CHAPTER VIII
GRAIN AND ALCOHOL

Our Allies and the enemy countries have restricted the manufacture of alcoholic beverages. The neutrals surrounding the Central Empires have also restricted the manufacture of alcoholic beverages. The inevitable conclusion is that the manufacture of these beverages represents a waste in grains that must be curtailed in war time. Naturally the same proposition was advanced in our country in the earliest days of the campaign for the restriction of waste. The situations are somewhat different, in that the countries in Europe are grain-importing countries while we are a grain-exporting country. Whenever our people are appealed to for reduction of waste, it is retorted that one waste directly under governmental control lies in the manufacture of alcoholic beverages. To this the reply is made by the trade in alcoholic beverages that the income derived therefrom more than compensates for the amount of grain consumed.

A judicial survey of the problem indicates that there are several factors that must be separated and
clearly evaluated: (1) The loss in grain that attends the manufacture of alcoholic beverages viewed as a total process, a problem in nutrition; (2) the loss of revenue that would attend the enactment of prohibition; (3) the purely ethical motives that formed the basis for the pre-war prohibition movement; (4) the bearing of alcoholism upon national efficiency in war time as a war-time problem; and (5) the relations of alcohol as a narcotic to the stress of an intensive warfare.

For us at this place the nutritional question involved in the manufacture of alcoholic beverages is alone to be considered. There has been a great deal of misapprehension concerning this, as was to have been expected when a peace-time problem has been carried over into war time. On the part of the proponents of prohibition exaggerated statements of the nutritional units concerned in the manufacture of alcoholic beverages have been widely circulated. On the other hand, certain interests concerned with the manufacture of alcoholic beverages have endeavoured to make it appear that a gain in nutritional units is accomplished through the fermentation of grain. The data are available to every one and the interpretation clear. Three sentences suffice to summarize the scientific conclusions:

(1) The grains employed in the manufacture of alcoholic beverages are predominatingly feed grains
and not bread grains, and the total amount employed represents on an average not much over 2 per cent of the total grain production;

(2) If the grains devoted to the manufacture of alcoholic beverages be devoted to the feeding of domesticated animals, there will be little gain as compared to the results when the same grains are used in the manufacture of alcoholic beverages and the spent residues devoted to the feeding of live stock;

(3) There would be a large gain if the grains devoted to the manufacture of alcoholic beverages should be devoted directly to the feeding of human beings.

The following paragraphs will make these relations clear. During the fiscal year ending June 30, 1916, the materials required for the manufacture of distilled spirits were in round figures as follows, in bushels: Malt, 4 million; corn, 32 million; rye, 3 million; oats, wheat and other cereals up to a total of 39,500,000 bushels. This grain is all supposed to be grain of good quality but it is not necessarily grain of millable quality. All of these grains are of course of quality fit for the feeding of domesticated animals. In addition, molasses was used to the extent of over 152,000,000 gallons. The money value of these ingredients was somewhere in the neighbourhood of $44,000,000.
The money value of the distillers' spent grains was somewhere in the neighbourhood of $9,000,000. These figures represent a large increase over the figures of the previous year, but this increase was due principally to an augmented demand for alcohol used in war industries.

An analysis of the data indicates that of the total production, 249,000,000 gallons, of distilled spirits in 1916, some 123,000,000 gallons were manufactured for purposes of human consumption, leaving 126,000,000 gallons that were devoted to technical use in industry, arts and the sciences. With the continuation of the war it is clear that our production of industrial alcohol must be progressively augmented. We are unable to hope that in the immediate future there will be any reduction in the utilization of grains for the manufacture of industrial spirits. The whisky now in bond could be redistilled — over 200,000,000 gallons were in the bonded warehouses in June, 1917. The molasses used in the manufacture of distilled spirits was in the past always molasses of feeding grade and not of the quality employed as human food. During the past year, however, owing to conditions in the manufacture of sugar, a great deal of molasses entirely fit for human consumption was used in distilleries.

