE OF MAJOR GRAINS IN FRANCE, SPECIFIED PERIODS 1885-1962*
(1885-93 = 100)

Period	Wheat	Rye	Oats	Barley	Maize
1885-93	100	100	100	100	100
1904-13	116	102	118	114	97
1929-38	134	112	139	126	128
1951-54	175	111	151	155	166
1955-62	210	127	175	222	222

* For sources of data see Appendix Table I.

oats rose even more sharply in percentage terms, its average yield in the 1930's was still below that of any major grain except rye. By 1955-62 wheat had scored an additional gain of 57 per cent, but had been surpassed by both maize and barley, which had added roughly 75 per cent to their 1929-38 yields. In contrast, oats and rye lagged far behind, with yield increases of only 26 and 11 per cent, respectively. The yield record of buckwheat was even worse, remaining essentially unchanged from the late 1880's. Reinforcing the dietary shift away from buckwheat, the persisting low yields tended to push buckwheat out of production in all regions except Brittany, where the remaining area is very small.

In the light of these relationships and in view of the small range of the average yields of the different grains in 1885-93 (Appendix Table I), it would appear foolish, indeed, for a French farmer to continue to grow rye or oats if his own farm-yield pattern resembled that of the nation as a whole, unless he had some special incentive to do so. In fact, such special incentives declined over the years, and particularly after World War II, as rising levels of living and technological progress made it increasingly possible for French farmers to substitute wheat for lower-priced rye for food, to substitute mechanized equipment for horses for draft power, and to substitute more desired crops for oats in crop rotations of greater flexibility.

Before turning to more specific consideration of the factors responsible for the yield and area trends just described, it seems desirable to summarize their combined net effect on production. Appendix Table I shows that the declines in area planted to wheat and feed grains prior to World War I were more than offset by the moderate improvements in yields per hectare effected during those years. On the whole, however, these early production gains were modest and were partially or wholly lost through the further sharp contraction of grain areas during 1914-38.

Almost all of the net increase in grain production recorded over the past three-fourths of a century has occurred since 1950 (Appendix Table I). According to the official figures, the total grain output did not reach the interwar peak until 1954 nor surpass the previous all-time record of 1907 until 1956. Yet the new record of 1956, obtained from an area some 35 per cent below that of 1907, was quickly surpassed in increasing amounts by five of the seven following harvests. Quite unprecedented was the phenomenal increase of 6.8 million tons in French grain production between 1951-54 and 1959-62—an increase of 43 per cent.

Among the five major grains, oats in particular, though rye as well, have stood considerably lower in production over the past five years than in any earlier period. On the other hand, wheat, barley, and maize have all registered successive record high outputs. Most impressive, the combined production of the four major feed grains (including rye) exceeded the output of wheat in 1955-58 for the first time on record; and this was repeated in 1959-62. Whether this shift in relationship is likely to persist is still uncertain, since it was made possible first by the abnormal freeze-killing of wheat in the winter of 1955/56 and later by the impossibility of carrying out wheat planting plans for the 1961 crop because of excessive autumn rains. In 1963 winter-killing of wheat was again extraordinarily heavy, further obscuring underlying production tendencies. An important future factor will be the prices established for the various grains in the European Economic Community. It is noteworthy that March 1964 reports indicated an in-

crease of almost one-fourth in the wheat area in prospect for the 1964 harvest, suggesting recovery to or above the postwar peaks of 1956 and 1957.

EFFECT OF PRICES VS. OTHER INFLUENCES ON GRAIN OUTPUT

Starting in any large producing country with a given state of technical knowledge and farm practices, a fairly stable total agricultural area, and a unified grain price structure, one can expect substantial changes in the level or composition of output over a decade or so only if:

- (1) technological improvements or better farm practices are more widely adopted, or
- (2) net prices to producers for grain, competing crops, or livestock products show substantial changes in "real" terms or in relationship to one another, or
- (3) changes in the effective costs of fertilizer, labor, or farm equipment favor or discourage expansion of the grain area planted, its intensity of cultivation, or its composition.

Although it is rarely possible to isolate the separate effects of such individual factors, which usually operate in combination and with interaction, one can often discern some of the broader relationships that persist over a decade or longer. This is so whether the relationship investigated pertains to long-time trends or shorter-period averages of total grain production or to the changing composition of that production, or to year-to-year changes in the plantings of a single primary grain (e.g., 10, pp. 271-287). Here the question raised is what effect grain prices have had as compared with other factors, in influencing long-term trends and changes over several years in the volume and composition of French grain production.

Relationships Between Grain Prices and the Total Grain Area

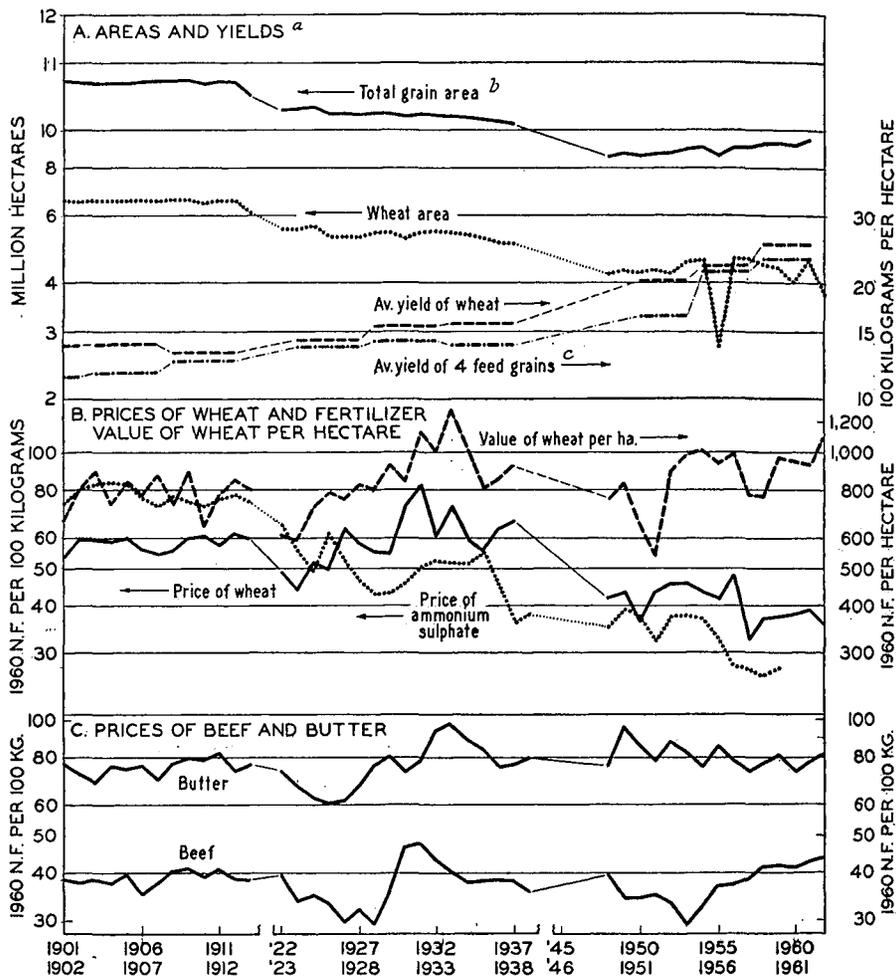
As a first step, it seems desirable to ask if past trends and short-period changes in "real" prices¹¹ of grain and competing products appear to have been associated with related changes in the total grain area. Data for the past six decades are presented in Chart 4. They indicate that the three periods separated by world wars—1900-14, 1923-39, and 1949-63—were characterized by successively lower levels of harvested grain areas (Section A). Within each period, on the other hand, both the area under wheat and that under all grains combined changed little, with a limited downward drift during the interwar years interrupted by a bulge of the wheat area centering in the early 1930's, and a minor expansion during most of

¹¹ "Real prices" of any one commodity are obtained by dividing the average price recorded in a given period (month or year) by an index of prices of a large number of commodities in the same period. The "real prices" of wheat, butter, etc. shown in Chart 4 are the result of deflation by a chained series of French indexes of wholesale prices. They are in terms of hypothetical francs that supposedly had about the same general purchasing power in each year represented as was true in 1960.

Although there is ample basis for questioning the validity of the only type of general wholesale price deflator that can be chained together from French statistics for adjusting prices over such a long period of time to a common franc value, this feature is less important for present purposes than it would be if primary reliance were not being put on price relationships between wheat, beef, and associated products.

CHART 4.—GRAIN AREAS AND YIELDS COMPARED WITH “REAL” PRICES OF WHEAT, BEEF, BUTTER, AND NITROGEN FERTILIZER, AND WITH THE “REAL” VALUE OF WHEAT PER HECTARE, 1901-63*

(Logarithmic vertical scale)



* For sources of data on areas, yields, and prices, see notes to Appendix Table I and Chart 5. Prices since World War II are net crop-year averages to producers. The wholesale price index used as a deflator has been chained together from indexes for varying numbers of commodities during different periods: for the original indexes used as part of the chain, see *Annuaire statistique de la France: Retrospectif 1961*, pp. 219-21.

Lower series of years shown at bottom of the chart refer to the years of harvest of the indicated crop areas and yields, which are plotted against prices in the preceding calendar or crop year indicated by the upper series of years (the latter represented by the initial year).

^a Before World War I, exclusive of Alsace-Lorraine, where all grains occupied about 0.35 million hectares, of which about half was wheat.

^b Total “grain area” includes the five major grains, buckwheat, and rice in all years, with the addition of sorghum and a couple of other minor grains after World War I and unspecified “other minor cereals” after World War II.

^c Includes rye (used predominantly as a feed grain in France), barley, oats, and maize.

the period since World War II. Although the wheat area reached its most recent peak in 1957, the total grain area continued upward to 1962. The first question is whether grain prices in francs of 1960 purchasing power—referred to as “real” prices—showed changes broadly similar to those of area. The second is whether the changing relationships between grain prices and the prices of competing farm products help to explain the changes in grain areas.

