

IV. VERMARKTUNG / MARKETING / MARCHÉ

THE WORLD FOOD SITUATION IN THE YEARS AHEAD

J. R. Jensma

Summary

The demand for feed grains and high-protein meals in the OECD countries increases on average by an estimated 3 % per annum. In the past the demand could be met thanks mainly to the availability of large reserves of agricultural land in the USA. These reserves, however, are now largely exhausted and the question arises as to how the growing demand must be met in the future.

For the high-protein meals, the solution must primarily be sought in the expansion of the soybean area in Brazil (1 million hectare per year) and in the continued improvement of soybean yield in the USA (1 % per annum). The production of fishmeal will probably decrease while production of groundnuts will level off or even decline slightly. The total world protein production will increase by 2.2 % annually, so that shortages in protein supply may be expected.

As for feed grains, the production of maize in the major exporting countries will increase by 2.6 % per annum. Of this increase, 80 % originates from improved yields in the USA. Since the yield in this country has already reached a very high level, a drop in the annual percentage increase seems unavoidable. The barley production will increase by an estimated 2.1 % per year, half of the increased tonnage originating from the USSR.

It can be concluded that average annual increase in production of feed grains and high-protein meals will remain below the 3 % in the coming years. When demand continues to rise at this - or at a higher rate - sharp price increases for agricultural commodities on the world market will be inevitable.

Another factor contributing to the price increases is that agricultural production in the developing countries is not rising quickly enough. In most of these developing countries the percentage growth rate for population is higher than that for yield, so that production per capita will decrease. The consequent increase in the demand for imports will also cause worldmarket prices to increase.

Introduction

Since the times of Malthus the question has been asked whether the world could continue to feed its growing population. So far the answers have been affirmative. In recent time some experts have even claimed that double or triple the present world population could easily be fed.

In my opinion, however, the question is not being asked sensibly. The crucial point is not what the world's production potential is, but what the rate of increase of production is likely to be. If growth in population and prosperity were to create an increase in food demand of say 5 % per annum and if the rate of production increase were in practice only 3 or 4 %, a serious situation would arise, long before the theoretical maximum level of production were reached. It is on these aspects that attention is focussed in the present paper.

We have further paid more attention to the feed grain supply of the wealthy countries than to the food grain supply of the poor countries. Although from the humane point of view the needs of the latter are more urgent, it is the demand of the first group of countries that is felt far more strongly on the market place.

We have estimated that the demand for feed grains and high-protein meals will rise by 3 % per annum over the period 1970-1985. This figure is based on a detailed analysis of trends in meat and feed grain consumption in the OECD countries ¹). The relation between the consumption of the various meat types and the private consumer expenditure was established and the latter was extrapolated. The meat consumption thus estimated was converted into terms of the amount of animal feed required which resulted in a required rate of growth of feed production. This figure is of course sensitive to changes in income in these countries. If real incomes were to rise at a lower rate than they have done in the past, the demand for meat - and hence for feed - would also rise less rapidly. A 3 % growth in demand, however, seems a reasonably conservative estimate, even if prosperity were to grow less than it did in the past.

To estimate an increase in production is more complicated, particularly when large areas of non-cultivated land are available for realising such an increase. Where and when this is not the case, estimates are more reliable since they can be based on trends in yield increase. I have, for the sake of argument, assumed that no readily usable land is available in the countries under discussion. The exceptions to this rule are mentioned separately.

1) Australia, Austria, Belgium, Canada, Denmark, Finland, France, West-Germany, Iceland, Ireland, Italy, Japan, Luxembourg, Netherlands, New Zealand, Norway, Spain, Sweden, Switzerland, United Kingdom, United States, Yugoslavia.

This paper is therefore based on the following assumptions:

1. Demand for feed grain and high-protein meal in the OECD countries will rise by 3 % annually on account of the combined effect of increases in prosperity and population.
2. Availability of new cultivatable land is or will become a major limiting factor in crop production in the main growing areas, unless otherwise stated.
3. Trends in yield increase or decrease over the period 1945-1972 can be extrapolated linearly to obtain a fair estimate of future rates of change.

High-protein feeds

Table 1 shows the production and the expected growth therein for the major sources of protein used in animal feed.

Table 1: World production of major proteins for animal feeds and the estimated growth therein

Protein source	Production in 1970 (million tons protein)	Estimated annual growth in production, 1970-1985	
		% ¹⁾	(million tons protein)
Soybean, USA	15.0	1.0	0.15
Soybean Brazil	2.1	22.0	0.46
Fishmeal	3.5	-2.0	-0.07
Groundnut	3.7	-0.2	-0.01
Others	5.7	2.0	0.11
Total	30.0	22.8	0.64

1) 1970 = 100 %

The 1 % growth of the US soybean production, which is based on the post-war trend in yield increase, would be higher if

- large areas of non-cultivated land were available for growing soybeans,
- the demand for soybean were to increase more rapidly than that for maize and cotton,
- new varieties and technologies were available so that a breakthrough in yield could be achieved within 5 years.