We face the necessity of securing non-edible ma-
terials from which alcohol may be prepared. Many substances are available to a greater or less extent in different portions of the country, were the methods of utilization developed as they have been abroad. Sweet and white potatoes, kañírcorn and sorghum grains ought to be included. In Germany the manufacture of alcohol from potato has been successfully practised for a long time and the excess sweet and white potatoes of this country would yield a large amount of alcohol. Sugar beet pulp, now utilized as a stock feed, also yields alcohol under appropriate processing, and the same is true of the residues of the sugar cane. The sulphite liquors of pulp mills, straw and sawdust can all be employed for the manufacture of alcohol and are indeed so employed in this country on a small scale. Garbage represents a source of carbohydrate from which alcohol may be produced. Unfortunately the development of processes for the manufacture of alcohol from other substances than grain and molasses is in its very beginning in this country, and it does not seem possible to hope for great expansion in these directions in the immediate future. Under these circumstances, we fear that during the next year more grain will be employed in the manufacture of alcohol for industrial purposes than was last year employed in the manufacture of distilled spirits for beverages and industrial
purposes combined. If the manufacture of alcohol be permitted to such distilleries only as are equipped to dry and market the spent grains the losses will be minimal.

Corn is our heaviest crop and corn is the grain most used in the manufacture of whisky. If this corn were used in feeding live stock what would be the gain over the use of corn employed in the manufacture of whisky? It is impossible to answer the question by a single statement or figure on account of a necessary difficulty in the selection of a criterion. One must either judge from the standpoint of total energy values or from the standpoint of the gain in a single all-important constituent, protein. Decision from the standpoint of protein is easy; from the standpoint of total energy, difficult, or, indeed, impossible.

The use of protein as a criterion in deciding the question is made all the more advantageous by the fact that in the feeding of live stock in this country protein is a much more important factor than carbohydrate or pure energy-producing material. Now when corn is converted into whisky all of the protein remains in the distillers' grains. If these were all recovered, dried and used as a stock feed, they would contain all of the original protein value of the grain. There are well-grounded objections to the use of distillers’ slops and moist distillers’
grains for feeding; but when distillers' grains are dried and heated these objections disappear, so that used as a concentrate in connection with other feeds, dried distillers' grains form a first-grade feeding-stuff.

The real question then becomes: What proportion of distillers' grains are employed as stock feed? It is impossible to obtain accurate figures. With the ascending price of cattle feed, the distillers can afford to recover their spent grains more carefully, and prepare them for the market by drying. As a matter of fact they are becoming more and more widely used as ingredients of mixed stock feeds. Unquestionably there is still loss in connection with small distilleries lying in more or less out of the way localities. Nevertheless, viewing the matter as a whole, it is clear that in the conversion of corn into whisky, there need be little loss of nutrient units from the standpoint of conservation. If the particular corn used in the manufacture of whisky were used instead as human food there would be a large gain, as will be later shown; but when one realizes that the consumption of corn as human food in this country is less than 10 per cent of the available crop, even this statement of the argument is somewhat forced.

During the fiscal year ending June 30, 1916, barley to the extent of over 52,000,000 bushels was
converted into malt for use in the manufacture of beer, including in this term all brewed beverages. In addition to this some 13,000,000 bushels of corn, including grits and cerealine, and 2,500,000 bushels of rice were also employed. The amount of sugar used is not recorded. This does not represent the total amount of barley converted into malt. There was a relatively heavy export and malt is also employed to a considerable extent by bakers and in various technical industries.

Now this amount represents from a third to a fourth of the whole of the ordinary crop of barley in our country. Barley in the United States is largely a feed grain, the manufacture of barley flour being practically unknown before the war. A certain amount of pearled barley and barley preparations were used in the diet of children and of the sick, and barley breakfast foods have also appeared upon the market. But barley in the distant past was regarded as a bread grain. In the pre-war period barley was used for bread in Russia, Sweden and Norway, and to some extent in Germany, where it was also widely consumed in the state of pearled barley. There is a common notion with American stockmen that barley has a low nutritive value as a feed for domesticated animals. This is entirely untrue. Barley, largely used either as barley offal or as the crushed grain, is an excellent
concentrated feeding-stuff, and, in Denmark and Germany, where the feeding of domesticated animals has been much more specialized than in this country, barley is a favourite feeding grain, particularly for swine.

The rice used in the manufacture of beer is in large part not such rice as could be sold for table rice, consisting more of broken rice, screenings and uneven grades that, perfectly good in themselves, are excluded by the standards of the market. Grits and cerealine also, while perfectly good products, are not high grade in market classification. If these grains were not employed in the manufacture of beer they would probably be used as feed for domesticated animals or poultry. If the barley employed in the manufacture of beer were used for animal feed directly there would be little gain in the exchange. About 15 per cent of the protein of the barley re-appears in the beer. A certain percentage, let us say, 10 per cent, is contained in the yeast. A certain percentage is in the sprouts and the remainder in the brewers' grains.