It seems reasonable to take wheat prices as fairly representative of the changes in level and trends of grain prices and to accept the prices of beef and butter as roughly indicative of the changing competition for land of green fodder crops and permanent pastures. If these assumptions are acceptable and if the French beef and butter prices used are even roughly suggestive of the returns per unit that farmers received from cattle feeding and pasturing,¹² several pertinent generalizations can be drawn from Charts 4, 5, and 6 and related information.

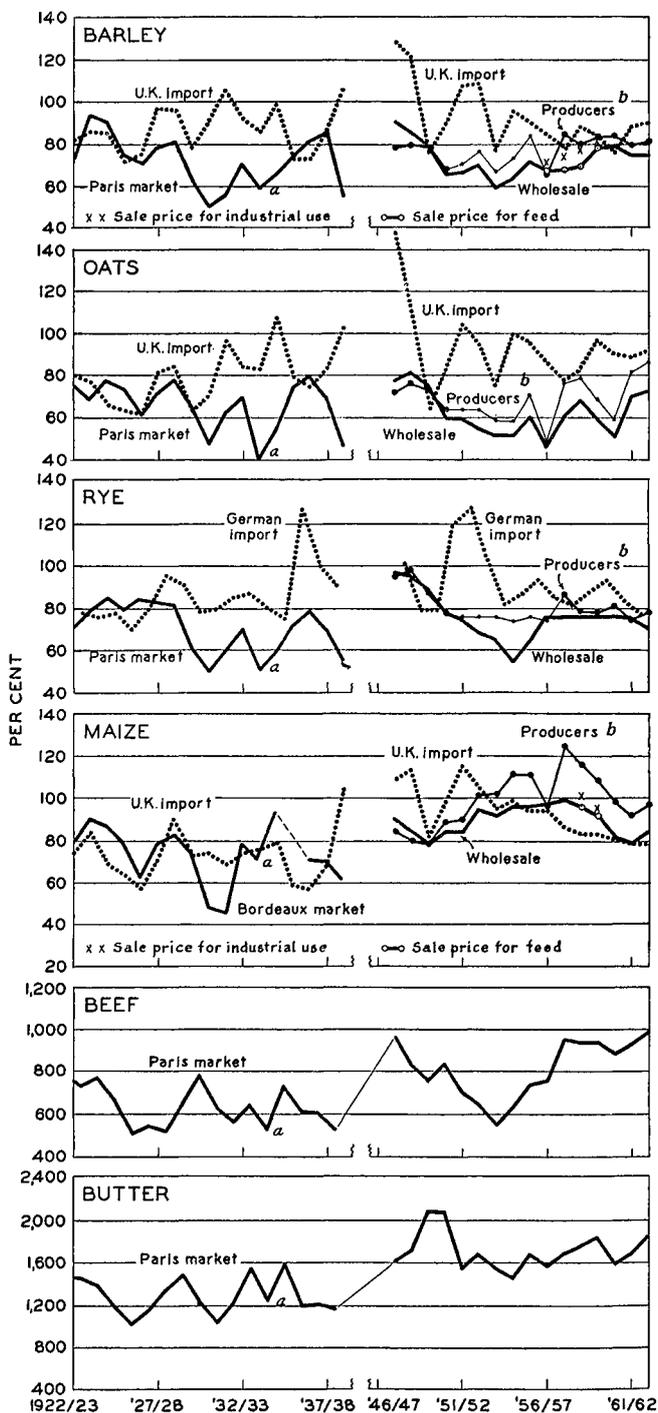
During 1901–13 real prices of wheat, beef, and butter all moved within narrow limits around unchanging levels, presumably contributing to the stable wheat and grain areas of that period.

In the interwar period, on the other hand, real prices and price relationships of the major farm products fluctuated sharply, at first around levels considerably lower than prewar, but from about 1930 as high or higher. On the whole, French price relationships somewhat favored wheat over other grains and livestock products, especially during the early 1930's (Chart 5). But although this was reflected in a significant bulge in wheat plantings, the total grain area was little affected. Neither the reduced interwar level of the total grain area nor its continual downward drift over that period can readily be explained by reference to grain prices—either to their real level or trend or to their relationship to prices of livestock products. In view of the overriding importance of the postwar adjustment problems of the early 1920's followed by the disruptive economic forces of the Great Depression, it seems probable that real price and price relationships of farm products held less meaning than usual for French farmers during most of the interwar period. The Depression, in particular, discouraged substantial investments in French agriculture. Not only did the total grain area contract during the 1930's but the reported cattle herd remained essentially unchanged despite increase in green fodder and permanent pasture.

Since World War II, real prices of wheat and most other grains have been much lower than in the interwar period, whereas butter and beef prices have been maintained at more attractive levels, perhaps partly accounting for the generally lower level of the postwar grain area. Postwar wheat prices reached their highest level during the six crop years ending July 1957 and wheat plantings were largest during 1954–58—a suggestive positive response that was slow to start. Since 1958 a reverse tendency has prevailed: lower real prices of wheat and sustained or higher real prices of animal products and feed grains have been reflected in reduction of wheat plantings, unprecedentedly rapid expansion of the area under green fodder crops, and increased plantings of feed grains.

¹² It is difficult to defend any available series of French prices of beef, milk, or butter: the officially reported Paris market prices here used have the notable advantage that they are available over a long period of time and are perhaps about as comparable as can be expected.

CHART 5.—RATIOS OF THE PRICES OF FEED GRAINS, BEEF, AND BUTTER TO THE PRICE OF WHEAT IN FRANCE AND ON WORLD IMPORT MARKETS, 1922-63*



* For footnotes, see p. 251.

During most of the interwar period and again after World War II sharp reductions in the real price of nitrogen fertilizer increasingly stimulated its use. Since this favored crops believed to be most responsive to fertilizer inputs (not only physically but in terms of added value of output), it favored grain areas more than ordinary French pasture land, and wheat, barley, and maize more than rye and oats. Although the crop-area patterns of the interwar period appear to have been little influenced by the relative decline in fertilizer prices (presumably due in large part to the Depression and associated abnormalities), land-use developments after World War II were broadly in line with economic expectations based on the reduced cost of fertilizer elements. More impressive over the entire six decades, however, is the close association between declining fertilizer prices and increasing yields per hectare—an association that suggests substantial decline in the costs of production of favored grains.

Chart 4 shows real values per hectare of wheat as well as real prices. Since changes in values per hectare reflect not only changing prices but also changes in yields per hectare, one might expect such values to provide a better explanation of major changes in area than wheat prices alone. For a number of periods this appears to have been true, for others not. A complicating factor is that comparative value-per-hectare figures cannot adequately be calculated for competing grass and livestock units.

In general, therefore, the available evidence is merely suggestive and not conclusive as to the role which prices have played in inducing changes in the level and trend of the total grain area of France. It seems clear that other factors, not fully reflected in the prices of grain and animal products, have been of considerable importance in some periods. Among these, large variations in national economic conditions, rapid technological advance, and spread of knowledge appear to have been most significant. To the extent that these factors resulted in changing costs of production of grain and competing products, they might have been expected to show up in farm prices. In substantial degree, however, such direct price effects have been prevented since about 1930 through government intervention aimed at maintaining officially desired prices for selected farm products. Consequently, it is more important than earlier to look closely at cost-influencing factors that have supplemented farm prices as incentives to expand or contract grain production. These have had a significant bearing not only on the total area planted to grain but also on the shares allocated to individual grains and on the yields per hectare harvested.

FOOTNOTES FOR CHART 5

* Basic price data were selected and in some instances adjusted in order to obtain series as comparable as possible over the long period of years covered. Most of the basic data are from national official statistical sources; but the annual average prices of major grains since World War II are estimates of the Food Research Institute or of the EEC Statistical Office (published in *Prix agricole*). Detailed data and information about the construction of the postwar price series will be given in the forthcoming book referred to in the general note on p. 225.

^a Price ratios for 1933/34 are unrealistically low since they are based on the inflated government-fixed price of wheat which was widely disregarded.

^b Estimated net (tax-paid) average prices received by producers for grain of standard quality. The light lines for rye and barley in 1952-55 and for oats since 1952 are estimates of the net effective prices to producers based on comparison of the levels of the official *minimum* (not fixed) prices for those years and reported Paris market prices, with allowance for wholesale commissions and marketing taxes.

Before giving more attention to the differential effects of the most important of these supplementary non-price incentives—the major technical changes rapidly introduced since the end of the World War II—it is desirable to see what readily visible evidence exists to support the view that changes in price relationships among the various grains have significantly affected their respective areas.

Influence of Grain Price Relationships on Areas of Individual Grains

Table 3 (p. 245) shows that marked changes have occurred over the past eight decades in the shares of the total grain area devoted to the various grains. To what extent were these associated with the kind of changes in grain price relationships that might have been expected to cause them? Did changing price relationships between rye and other grains account for the steady decline of the rye area from 11 to 3 per cent of the total between 1885–88 and 1959–62? What effect did prices have in bringing the oats area to a peak of 31 per cent of the total grain area in the mid-1920's, followed by very slow, then precipitous contraction to only 15 per cent about 1960? Finally, why did the area shares of barley and maize change little between 1885–88 and the late 1930's, amounting to only 7 and 3 per cent, respectively, in the last four prewar years, and later rise sharply to corresponding percentages of 23 and 9 per cent?

If changes in grain price relationships were primarily responsible for these large area shifts, this should be apparent from Chart 7 (p. 260) and Appendix Table III, which show the prices of each of the four major feed grains as percentages of the price of wheat in twelve peacetime periods of roughly five years each. Since wheat retained its top position and scant half share of the total grain area throughout the three-quarters of a century represented (Table 3, p. 245), its crop-year average price to producers serves as an unusually good basis for comparison of the relative price changes of the other major grains.¹³

Changes in price relationships among the various grains provide some, but not enough, satisfying answers. The generally low price ratios for rye and, after World War I, the sharply reduced, even lower price ratios for oats appear broadly consistent with the overall net contraction in the shares of these two grains in the total grain area.¹⁴ Similarly, the sharp relative advance in government-fixed maize prices after World War II was associated, as might have been expected, with a marked absolute and relative increase in the area sown to maize. Scarcely less impressive was the substantial bulge in the wheat area in the 1930's (Chart 3, p. 244) in response to wheat-favoring price measures that were reflected in abnormally low ratios of feed grain prices to the price of wheat (Charts 5 and 7).