These conditions are open to discussion, but I do not think any one of them likely. Thus, although I do not exclude the possibility of a more rapid rise in yield after, say, 1980, I believe that the era of rapid expansion of

production in line with demand has passed. 1)

The situation in Brazil is different in that land is available for rapid expansion. This is due to the introduction of double cropping by which, in the course of one season, a cereal crop is followed by a soybean crop. The Brazilian government expects a soybean area expansion of 1 million ha per annum and, although the accuracy of this forecast is difficult to assess, it is certain that a large potential is available. It is, however, likely that an increasing share of Brazil's production will be used domestically. Income and population are growing very rapidly and this will certainly create a large demand for meat products.

Fishmeal production is more problematic. The general opinion amongst experts is that the dangers of overfishing are clearly apparent (IDYLL, 1973), and that the maximum attainable catches have been reached. The danger of a decline is therefore obvious and this can only be prevented if international agreement on quotas are reached. Such agreement is emerging, but we do not expect it to be operative on a truly international scale within the next 10 years. As a consequence we expect an annual decrease in fishmeal production of 2 %.

Neither can the groundnut prospects be considered to be very bright. Table 2 shows the trends in exporting countries. Of the world export of groundnut meal, 80 % originates from India, Senegal and Nigeria. These countries have been suffering from drought for the last ten years, and their yields have consequently gone down. If this drought is a permanent phenomenon, as it may well be (BRYSON, 1973), then a further decline in yield is possible. In neither of the 3 countries is an expansion of area likely. So a further fall in production must be reckoned with.

In Table 1, the category "Others" includes meals from cottonseed, rapeseed, linseed and copra; their quality is inferior to that of the other meals and they are not therefore interchangeable with the better-quality meals. Nevertheless, they are valuable as additional sources of protein and their growth is estimated at 2 %, a figure which is based mainly on yield increases. Thus the "protein balance" in Table 1 indicates a projected annual increase of 2.2 % instead of the 3 % required for sustained growth in prosperity and population. Moreover two thirds of this projected growth must be supplied by Brazil.

1) Upon finishing this manuscript we received a USDA publication (The Farm Index, US Department of Agriculture, Dec. 1973, pp. 8-17) in which it was claimed that there was still sufficient land available to expand the maize and soybean area in the US by 1.3 million ha per annum up to 1980. If this projection were to materialize the situation described in this report would not arise before 1980.

Table 2: Trends in production and yield of groundnuts in the major exporting countries

Country	Production (million tons)	Yield (ton/ha)	Estimated annual increase, 1970-1985	
			Yield (%) ¹⁾	Production (million tons)
India	6.0	0.8	-0.2	-0.012
Senegal	1.0	0.8	-0.3	-0.013
Nigeria	1.0	1.1	-1.1	-0.011
Brazil	1.0	1.2	1.0	0.010
Burma	0.5	0.8	1.2	0.006
Argentina	0.3	1.1	0.6	0.0018
Total	9.8		(-0.2)	-0.018

1) 1970 = 100 %

The annual increase of soybean production in the USA over the last 20 years of large-scale cultivation was in the order of 7-8 % or 0.7-0.8 million tons of protein. We estimate that Brazil will supply an extra 0.46 million tons of protein each year (Table 1). It is clear from these figures that Brazil alone is as yet unable to take over the role of the USA in meeting the extra protein demand.

In conclusion it seems unlikely that protein production from conventional sources will be able to keep pace with demand.

Feed grains

Maize is the world's most important feed grain (Table 3). Half the world production and 60 % of the world export originates from the USA. Since 1945 yields in that country increased by 4-6 % per annum as a consequence of greatly enhanced use of fertilizers and better varieties. At the present high yield level, the law of diminishing returns makes itself felt and for a continued rise in yield a very much higher "input" level is required. The consequences are higher costs and possibly a higher risk of soil and water pollution.