The sprouts are used largely in the manufacture of yeast for bread-making and also in other technical industries, though employed to some extent as a high-grade stock feed. The yeast ought to be entirely saved and used as stock feed, and in the best breweries it is not wasted. In many smaller brew-
eries, however, there is a large waste in yeast. The dried brewers' grains proceeding from a unit of malt after the manufacture of beer is completed contain the largest fraction of the protein of the original barley. In view of the present price of feed it must be assumed that there is little wastage in spent grains and sprouts. Assuming that this wastage is as much as 10 per cent, it is apparent that domesticated animals receive at present about two-thirds of the protein contained in the original barley and that of the remainder the largest fraction goes into human food in the form of beer and in bread. Obviously there is, from the nutritional point of view, little loss when barley is employed in the manufacture of beer and the residues fed to domesticated animals contrasted with the results of direct feeding of the barley to animals.

A very different result however is obtained when the barley is used as human food. Transfer of barley from the brewery to the flour mill involves a gain in nutritive units for human consumption and a loss for domesticated animals. The gain and loss are not directly comparable, but the relations may be made clear. In accordance with the experience of European countries during this war, barley flour represents one of the best flours for admixture with wheat flour in the production of mixed flour bread. The best results are obtained, with
the lowest alteration in the bread-making qualities of the mixture, and with the least detectable change in taste of the bread and retention of the keeping qualities of the flour, when the barley is milled to not more than a 60 per cent extraction. If the barley were so milled, and the flour were employed as human food and the offal used as stock feed, about one-third of the protein would be in the grain offal and two-thirds in the flour. If the grain offal were fed under standard conditions to dairy cattle, the protein would be recovered to an extent of about 30 to 35 per cent; if fed to pork the protein would be recovered to an extent of about 25 per cent under favourable conditions. These same coefficients must be applied to the barley when used in the manufacture of beer and the residues used as stock feed.

On the one side of the comparison, then, we have the food units in the barley flour plus the food units obtained in milk, pork or beef as the result of feeding of the barley offal. On the other side of the comparison is the food unit in the beer plus the food units obtained in milk, pork and beef as the result of feeding the brewers' grains, sprouts, and yeast. The recoveries are in each instance highest in the case of milk and lowest in the case of beef. When the protein values of 50,000,000 bushels of barley are thus calculated, on the basis of standard feeding values and assuming that the grains are em-
ployed to the same extent both in the feeding of cattle and of swine, the gain in protein as human foodstuff when the barley is used in the manufacture of flour instead of in the manufacture of beer would amount to somewhere between 80,000,000 and 100,000,000 pounds of protein. This amount of protein is sufficient to meet the annual protein requirements of about 2,500,000 people. Exported to France and expressed in terms of bread, the American barley used in the manufacture of beer last year was equal to the normal bread ration of 7,000,000 people. This figure becomes more impressive when we recall that the beer here cannot be applied to a per capita ration.

The gain, however, in another sense would be still larger. What our Allies need is flour, and the flour of barley is entirely acceptable to them and can be mixed with wheat flour in the proportion of four to one. The loss in feed protein involved in the use of this barley as food is so small in contrast to our production of corn, oats, beans, cowpeas, cottonseed cake, linseed cake, and velvet beans as to fall outside of all consideration in the quantitative sense. Calculated in terms of milk, the protein value of brewers' grains is worth about 150,000,000 gallons of milk per annum. This, while a large figure, does not loom large against some 8,000,000,000 gallons of milk that are supposed to
be produced annually in this country. On the other hand, brewers' grains are not used evenly throughout the country in a geographical sense, but are used to a large extent in certain zones. In Wisconsin and Illinois and in the eastern dairy territory, the loss of dried brewers' grains would embarrass the feeding operations unless other proteins were made available. Such proteins, however can be made freely available; their utilization is merely a question of organization on the part of national and state departments of agriculture.

From all this it can be seen that there is not much occasion for discussion of grain and alcohol from the food-saving point of view, unless the people are prepared either to consume the barley flour themselves or to export this barley flour to our Allies. Merely to cease the manufacture of beer without provision for the utilization of the barley flour would accomplish almost nothing. The barley would simply remain as a slight addition to the stock of feed grains and little conservation would have been accomplished. If, however, the barley were milled, the flour would represent a very material addition of human food, an addition much needed because of the present low stock and short crop of wheat.