In spite of these important signs of positive relationship between price changes and major area shifts among the various grains during 1885–1962, the record also shows pertinent conflicting tendencies. Price ratios do not explain why the share

¹³ This is true in spite of the less representative character of recent postwar wheat prices, which are approximate averages of the wide range of net (tax-paid) prices received by small and large producers combined, the former having received prices considerably above average, the latter considerably below.

¹⁴ This would not follow if costs per ton of producing rye were lower than those for other grains or if the production costs for oats suddenly fell sharply after World War I relative to those for other grains. However, no available evidence supports such a view of cost relationships in France, nor do Jasny's conclusions regarding grain cost relationships in several widely differing areas of the world (25, pp. 345–419).

of oats in the total grain area should have expanded in the early 1920's and been maintained at such a high level throughout the entire interwar period, nor why rye should have suffered further substantial loss of area after World War II, nor why maize should have gained so much less land than barley over the past decade. For further light on such unexplained developments we turn to consideration of the differential effects which technical improvements and inherent regional factors had on the areas and yields of the various grains.

Technological and Regional Factors as Determinants of Grain Areas

In a period of rapid technological progress and government price controls, changes in the prices of farm products may be a less important determinant of land use and output than changes in production costs. This appears to have been broadly true in France during most of the recent postwar period of "agricultural revolution."

Some agricultural regions of France and some individual grains have been favored more than others by improvement of seed, by the introduction of better types of farm machinery, and by increased production and declining real prices of nitrogen and scientifically mixed fertilizers. Similarly, some regions and grains have profited more than others from government efforts to promote land consolidation and to increase and spread knowledge of better farming methods. And some have been more disadvantaged than others by the persisting rise in wages of farm labor.

Although most of these factors could be expected to reduce the unit-costs of grain production of efficient farmers and to show up in lower prices of the most favored grains, some of the price effects have not had time to be fully registered, and some have been deliberately curtailed or prevented by rigid government price supports. Other types of evidence, however, remain. The individual grains most favored by technical improvements have taken good land away from other grains and other crops and have shown greater relative increases in yields per hectare. The national record of these changes in land use and relative yields has already been presented, but it shows only part of the picture. Some of the most pertinent facts become apparent only when we look at regional changes and at the differing responses of individual grains to man-made improvements in their environment.

Of the five major grains, rye and oats have benefited least from the many technical and other improvements introduced in French agriculture over the past half century and most strikingly since the end of World War II. This is due in large part to the greater tolerance of these two grains for poor soils and to their smaller yield-response to heavier applications of fertilizer. In addition, rye has suffered as a result of the historic upgrading of human and animal diets in France; and oats has declined sharply in demand as mechanization has reduced the number of horses on French farms and in the French army. Insofar as a preferred demand still exists for rye for human food, it is largely confined to small tradition-tied subsistence farms and those on the German border. Even in these areas it has continued to decline since World War II. For oats, the sharply reduced preferred demand of the present days is also a farm demand, but it is more widely distributed geographically, since many well operated farms continue to keep one or two horses to supplement mechanized equipment.

These varied factors have been reflected in impressive changes in the regional distribution of French grain areas and production over the past half century. The most important regional trends and shifts are apparent in crop data for the four regions of the country for which boundaries are shown in Map 3-A (p. 234) and selected area data are given in Appendix Table II.

Rye and (since 1940) oats have been increasingly pushed off of the richer lands of the North and West Central regions of France, where oats was still of great importance in the late 1930's. At present the small rye area is concentrated on the poorer soils of the Massif Central and in a few scattered areas in Alsace-Lorraine, Brittany, and nearby departments. Although more evenly distributed than rye, oats has declined most sharply in the North and western West Central regions, where the largest percentage of the nation's horses were previously concentrated and where mechanization has been most widely adopted. That oats production was not cut more sharply in those regions in the 1930's in the face of record-low relative prices reflects the subsistence character of this crop: most farmers preferred to keep their work horses in the 1930's and to feed them home-grown oats rather than to invest at that time in more efficient new machinery.

In the northwestern areas of flat land and good soils, higher-yielding barley has recently gained much land at the expense of oats; and wheat and maize¹⁵ have made secondary, less substantial gains. All three of these favored grains are inherently more responsive than oats or rye to increasing inputs of fertilizer, better rotations, and other improvements that provide a better soil environment. Moreover, all three have higher feeding values per ton than oats and are more palatable feeds than rye. For all three, real costs of production have presumably declined since World War II as efficient farmers have taken increasing advantage of lower priced fertilizers, better seed, and improved labor-saving farm equipment.

The competitive strength of maize, however, has been limited up to the present time by factors of climate. Restricted as to location both by its own climatic requirements and by its greater comparative advantage over other grains, forage crops, and dairying in areas subject to high temperatures, maize has thus far remained predominantly a crop of the Southwest. There the postwar spread of hybrid seed, mechanization, and lower cost fertilizers have not only raised yields per hectare spectacularly and won additional local land for maize, but these same developments have made possible a northward and eastward extension of the primary maize belt in the face of rising labor costs. Indeed, this group of production stimulants¹⁶ combined with high government price supports have been so powerful over the past decade that all four regions of France have reported sharp percentage increases in the area under maize (see Appendix Table II). Although none of these major regions except the South has yet recorded a maize area as large as 100,000 hectares, four adjoining departments of the North and West Central regions harvested an area slightly larger than this in 1962 (20).¹⁷ The South

¹⁵ Throughout this study reference is to maize areas planted for grain except as otherwise specified. There has been a significant but not large additional expansion of maize planted for green fodder.

¹⁶ A recent study (22) indicates that full mechanization of corn production between 1950 and 1958 cut the cost per hectare of producing corn much more than full mechanization of wheat production lowered its costs. The relative position of corn was further improved in France because corn enjoyed the greatest yield increase.

¹⁷ The four departments were Eure-et-Loire and Seine-et-Marne in the North region, and Loir-et-Cher and Loiret in the West Central.

alone accounted for three-fourths of the total maize area of the nation in 1960-62 and together with the four selected northern departments for roughly 85 per cent. Future expansion of the maize area in all four regions of the country seems likely as new strains of hybrid maize are introduced and as farmers in the most suitable regions learn how to obtain higher and higher yields from both existing and new varieties. The present extreme dominance of the South in maize production will almost inevitably dwindle even while its own low yields and absolute production continue to increase.

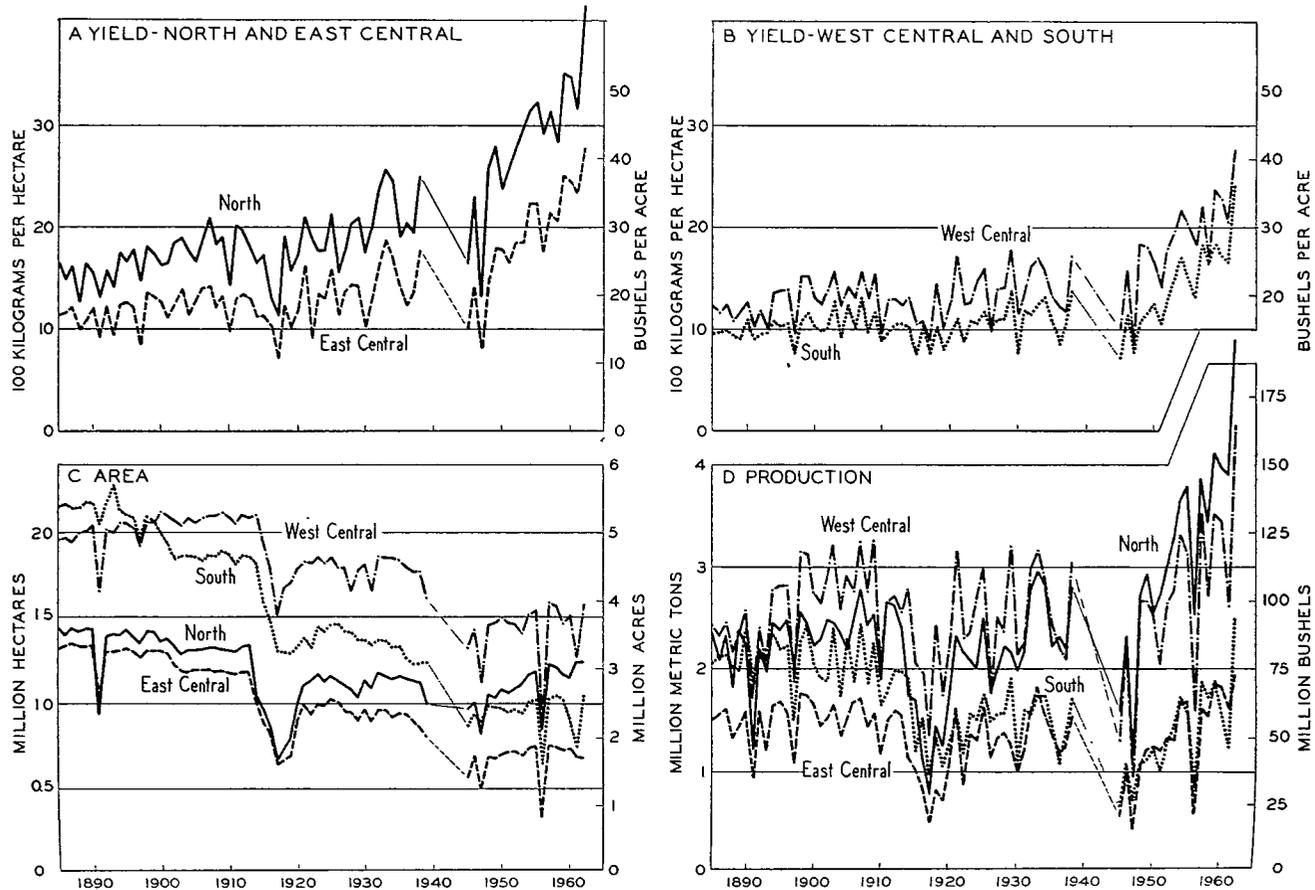
For wheat, detailed regional data are shown in Chart 6, extending back to 1885. In the 1880's and 1890's the farming region of France with the largest wheat area was the South, where the average yield per hectare was the lowest, roughly 1.0 ton per hectare (15 bushels per acre). In the North, where yields were highest—then roughly 60 per cent higher than in the South—wheat occupied an area only 70 per cent as large. Although sowings of wheat were substantially reduced in all four regions between 1890 and 1960, the net reduction was by far the greatest in the South, and contrariwise, was so small in the North that that region has ranked above the South in wheat area ever since the end of World War II.