Our projection for the US, which is identical with that of the U.S. Department of Agriculture assumes that yield will increase linearly with time over the next 15 years. The actual increase, however, will most likely be non-linear, and the percentual increase may fall well below the 2.8 % level. In either case the increase in production will be inadequate to meet a 3 % increase in demand and the effects of this on the world market may be considerable. It would mean that the price of maize will tend to increase which would strengthen the competitive position of the crop vis-a-vis soybean. This could result ultimately in a stabilization or a decline of the

Table 3: Trends in production and yield of maize in the major exporting countries

Country	Production (million tons)	Yield (ton/ha)	Estimated annual increase, 1970-1985	
			Yield (%) ¹⁾	Production (million tons)
USA	141	6.0	2.8	3.948
Brazil	14	1.4	0.5	0.07
Argentina	10	2.0	1.7	0.17
France	9	5.0	3.6	0.324
Roumania	8	2.5	2.9	0.232
Thailand	2	2.5	3.2	0.064
Total	184		(2.6)	4.808

1) 1970 = 100 %

soybean area, depending on the ratio between the prices for the two crops in a particular season. This situation arose in the spring of 1974 when the maize price was more favourable than the soybean price, which resulted in a 3 % decrease of the soybean area.

In some of the other exporting countries the potential for yield increase is better because the absolute yield level is low. Their total production, however, is too low to make up for a possible lack in growth in the USA. The total annual growth in production in the countries under discussion adds up to 2.6 % which again is under the 3 % level require to meet a sustained demand.

The second most important feed grain is barley (Table 4). The estimated average growth in production resulting from yield increases is 2.1 % per annum, well below the required 3 %. About half the absolute increase will originate from the USSR from which country exports are highly erratic. In countries where yields approach the 4 ton level the production growth rate is very low, indicating that a ceiling in yield is being reached.

Canada and the USA seem to have the best potential as they combine a low yield level with a fairly high growth rate. Summing up, the prospects for barley are less favourable than for maize. A breakthrough in yield - the aim of hybrid barley breeders - is urgently needed.

Food grains in some developing countries

Adequate production of cereals for food purposes is the major problem of the developing countries. In this context the term "Green Revolution" - that is, the revolution in farming practices and varieties which has led to spectacular yield increases - cannot be avoided. Table 5 demonstrates the

Table 4: Trends in production and yield of barley in the major exporting countries

Country	Production (million tons)	Yield (ton/ha)	Estimated annual increase, 1970-1985	
			Yield (%) ¹⁾	Production (million tons)
USSR	36	1.5	2.5	0.9
Canada	15	2.2	1.8	0.27
France	10	3.3	2.5	0.25
USA	9	2.3	2.0	0.18
UK	9	3.6	1.6	0.144
West Germany	6	3.7	1.6	0.096
Denmark	6	4.0	0.6	0.036
Australia	3	1.0	-0.3	-0.09
Total	85		(2.1)	1.786

1) 1970 = 100. %

Table 5: Annual production of food grains (in kg/capita) in 6 developing countries

Crop	Country	1950	1970	1985
Wheat	Mexico	21	48	42
	India	17	36	34
	Turkey	230	290	230
Rice	Philippines	136	139	142
	Indonesia	123	146	116
	India	93	116	103
Maize	Mexico	120	177	150
	Brazil	112	152	105
	Philippines	34	52	30

effect of this phenomenon on the supplies per capita, and provides a glance into the future.

The gain in production per capita in the countries selected has been about 1.5 % per annum, which is a considerable achievement. If, however, the trends in yield per ha are extrapolated (the area under cultivation being assumed constant) and the total yields thus calculated are divided by the expected population figurem the picture for the coming decade is far from bright. In some countries the low level of production per capita of 1950 will be reached again by 1990, meaning that all the technological progress will have been absorbed by the population explosion. Population growth in

these countries is in the order of 2-3 % per annum and, even in developed countries, it is difficult to maintain the same rate of yield increase in most crops. The latter, however, is an absolute necessity if per capita production is at least to remain constant.

To maintain such a rate of growth, it is essential that nitrate for fertilization and water for irrigation are available at all times. Nitrate supply, however, has been seriously hampered since the end of 1973, due to the world oil situation. The increase in world prices will further affect the nitrate price and availability in the future. This represents another serious threat to agriculture in developing countries.

The availability of irrigation water is equally important. Every plant contains large amounts of water (some 90 % of total plant weight) and for adequate growth it has to evaporate very much larger amounts. Water is also needed to produce electricity, needed both for irrigation pumps and for nitrate production. Food production is impossible without water and in most developing countries it is the major limiting factor. If the experts, who forecast that drought periods will be more frequent than in the past, are right, the prospects for the developing countries are very grim indeed. Their demand for imports will increase further and their foreign currency reserves, which are badly needed for imports of oil and fertilizers, will decline even more.

References

1. BRYSON, R. A. (1973): World Food Prospects and Climatic Change. Testimony before Senate Committee, 18. Okt. 1973
2. IDYLL, C. P. (1973): The anchovy crisis. Sci. Am. 228, 27-29