Only in the North has the wheat area of recent years been as large as or larger than in the interwar period; and in no other region has there been as big a net increase over the past decade (Chart 6-C). The great importance of this fact becomes evident when it is considered jointly with the unprecedented increase in yields in the same area and with supplementary information on wheat prices. These indicate that the large, efficient wheat producers of the North, aided by powerful new machinery, lower-cost fertilizer, and the best available seed, found expansion of wheat production profitable over the past decade *despite* the higher surplus-disposal taxes they had to pay on their large wheat deliveries—taxes that cut the net average price they received considerably below the average for the nation as a whole. Looking to the future, it is important to note that these same efficient producers are the ones who will gain the largest net increases in price if a unified Community grain market is established in line with present plans, since such a market would “harmonize” French and German prices at levels above those now current in France and would operate without the present discrimination against large producers.

In general, this survey of past and continuing trends in the regional distribution of French grains points up several long-established tendencies and recent changes that deserve emphasis. Over many decades there has been a general tendency for farmers in the four major agricultural regions of France to react similarly in planting more or in planting less of any given grain and of all grains combined. Only for wheat, the grain for which government intervention has been most pronounced in all decades, have minor differences existed among regional trends, and even these differences have consistently increased the regional share of the nation's wheat area that is in the North (the region of highest yield per hectare) and reduced the share in the South, where yields are lowest.

There is little question that the pronounced regional shifts in grain-area patterns since 1950 have been largely due to government maintenance of attractive prices for wheat, barley, and maize in the face of declining real costs of production achieved through increasing technical improvements and spreading knowl-

CHART 6.—REGIONAL CHANGES IN WHEAT AREAS, YIELDS, AND PRODUCTION
IN FRANCE, 1885-1962*



* For sources see Appendix Table II. The four regions are indicated graphically on Map 3-A, which also shows the distribution of wheat production in 1960. An earlier version of this chart was presented by M. K. Bennett in a study of regional trends in wheat yields (2, p. 91).

edge of better farm practices. The same underlying factors have accentuated the long-continuing tendency for French farmers to cultivate good grain land more intensively, and to concentrate on favored grain crops in increasing degree on the rich, flat, consolidated lands of the North and West Central regions, except as climatic factors have kept maize closely tied to the Southwest "maize belt."

Most broadly it may be said that the regional shifts of grain areas since World War II have accentuated earlier tendencies toward greater concentration of the individual grains in areas where they have the greatest comparative economic advantage. The shifts have not only been influenced by, but in turn have influenced, the average levels of hectare-yields of the respective grains. Their overall net effect, though small, has been to raise the average yields of wheat, barley, and maize and to lower those of rye and oats.

Price and Other Influences on Yields per Hectare of Grain

There remains the important question as to the effect of grain prices upon yields per hectare. Neither economic reasoning nor the nature of the available data (partly shown in Charts 4 and 7) encourages expectations of finding illuminating statistical correlations between prices and yields.¹⁸ Yet it is obvious that higher grain prices, lower fertilizer prices, or any improvement that raises the yield response of grain to fertilizer applications necessarily makes heavier applications more profitable. As Lamer has phrased it (27, pp. 81-84):

The basis for the farmer's decision as to the rate of fertilizer application is the curve of physical productivity converted into economic terms. . . . In this way net revenues are computed—i.e., income of crop yields less fertilizer expenditures. The highest point on the net revenue curve corresponds with the economic optimum rate of fertilizer application . . .

. . . the revenue curves shift continually with fluctuations of prices of agricultural products and fertilizers. The optimum fertilizer rate must be determined anew each year.

Although experts agree that higher grain prices raise the rate of fertilizer application that is scientifically warranted, they also point out that in areas where fertilizer use falls far short of the optimum level larger inputs of fertilizer would prove profitable even at appreciably lower grain prices. Under such conditions—probably common even today in most regions of France except the North—price changes have little influence on fertilizer use and associated yields: the dominant factor is farmers' knowledge about profitable rates of application. Even in such cases, however, higher grain prices are likely to encourage farmers to spend more freely on various types of farm equipment and supplies including fertilizers.

For this reason and also because more than a third of the French grain crop is raised in the North, where fertilizer applications are high and scientifically planned, there is reason to believe that a significant part of the postwar increase in French grain yields would not have occurred if producers had received unsub-

¹⁸ This is partly because higher grain prices encourage increase in fertilizer use which tends to increase yields, which in turn tend to lower grain prices in the absence of government intervention.

sized grain prices.¹⁹ Today the number of French farms on which optimum rates of fertilizer application are approached is much larger than a decade ago, when it was already larger than in any prewar year. This fact itself means that passage of time has increased the influence of grain prices on fertilizer use and therefore on grain yields and production. In future years this influence will be greater still.

Value-per-Hectare Relationships Best Index of Production Incentives

When agricultural prices are relatively free, increased yields per hectare and lower unit costs tend to be reflected rather promptly in declining prices. This was clearly true during 1885–1914, when slowly improving farm practices and modest technological advances were reflected in earlier and greater increase of yields per hectare of wheat than of other grains and in relative decline of wheat prices. These roughly compensating movements of prices and yields are evident in the price ratios and yield ratios in Chart 7 (p. 260), which also shows the resulting greater stability of value-per-hectare ratios.²⁰

On the other hand, when rigid government controls keep the price of one or more farm products unrealistically high in the face of a relative decline of per-unit costs, farmers naturally tend to favor such products, both in planted area and in intensity of cultivation. In exporting countries the result of unrealistic national pricing becomes apparent in the accumulation of surplus stocks of po-

¹⁹ Available data are not sufficiently comparable to permit direct calculation of the degree of price advantage which French producers have gained through government intervention in grain markets and international trade. There is no question, however, that wheat and maize have received the most protection. For wheat net (tax-paid) prices to producers for the crops of 1958–61 averaged roughly 20 per cent above average French export values and 10 per cent above British import values. For maize, French producer prices were approximately 32 and 40 per cent, respectively, above French and British import values and probably a full 40 per cent or more above weighted average French export values. Since the export and import values include higher transport and handling costs as well as a wholesale commission not included in the net price payments received by producers, adjustment of these several price series to reasonably comparable terms as to position and character of delivery would tend to increase the price differences indicated above. This conclusion, however, does not allow for possible differences in the average quality of the grain priced to producers and in international trade. Since the wheat exported from France is apparently of lower quality than domestic marketings, which in turn are of lower quality than British imports, the average degree of protection afforded French wheat during 1958–61 is perhaps fairly well represented by the unadjusted 20 per cent figure. In view of the differentiated marketing taxes imposed on wheat, large producers received less protection than any calculated average, small producers more. The adjusted figures for maize suggest producer protection of some 40 per cent based on roughly comparable international prices.

²⁰ It is not to be expected that such stability should always be represented by moderate fluctuations around a *horizontal trend*. During 1885–1914, the value-per-hectare ratios of rye to wheat tended slightly downward and those of oats and barley to wheat slightly upward, while maize ratios first moved downward then sharply upward, uncertainly suggesting a horizontal trend (Chart 7). Sustained shifts in level of the value-per-hectare ratios of individual grains may be expected under conditions of (1) marked changes in consumer preferences reflected in prices but not yields per hectare, or (2) sustained changes in relative unit costs of production that are reflected in prices but not yields per hectare or reflected in yields but not prices. The decline in oats value ratios after the end of World War I partly reflected reduction of the price premiums buyers had previously been willing to pay for oats as a preferred feed. In contrast, rising labor costs tended to raise the prices and values per hectare of maize relative to other grains except as new labor-saving machinery, better varieties of seed, and improved farm practices offset the increased wage rates by compensating cost reductions partly reflected in higher yields per hectare. Over the past decade government price discrimination in favor of maize has kept French maize prices abnormally high in relation to long-term equilibrium levels in international trade and apparently also above French equilibrium levels.

A final limitation on sustained changes in the price ratios of grains used for feed is their relative feeding values. This economic control operates in all countries except those in which the government persistently intervenes to support the price of a given grain through export subsidization or through discriminatory production or marketing controls not similarly extended to other grains.

littically favored products like wheat, in heavy budgetary expenditures for export subsidies and surplus disposal, and as a last resort, in government restrictions on production or marketings of the products concerned. In importing countries similar production symptoms develop but impose little or no budgetary pressure unless protests from consumers, faced with higher prices, and from employers, faced with rising wages, force government officials to finance the higher farm incomes through some form of direct subsidy.

In view of the long-expressed desire of many governments to help domestic farmers obtain "fair" and "stable" prices of leading grains, and in view of the importance of keeping such prices in line with changing long-term equilibrium levels and relationships, it is desirable to seek a rough index of the changing relative costs of production of the various grains and chief competing crops. This is needed whether the problem is to secure information to guide national policy decisions or (as in the present instance) to throw light on the effects on national production of past and anticipated future changes in (1) grain prices and (2) technical improvements. Since unit costs of production cannot be measured satisfactorily by direct methods,²¹ the most that can be hoped for is a rough index of changing production incentives (price-cost relationships). One possible crude approach to such an index lies in combined consideration of three national statistical series, all of which are readily available and related in some way to the profitability of grain production: (1) the net annual prices received by producers of the major grains, (2) the annual yields per hectare of the same grains, and (3) their sown (or adjusted harvested) areas.

Combination of the first two series results in annual value-per-hectare figures which should serve as a useful indication of the relative profitability of production of the individual grains, reflecting price influences on the one hand, and yield-raising technical improvements on the other. For proper comparisons over time, the annual value figures need to be deflated or expressed as ratios based on the value of the most representative grain (usually the most commercially important), thus ruling out the effect of substantial changes in purchasing power of the national currency. Supplementary analytical attention must also be paid to the changing relative costs of fertilizers, farm labor, and labor-saving equipment, since some grains and competing crops respond better to fertilizers than do others and some require relatively more labor or equipment, or show greater changes in such requirements over time.

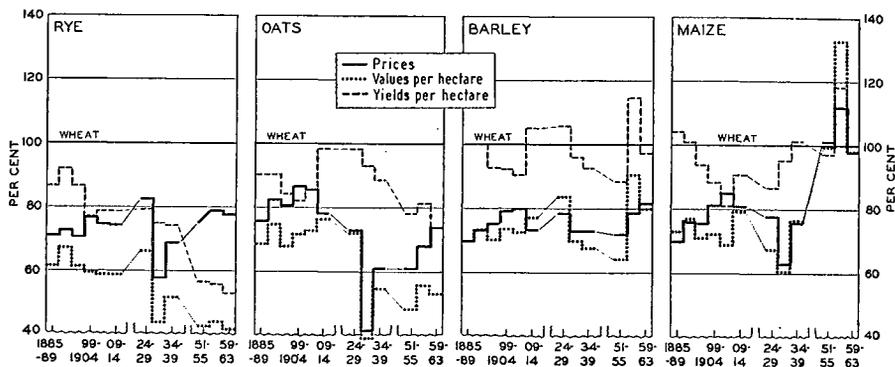
Fortunately, it is possible to test the general validity of the proposed value-per-hectare series as an indicator of changing economic incentives to expand or contract the production of a particular grain or of all grains combined. Since farmers can be counted on to expand their plantings of the grains or competing crops that they find most profitable at the expense of the least profitable, recorded area changes should correlate closely with any statistical measure that purports to reflect changing production incentives.

This test appears to be fairly well met by the value-per-hectare ratios shown in Chart 7. It is clear that they provide a better basis for explaining the changing

²¹ This would be true if only because artificially high government price supports or subsidies for specific agricultural products tend to be quickly reflected in land values, which in turn raise calculated total costs of production.

shares of the total grain area claimed by the various grains (Table 3) than do the corresponding price ratios. For example, the sharply reduced value ratios for rye after World War II, together with the persisting earlier declines, suggest an explanation for the continuing downward trend of the rye area in the postwar period: this development could not have been anticipated on the basis of the price ratios alone. Similarly, the value ratios suggest more reason than do the price data for oats being more rapidly displaced by barley and maize after World War II than earlier. Even in the interwar period, when grain area changes were small and hardest to explain, there was relative expansion of plantings of the two grains—wheat and barley—that were best maintained in average values per hectare.

CHART 7.—AVERAGE PRICES, YIELDS, AND VALUES PER HECTARE OF FOUR FEED GRAINS AS PERCENTAGES OF THE PRICE, YIELD, OR VALUE OF WHEAT, SELECTED PERIODS, 1885-1963*



* See Appendix Table III.

The records of past relationships between value-per-hectare ratios and area shifts suggest four generalizations that deserve mention in attempts to appraise the probable grain production effects of current and future grain price proposals for the European Community and for France in particular.

First, there appears to have been a general tendency for shifts in grain areas to lag behind changing value-per-hectare indications and to be large only in response to changes in value relationships that were both sizable and persistent over a number of years.

Second, shifts of area away from a spring-sown feed grain (oats) have tended to be associated with compensatory expansion of a higher yielding feed grain also sown in the spring (barley or maize) and to have had insignificant effect on the areas of autumn-sown wheat and rye. On the other hand, the reverse has not been true. Decline of the share of autumn-sown rye in the total grain area has not been associated with marked increase in autumn-sown wheat, but has usually favored the two spring feed grains of highest relative value per hectare—since World War II, maize and barley. To what extent, if any, the higher quantum tax on large wheat deliveries may have encouraged large grain producers to shift from wheat to barley or maize after 1958 is not clear, but the available regional data suggest that this influence was probably minor.

Third, if French grain price ratios and value-per-hectare ratios of the postwar period are looked at in historical perspective, maize stands out as the grain that appears to have been most overpriced by government decrees of the 1950's. That maize has shown a greater percentage increase in area than any other grain is thus readily understandable. That the expansion of area has been smaller for maize than for barley reflects the geographical limits within which maize has a natural economic advantage over other crops, and perhaps also the higher requirement for labor in maize production.

Fourth, grains that are expanding in area in response to rising values per hectare may be assumed also to be attracting increasing applications of fertilizer and other capital inputs on many farms, since price-cost relationships that stimulate increase of cultivation at the extensive margin operate similarly at the intensive margin.

CONCLUDING OBSERVATIONS

The preceding analysis demonstrates that French grain prices have functioned as one important element in a complex set of determinants of the volume and composition of French grain production. Scientific and technological changes in the broadest sense, spread of knowledge of better farming practices, and variations in general economic conditions have interacted with grain prices in different ways and different degrees at different times. In combination, these varying factors have resulted in overall net changes in grain areas and yields differing from region to region and from one type of grain to another. The grain price levels ("real" prices) and relationships prevailing over the past decade would have brought very different production responses in the 1930's and still different ones in the several decades preceding World War I.

Within three-fourths of a century the French grain economy has witnessed a net *decline* of something like 35 per cent in the total grain area, a doubling and more of the average yield per hectare, and a resulting net *increase* in production of roughly 40 per cent. The two latter developments were concentrated chiefly in the period since World War II. None of these changes can be directly attributed to prices alone and none to other factors alone. In the interwar period, the Great Depression was the most important single element; since World War II the dominant feature has been a group of heterogeneous factors known as "technological progress." In both periods government intervention has sustained grain prices at artificially high levels, forcing them to play the role of an accessory stimulant to grain production rather than permitting them to adjust agricultural resources in line with fundamental economic forces.

The long-time contraction of the grain area, amounting to a net loss of over five million hectares (almost 13 million acres) over 75 years, mainly represented wartime shifts away from grain to pasture and fodder crops. After World War I grain continued to lose land despite irregular maintenance of real prices around prewar levels. In contrast, the period since World War II has been characterized by persisting recovery of earlier losses of grain area in the face of generally lower and declining real prices of most grains. Most significantly, grain has recently competed effectively for land in the major grassland regions, where permanent pasture has contracted partly in response to improving grassland management

that has included the transfer of some permanent pasture to better temporary pasture grown in long-period rotation with grain or other crops.

Many of the noteworthy changes in the French grain economy since World War II have primarily reflected a remarkable agricultural revolution that is by no means completed. It has brought widespread introduction of higher yielding grain varieties (most notably hybrid maize and better strains of wheat and barley), improved agricultural machinery and equipment, relatively cheaper fertilizers together with increasing spread of knowledge about their use, and generally better farming practices. In combination these developments have resulted in sharply higher crop yields and crop values per hectare, reduced requirements for farm labor (often the most limiting factor to production), and associated lower real costs per ton of grain produced. By 1950 French agriculture, and grain production in particular, had essentially recovered from wartime reverses except for some loss of crop area. Later, during the decade ending 1959–62, the nation's grain production showed a striking increase of 8.6 million tons or 61 per cent which reflected a phenomenal rise of 52 per cent in average yield per hectare and an area expansion of well over six per cent. The annual rates of increase of production, yield, and area in that decade were all without historical precedent.

This remarkable record has led some observers to conclude that the full increase in French grain production since about 1950 is attributable to the many notable improvements just mentioned, with grain prices playing a negligible role. More specifically, some have argued that the unprecedentedly low real prices of grain in the past decade could not possibly have contributed to increase in production. And the still lower "world" prices have often been dismissed from consideration as "unduly depressed" because of the government-supported surplus production and huge subsidized exports of United States grain (primarily wheat).

There is ample reason to challenge this view on grounds both of economic theory and of historical evidence. In an agricultural revolution such as that of postwar France, where grain prices have been maintained and increased in current monetary units only by means of government price decrees, marketing controls, and irregularly increasing surplus-disposal sales at subsidized prices, grain prices to producers have been held above equilibrium levels and have not been permitted to respond in normal manner to declining costs. Such a situation inevitably stimulates production. The pertinent question is not whether recent real prices of French grain have or have not been at historical lows or whether American grain producers have been subsidized at higher prices (as they often have been); the question here is rather how much reduction in French grain prices would have been required to balance domestic supplies against demand at a long-term equilibrium level.

Since this type of balance implies unsubsidized exports of surplus French grain—mainly wheat and barley—at "world" prices, attention must be given to the French claim that "world" prices have been artificially depressed by the grain policies of competing exporting nations. When close study is made of the domestic and export pricing policies, marketing controls, production and export records, and stocks financing provisions for grain in the leading grain exporting countries, no good evidence can be found to support the French view. Indeed,

it seems clear that world "commercial" export prices of wheat have more likely been held above than pushed below equilibrium levels since 1953,²² and that commercial export prices of feed grains have been much less (perhaps insignificantly) affected by government intervention.

Probable Reduction in French Grain Output at "World" Prices, 1950-62

The most important question, therefore, is how much French grain production would have differed during recent years if French prices had been essentially on a free international basis since 1951/52, the first postwar year in which the government-fixed price of any French grain was raised much above world parity. No firm quantitative answer can be given; but it is possible to arrive at a rough judgment of the probable order of magnitude involved. Price data suggest that if French producers had received international rather than protected domestic prices for the grain crops of 1958-61, their average net prices would have been lowered by something like 15 per cent for wheat (with more reduction for small producers and less for large ones), perhaps 8 to 10 per cent for barley, and roughly 30 per cent for maize.²³ These figures are based on approximated annual export parities for wheat and barley and a shifting import-export parity for maize. Although closer to international parity than the price of barley during 1958-61, producer prices of oats and rye would probably have been lowered almost as much proportionally as barley if the latter, together with wheat and maize, had been priced on a "world" basis. Even greater price reductions would have been required to put most French grains on an international basis during 1952-56, but the *relative* cuts required for one grain as compared with another would have been much the same.

If French farmers had received the domestic equivalent of world prices since the end of the 1940's, they would have adjusted their farming operations to very different price relationships and value-per-hectare relationships among the individual grains, between grains and other crops (especially green fodder and roots), and between grains and livestock products.²⁴ In particular, wheat would have appeared relatively less attractive to producers, especially small producers who could conveniently have raised more barley, green fodder, and livestock; the values per hectare of maize would have been much less stimulating to expansion outside of the Southwest maize belt, where the competitive position of maize, though reduced, would still have remained strong as compared with most other crops; the values per hectare of oats and rye would still have appeared depressed

²² Since 1953/54 this has been largely accomplished by export pricing decisions made by United States and Canadian officials in line with implicit and explicit "understandings" between representatives of the two countries, and by diversion of huge amounts of surplus grain to nations granted great price concessions under P.L. 480 Title I. For fuller discussion of these important price policy developments and their effects, see 8 and 9, pp. 353-70.

²³ For further details see p. 258, note 19. The percentages given here are equivalent to those on p. 258n, but lower because they are based on the higher French domestic prices rather than on world prices.

²⁴ A basic assumption underlying the following discussion of production adjustments is that no other change would have been made in government programs that would have offset the effect of the lower grain prices or would have speeded differential advances in productivity.

Although prices of livestock products, especially milk, would also have declined under lessened government support, an active consumer demand would have given greater relative advantage to preferred products such as meat, beef in particular. This in turn would have given somewhat greater relative strength to green fodder crops and permanent pasture.

in historical perspective; and only barley would have been favored more than it was in fact relative to all other grains. In general, the position of all grains would have been weakened relative to green fodder crops, perhaps certain root crops, and permanent pasture.

After taking account of these hypothetical changes, the differing regional concentrations and conditions of production of the various grains, and the nature and effects of the most pertinent "technological" changes of the postwar period, it seems reasonable to hazard the guess that French farmers would have responded to the lower "world" prices by increasing the total grain area only about a third to a half as much as they actually did between 1949-52 and 1959-62, and by using somewhat less fertilizer and other yield-raising capital inputs. Table 5 suggests the general order of magnitude of the crop reductions that might have been witnessed.

TABLE 5.—ROUGH APPROXIMATIONS OF POSSIBLE CHANGES IN FRENCH GRAIN PRODUCTION UNDER HYPOTHETICAL PRICING AT "WORLD" LEVELS, 1949-52 AND 1959-62 AVERAGES*

Years of harvest	Area (million hectares)			Production (million metric tons)		
	All grains	Wheat	Other grains	All grains	Wheat	Other grains
1949-52						
Actual reported	} 8.68	4.27	4.41	14.15	7.83	6.32
Possible at "world" prices						
1959-62						
Actual reported	9.23	4.34	4.89	22.78	11.55	11.24
Possible at "world" prices	8.8-9.0	4.1-4.2	4.8	21.2-21.9	10.5-10.9	10.6-10.9
"Possible" below "actual"	.3-.4	.2-.3	.1	.9-1.6	.6-1.0	.3-.6
Ten-year increase						
Actual reported	.55	.07	.48	8.64	3.72	4.92
Possible at "world" prices	.2-.3	-(.1-.2) ^a	.4	7.0-7.7	2.7-3.1	4.3-4.6

* Reported area and production from sources cited for Appendix Table I. All calculations are from less rounded data and the indicated differences may not always agree with the figures shown. See text for discussion of assumptions underlying approximations of possible production at "world" prices.

^a Ten-year decrease.

The "reported" figures are averages of official estimates. For 1949-52 essentially the same harvest results might have been obtained if no domestic price programs had existed, since the fixed domestic prices differed little from equivalent "world" prices until 1951/52, and even then were not far out of line with import prices of top-quality grain sold outside of international agreements.²⁵ Primary interest centers on the "possible" production figures shown for 1959-62. As previously noted, these are not true estimates but very rough approximations of the production effects of pricing French grain at "world" prices throughout the postwar period. Behind these figures lie carefully considered but uncertain opinions, based in large part on the information and conclusions presented on earlier pages of the present study.

Although the margins of uncertainty and error are large, the figures in Table 5 and the information on which they are based appear to warrant five major generalizations.

²⁵ In 1951/52 France was a net importer of 643 thousand tons of wheat including flour and paste; whereas in all subsequent years except 1956/57 she was a net exporter. Until 1956/57 she ranked as a sizable net importer of feed grains, thereafter as a regular net exporter, except in 1958/59.

First, both the total cropland and the total grain area of France would have expanded during the 1950's even if French producers had received "world" prices for their grain; but the expansion would have been significantly less than that actually recorded. The small part of the increase in cropland that reflected delayed recovery from wartime handicaps would have taken place anyway. So, too, would something like half or more of the remaining increase that primarily represented improved use of fallow land, shift from permanent to better temporary pastures with occasional plow-up and seeding of grain or root crops, and return to cultivation of unused agricultural land for which ownership titles were made more secure or government plans for consolidation were effective. This suggests that of the total increase in cropland over the ten years ending 1959-62, roughly three-fifths to two-thirds would have been recorded even in the absence of the special price protection which the French government gave the leading grains. Loss of that protection, however, would not only have reduced the total crop area of 1959-62, but also would have cut the share of grain below the near-record low of 50.3 per cent reported for 1959-62.²⁶ (These facts and inferences are consistent with the assumption accepted for Table 5 that continued pricing of French grain on a "world" basis during the 1950's would have reduced the reported ten-year increase in the grain area by 50-70 per cent, and the average area reported for 1959-62 by 3-4 per cent, an assumption independently arrived at on the basis of other facts and relationships.)

Second, under such conditions, wheat would have suffered a greater loss of area than feed grains. Barley would have taken over a considerable part of the land lost by wheat, and maize, though more sharply cut in price by adjustment to a "world" basis, could still have been profitably expanded in favorable areas owing to the unexhausted impetus generated by recent introduction of high-yielding hybrid seed. (For Table 5 it has been assumed that wheat, officially reported to have covered 47.0 per cent of the actual grain area of 1959-62, would have remained on only 46.0 to 46.5 per cent of the smaller area planted to grains if prices had been on a "world" basis, both the reported and the approximated percentages being lower than they would have been in the absence of unfavorable weather for planting the 1961 crop.)

Third, since the phenomenally sharp increase in grain yields per hectare in the 1950's—51.5 per cent—accounted for the great bulk of the increased production between 1949-52 and 1959-62, the most important single question is what effect lower "world" prices would have had in restraining the increase in yields. The impact would have been greatest on the large, efficiently run farms of northern France. By 1959-62 operators of those farms had raised inputs of fertilizers, pesticides, and man-and-machine hours close to calculated optimum levels. At lower "world" prices, they could have continued to maximize their profits (as then calculated) only by somewhat reducing such inputs, an adjustment that

²⁶ It seems probable that this reduction would have been significant but not large in view of (1) the historically small changes that have been recorded in this ratio from one five-year period to another in peacetime periods (Table 2, p. 242), (2) the limited size of the price cuts required to put the net prices of most French grain on a "world" basis, particularly to large producers, and (3) the nature of possible alternative crops that might have been grown, many less favored than grain by the "agricultural revolution" or more disadvantaged by shortage of labor. For purposes of calculation, the reduction is here approximated at 1-2 per cent below the level actually reported, suggesting that at "world" prices grain would have occupied 49.2-49.8 per cent of the total crop area of 1959-62, as compared with a reported 50.3 per cent.

would have resulted in appreciably lower yields. On the other hand, most French producers were still using fertilizers and other capital inputs so sparingly in 1959–62 that the grain price reductions envisaged on the basis of “world” levels would not have warranted any cutback in use of these yield-raising elements. Even so, the associated reduction of cash income and the psychological influence of lower grain prices would probably have resulted in some reduction. (For Table 5 the assumption has been made that at “world” prices, the average yield per hectare of both wheat and all feed grains combined would have been only one to three per cent lower than reported in 1959–62.²⁷ This reflects the belief that the “agricultural revolution” would have pushed French grain yields up almost 50 per cent over the ten-year period—roughly 95 per cent of the yield increase actually recorded—even if French grain prices had been at the lower “world” levels.)

Fourth, these considerations suggest that French grain production might have averaged 1.0 to 1.5 million tons less annually during 1959–62 if the French government had not kept the major grains priced above “world” levels. Although the indicated reduction is only 4 to 7 per cent, it would have been enough to wipe out half of the average annual net exports of 2.5 million tons which France pushed into world markets with the aid of export subsidies and special agreements during this period. By any economic standard such a reduction of competitive exports would have represented a significant enlargement of the commercial import markets available to other exporting countries.

Implications for the Future

Even if the approximations in Table 5 properly reflect the effect of pricing French grains above “world” levels during 1950–62, they may nevertheless unduly minimize the role of government intervention in creating and maintaining disturbing world surpluses of grain. For wheat, if not also for maize and barley, the available evidence suggests that international “commercial” prices have been held significantly above long-term equilibrium levels since the mid-1950’s by means of government controls over prices, marketings, and residual stocks operated primarily by the two leading North American exporting nations. To the extent that “world” prices were thus inflated, French wheat production was presumably stimulated by national and international price intervention even more than Table 5 suggests.

Looking to the future, it seems clear that marked technological and agricultural advances of many types will continue to be witnessed both in France and in other countries of the European Community. Such advances are likely to be speeded and extended by the Commission’s constructive emphasis on plans to increase agricultural efficiency. It is therefore reasonable to expect persisting increases in yields per hectare and production of grain, successful efforts to save costly farm labor through reorganization of farm work and more mechanization, and declining real costs per ton of grain produced. Under such conditions,

²⁷ In view of the assumed changes in grain price ratios and the differing levels of fertilizer application on the different grains and in the various regions of France, one might expect smaller declines in the yields of most individual feed grains than of wheat. But since the altered price conditions would have brought a change in area composition of the feed grain aggregate that would have reduced its average yield, the net reduction from the reported average yield of 1959–62 might have been almost the same for the feed grain total as for wheat.

the real prices of the various grains, and wheat in particular, should move downward both substantially and persistently from current levels.

If, in the face of such changes, the Common Market governments insist on harmonizing the Community's grain prices at levels that will maintain or even push up the real prices of grain received by French producers over the coming decade, the grain production of France may be expected to expand sharply and the feeding of grain to livestock to increase less than consumer food preferences and general economic conditions would otherwise warrant. Such excessive real prices would seriously affect the interests of the leading grain exporting countries by adding another three to six million tons (say 100 to 250 million bushels) of grain to the increased exportable surplus that France will almost certainly have at the beginning of the 1970's solely as a result of continuing agricultural improvements even if unstimulated by national or international price protection.²⁸

In addition, such inflated grain prices would adversely affect the land-use pattern and cost-price structure of French agriculture and also the interests of consumers in the Common Market countries. Land that otherwise would be in pasture would be shifted to grain production; land values and rents would rise, weaving into the cost structure the discounted value of the anticipated high grain prices; and applications of fertilizers and other capital aids would be pushed up to levels out of line with long-term equilibrium prices. Simultaneously and no less significantly, the higher grain prices would raise the cost of feedstuffs, keep meat prices high and hold down expansion of meat consumption, retard the development of grain-feeding of cattle, and seriously curtail the expanding use of grain for feed. Such use is the only potentially big outlet for world grain surpluses in developed countries and the chief hope of bringing the grain-livestock economy of the European Economic Community into better balance with the dietary desires of consumers and general long-term economic trends.

Fortunately, the basic Grain Regulation of the European Community does not include a rigid, highly protective pricing guide. Fortunately, too, it appears to be administratively possible for approved representatives of the EEC to negotiate with outside exporting countries the general level at which the Community's grain prices will be set—if not for 1964/65, at least for years farther ahead. The chief hope for the future of the world grain economy lies in negotiations of this type, which will meet a first crucial test in the "Kennedy Round." If both the EEC and the United States take a more constructive, liberal economic approach to their own agricultural and trade problems, and if, in addition, they join with other GATT governments in approving badly needed modification of certain GATT provisions relating to agricultural products (e.g., those permitting excessive, trade-restrictive use of exemptions and escape clauses), the year 1964 may long be remembered as the turning point away from distorting agricultural price supports, essentially unscalable import barriers, and trade-disturbing export subsidies.

Many experts consider it desirable or even essential to supplement the forthcoming GATT negotiations with an International Grain Agreement. Such an Agreement might be economically constructive, or it might be disturbing or ineffectual, depending on what it attempts to achieve and the instruments it

²⁸ The concluding chapter of the forthcoming book referred to above, p. 225, will contain additional discussion of this subject.

employs. At present two very different proposals for an International Grain Agreement warrant attention.

The first, currently in the limelight, would establish higher "world" prices than now exist for commercial exports of grain, particularly wheat, optimistically counting on diversion of increasing surpluses to underdeveloped countries in the form of questionable "development aid." Such a price-raising Agreement, enforced in the face of persisting reduction in production costs associated with continuing rapid technological improvements, would encourage additional expansion of grain production in many commercial importing and exporting countries. In the European Community, it would strengthen the influence of proponents of higher price supports and reduce the restraining burden of export subsidies. Although low-cost producers in the major exporting countries would gain a short-term price advantage, they would simultaneously face a contracting commercial export market and intensified export competition—even competition to supply grain as "development aid." The long-term imbalance in the world grain economy would thus be exaggerated rather than lessened by such an Agreement.

In contrast, it should be possible to frame an International Grain Agreement that would strike at the root of the current world imbalance by gradually adjusting inflated national price supports downward to equivalent international levels. Such an Agreement might commit participating nations to make similar annual reductions in domestic price supports that are higher than, say, 90-95 per cent of the average "world" market price of the three to five preceding years. In the European Community, the United States, and other countries with currently inflated price supports, an Agreement of this type would lower prices to consumers, increase utilization of grain as livestock feed, and promote needed resource adjustments, while guaranteeing to grain producers minimum prices that are realistic and economically defensible. The international effects would be equally or more important. Such an Agreement would increasingly expand international commercial trade in grain in line with relative national costs, and permit "world" import prices to reflect and balance the changing forces of world supply and demand. This implies, of course, international safeguards to assure non-competitive, constructive liquidation of government surpluses, probably with some special provision for the maintenance of modest price-stabilization reserves.

CITATIONS

- 1 Michel Augé-Laribé, *L'Evolution de la France agricole* (Paris, 1912).
- 2 M. K. Bennett, "Trends of Yield in Major Wheat Regions since 1885: Part 1, General Considerations and Rising Trends," *Wheat Studies of the Food Research Institute* (Stanford, Calif.), Vol. XIV, No. 3, Nov. 1937.
- 3 Centre de Recherches d'Economie et de Sociologie Rurale de l'Ouest Agricole (Ecole Nationale Supérieure Agronomique de Rennes), "Structures de la France agricole," *Etudes d'économie rurale*, Vol. 12, No. 38, Dec. 1961.
- 4 J. F. Dewhurst, J. O. Coppock, P. L. Yates, and Associates, *Europe's Needs and Resources: Trends and Prospects in Eighteen Countries* (Twentieth Century Fund, New York, 1961).
- 5 Folke Dovring, *Land and Labor in Europe 1900-1950* (The Hague, 1956).
- 6 European Economic Community (EEC), Commission, *La Consommation des engrais dans les pays de la C.E.E.* (Etudes, série agriculture No. 8, 1962).

- 7 ———, Statistical Office, "L'Utilisation des terres," *Statistique agricole*, No. 5, 1959.
- 8 H. C. Farnsworth, "American Wheat Exports, Policies, and Prospects," *Food Research Institute Studies* (Stanford, Calif.), May 1960.
- 9 ———, "The Problem Multiplying Effects of Special Wheat Programs," *American Economic Review*, May 1961; also *Food Research Institute Papers*, No. 4-61.
- 10 H. C. Farnsworth and W. O. Jones, "Response of Wheat Growers to Price Changes: Appropriate or Perverse?," *Economic Journal* (London), June 1956.
- 11 Food and Agriculture Organization (FAO), *Production Yearbook 1962*.
- 12 France, Institut National de la Statistique et des Etudes Economiques (INSEE), *Annuaire statistique de la France: Retrospectif 1961*.
- 13 ———, "L'Espace économique française," *Etudes et conjoncture*, Numéro spécial, 1951.
- 14 ———, *Recensement général de l'agriculture de 1955: Caractéristiques générales des exploitations*, Vol. I (1958).
- 15 *Ibid.*, Vol. II (1959).
- 16 ———, Ministère de l'Agriculture, *Cahiers mensuels de statistique agricole*, No. 76, June 1963.
- 17 ———, *Revue du Ministère de l'Agriculture*, Supplements to issues of January and February 1953.
- 18 ———, "La Valeur des terres agricoles en France en 1959," *Revue du Ministère de l'Agriculture*, No. 166, June 1960.
- 19 ———, *Statistique agricole 1961*.
- 20 ———, *Statistique agricole 1962*.
- 21 ———, *Statistique agricole*, various issues.
- 22 G. Gindert, "Die Betriebswirtschaftliche Stellung des Körnermaisbaues in der E.W.G.," *Berichte über Landwirtschaft*, Heft 1, 1962.
- 23 D. Grupe, "Entwicklung und Möglichkeiten der Getreideproduktion in Frankreich," *Agrarwirtschaft*, Vol. 9, No. 10, Oct. 1960.
- 24 International Institute of Agriculture, *International Yearbook of Agricultural Statistics*, 1910 through 1941/42-45/46.
- 25 Naum Jasny, *Competition Among Grains* (Food Research Institute Grain Economics Series, No. 2, Stanford, Calif., 1940).
- 26 Joseph Klatzmann, *La Localisation des cultures et des productions animales en France* (France, INSEE, Paris, 1955).
- 27 Mirko Lamer, *The World Fertilizer Economy* (Food Research Institute Studies on Food, Agriculture, and World War II, Stanford, Calif., 1957).
- 28 Organization for Economic Cooperation and Development (OECD), *Fertilizers: Production, Consumption, Prices and Trade, 1960-63* (12th Study, Paris, 1963).
- 29 Organization for European Economic Cooperation (OEEC), *Fertilizers in Agricultural Recovery Programmes* (Paris, n.d.).
- 30 ———, *Fertilizers in Europe: Production, Consumption, Prices and Trade, 1958-61* (10th Study, Paris, 1961).
- 31 ———, *Manures and Fertilizers: Potential Progress in Europe* (Paris, 1954).
- 32 ———, *Pasture and Fodder Development in Mediterranean Countries* (Paris, 1951).
- 33 ———, *Pasture and Fodder Production in North-West Europe* (Paris, 1954).
- 34 Alphonse Vernier, "Les Facteurs que gênent les exploitations agricoles," *Etudes et conjoncture* (France, INSEE), March 1963.
- 35 L. A. Vincent, "L'Exode agricole en France depuis 1900: Sa liaison avec les taux de productivité et l'élasticité de consommation," *Etudes et conjoncture* (France, INSEE), Vol. 18, February 1963.
- 36 ———, "La Productivité nationale en France de 1949 à 1961," *Etudes et conjoncture* (France, INSEE), Vol. 17, May 1962.
- 37 M. S. Williams and J. W. Couston, *Crop Production Levels and Fertilizer Use* (FAO, 1962).

APPENDIX TABLE I.—LONG-TERM TRENDS IN GRAIN AREAS, YIELDS PER HECTARE, AND PRODUCTION IN FRANCE, 1885-1962*

Year of harvest	Total reported ^a	Wheat	Rye, barley, oats, maize	Other reported ^b	Rye	Barley	Oats	Maize
AREA (<i>thousand hectares</i>)								
1885-88	14,428	6,964	6,847	617	1,640	927	3,720	560
1889-93	14,335	6,783	6,950	602	1,552	953	3,887	558
1894-98	14,322	6,882	6,872	568	1,503	861	3,929	579
1899-1903	13,858	6,728	6,549	581	1,390	740	3,888	531
1904-08	13,400	6,539	6,315	546	1,256	713	3,854	492
1909-13	13,400	6,539	6,386	475	1,198	755	3,966	467
1924-28	11,197	5,381	5,357	459	819	704	3,490	344
1929-33	11,005	5,373	5,218	414	719	742	3,417	340
1934-38	10,634	5,224	5,025	385	663	742	3,278	342
1949-52	8,667	4,272	4,133	272	479	988	2,334	332
1951-54	8,750	4,314	4,172	264	426	1,132	2,243	371
1955-58	8,925	4,145	4,419	361	367	1,630	1,862	560
1959-62	9,227	4,341	4,685	201	283	2,128	1,432	842
YIELD (<i>100 kg. per hectare</i>)								
1885-88	11.3	11.8	10.8	9.6	10.2	11.8	10.7	12.3
1889-93	11.1	11.5	10.7	10.0	10.6	11.5	10.4	11.6
1894-98	12.0	12.9	11.3	9.8	11.2	12.0	10.9	12.1
1899-1903	12.4	13.7	11.4	9.5	10.6	12.7	11.3	12.1
1904-08	12.6	13.8	11.7	8.1	10.9	12.5	11.8	11.2
1909-13	12.8	13.2	12.5	10.3	10.4	13.9	13.0	12.0
1924-28	13.8	14.2	13.6	10.8	11.3	15.0	14.0	12.3
1929-33	14.6	15.4	14.1	11.2	11.6	14.8	14.4	14.7
1934-38	14.6	15.6	13.8	10.3	11.6	14.5	13.9	15.8
1949-52	16.3	18.3	14.5	11.8	11.6	16.2	14.6	13.3
1951-54	18.2	20.3	16.4	13.4	11.5	18.0	15.9	19.8
1955-58	21.3	22.2	21.4	10.8	12.4	25.5	18.1	26.3
1959-62	24.7	26.6	23.2	19.4	14.0	25.9	18.8	26.6
PRODUCTION (<i>thousand metric tons</i>)								
1885-88	16,240	8,240	7,410	590	1,660	1,090	3,970	690
1889-93	15,860	7,830	7,430	600	1,650	1,100	4,030	650
1894-98	17,120	8,880	7,680	560	1,680	1,030	4,270	700
1899-1903	17,200	9,210	7,440	550	1,470	940	4,390	640
1904-08	16,854	9,040	7,370	444	1,370	890	4,560	550
1909-13	17,141	8,640	8,010	491	1,240	1,050	5,160	560
1924-28	15,410	7,630	7,284	496	925	1,055	4,880	424
1929-33	16,123	8,300	7,361	462	831	1,099	4,930	501
1934-38	15,491	8,140	6,956	395	769	1,074	4,572	541
1949-52	14,146	7,830	5,995	321	557	1,599	3,396	443
1951-54	15,958	8,771	6,834	353	488	2,040	3,573	733
1955-58	19,019	9,183	9,446	390	456	4,151	3,365	1,474
1959-62	22,784	11,546	10,848	390	397	5,516	2,692	2,243

* Data for 1885-1913 from France, INSEE, *Annuaire statistique de la France: Retrospectif 1961* and *ibid. 1951*; for 1922-38 and 1945-61 from France, Ministère de l'Agriculture, *Statistique agricole*, various issues, and *Revue du Ministère de l'Agriculture*, various issues; and for 1962 from *Cahiers mensuels de statistique agricole*, Supplement July 1963.

^a Includes wheat, rye, barley, maize, buckwheat, and rice (when significant) in all years, with minor crops reported only in later years as indicated in footnote ^b.

^b Buckwheat, which accounted for most of the area and production prior to World War II, and rice (insignificant before 1908) were the only other grains reported before 1913. Coverage was expanded by the addition of mixed grains and millets from 1924, and by the further addition of sorghum and "other minor cereals" after World War II.

APPENDIX TABLE II.—REGIONAL DISTRIBUTION OF ARABLE LAND AND MAJOR ROTATION CROPS IN FRANCE, 1924, 1935, 1952, AND 1960*
(Million hectares)

Year ^a	N	WC	EC	S	N	WC	EC	S	N	WC	EC	S
	ARABLE LAND				SPECIFIED CROPS ^b				FALLOW AND OTHER ^c			
1924	4.39	7.76	4.45	6.00	3.72	6.54	3.45	4.71	.67	1.22	1.00	1.29
1935	4.09	7.55	3.97	5.42	3.66	6.70	3.34	4.53	.43	.85	.63	.89
1952	3.73	6.87	3.32	4.63	3.43	6.27	2.95	3.94	.30	.60	.37	.69
1960	3.76	6.95	3.42	4.87	3.58	6.59	3.20	4.41	.18	.36	.22	.46
Change												
1924-60	-.63	-.81	-1.03	-1.13	-.14	+.05	-.25	-.30	-.49	-.86	-.78	-.83
1952-60	+.03	+.08	+.10	+.24	+.15	+.32	+.25	+.47	-.12	-.24	-.15	-.23
	GRAIN				ROOT CROPS				GREEN FODDER ^d			
1924	2.43	3.88	2.22	2.90	.49	1.22	.51	.70	.80	1.44	.72	1.11
1935	2.33	3.69	2.03	2.71	.59	1.36	.53	.70	.74	1.65	.78	1.12
1952	2.03	2.94	1.58	2.15	.66	1.22	.40	.45	.74	2.11	.97	1.34
1960	2.23	3.01	1.66	2.30	.65	1.19	.38	.42	.70	2.39	1.16	1.69
Change												
1924-60	-.20	-.87	-.56	-.60	+.16	-.03	-.13	-.28	-.10	+.95	+.44	+.58
1952-60	+.20	+.07	+.08	+.15	-.01	-.03	-.02	-.03	-.04	+.28	+.19	+.35
	WHEAT				RYE				BARLEY			
1924	1.14	1.86	1.00	1.34	.08	.26	.17	.38	.15	.30	.15	.12
1935	1.17	1.86	.96	1.35	.04	.18	.12	.32	.14	.32	.15	.12
1952	1.09	1.49	.73	.98	.02	.13	.08	.20	.26	.40	.20	.21
1960	1.16	1.53	.75	.92	.01	.08	.05	.16	.66	.71	.45	.27
Change												
1924-60	+.02	-.33	-.25	-.42	-.07	-.18	-.12	-.22	+.51	+.41	+.30	+.15
1952-60	+.07	+.04	+.02	-.06	-.01	-.05	-.03	-.04	+.40	+.31	+.25	+.06
	OATS				MAIZE				FALLOW			
1924	1.00	1.14	.80	.56	.00	.00	.03	.30	...	...	...	...
1935	.95	1.08	.73	.52	.00	.00	.03	.31	...	...	...	...
1952	.64	.77	.51	.36	.00	.01	.03	.31	.10	.43	.31	.49
1960	.32	.54	.33	.23	.07	.07	.05	.63	.04	.18	.17	.27
Change												
1924-60	-.68	-.60	-.47	-.33	+.07	+.07	+.02	+.33	...	...	...	...
1952-60	-.32	-.23	-.18	-.13	+.07	+.06	+.02	+.32	-.06	-.25	-.14	-.22

* Data compiled from France, Ministère de l'Agriculture, *Statistique agricole 1960* and earlier issues. Regions as shown on Map 3-A, p. 234: North (N), West Central (WC), East Central (EC), and South (S). See also Chart 6 and its general footnote.

^a Year of harvest.

^b Summation of the area under grains, root crops, and green fodder crops as specified below.

^c Residual: reported arable land minus crops specified in ^a.

^d Including temporary pastures.

APPENDIX TABLE III.—RATIOS TO WHEAT: AVERAGE PRICES TO PRODUCERS, YIELDS PER HECTARE, AND VALUES PER HECTARE OF SPECIFIED GRAINS, SELECTED PERIODS, 1885-1963*

Crop years	Price				Yield				Value per hectare			
	Rye	Barley	Oats	Maize	Rye	Barley	Oats	Maize	Rye	Barley	Oats	Maize
1885-89	71	70	76	70	86	100	91	104	61	70	69	73
1889-94	73	74	83	76	92	100	90	101	67	74	75	77
1894-99	70	75	81	76	87	93	84	94	61	70	68	71
1899-1904	77	80	87	81	77	93	82	88	60	74	72	72
1904-09	75	80	86	85	79	91	86	81	59	72	73	69
1909-14	75	74	78	81	79	105	98	91	59	78	77	74
1924-29	83	79	73	78	80	106	99	87	66	83	72	68
1929-34	58	73	41	63	75	96	94	95	44	70	38	60
1934-39	69	73	61	76	74	93	89	101	51	68	54	77
1951-55	75	72	61	101	57	89	78	98	42	64	48	98
1955-59	79	79	68	112	56	115	82	118	44	91	55	133
1959-63 ^a	78	82	74	98	53	97	71	100	41	80	53	98

* Price ratios for each period calculated from annual (typically crop-year) average prices, based on data from the following sources: 1885-1914 from France, Ministère de l'Agriculture, *Statistique agricole annuelle 1931*, and Statistique générale, *Annuaire statistique de la France 1932*; later data mainly from similar more recent official sources and for the most recent years primarily from EEC, *Prix agricole* (net average prices to producers) and estimates of the Food Research Institute. Detailed price data for the past 16 years will be presented in the forthcoming book referred to in the general note to this study. Yield ratios calculated from data in Appendix Table I. Value per hectare ratios represent the multiplication of the price and yield ratios.

^a Preliminary. Average net prices for the crop years 1961/62 and 1962/63 are partly estimated: they are based on calculated net average minimum prices which for 1962/63 resulted in somewhat lower ratios than the market prices (minus taxes) actually received by producers.