

## PATTERNS OF FEED UTILIZATION AND TRADE

by

B. Agostini

### Introduction

1. A preliminary assessment of the overall pattern and trends in livestock feed utilization in the world was made in a recent study by FAO on the basis of the fairly well-documented information on the major concentrate feeds, such as cereals and oilmeals, and on estimates of the amounts of other feeds needed to maintain the world livestock population and output of livestock products. This paper draws substantially on that study.

### The pattern of total feed resources and their utilization

2. It is estimated that the world consumption of animal feed in 1983, was over 3 500 million tons of barley equivalent. About 970 million tons were consumed in the form of concentrate feeds, mainly cereals, milling by-products and oilmeals. The remainder was consumed as roots and tubers, roughage, primarily grass and forage many agro-industrial by-products and numerous other non-conventional feeds (Table 1).

3. For several decades the feeding of concentrates has been increasing at a faster rate than that of roughages, reflecting significant changes in the composition of the livestock population and in feeding methods. Over the past decade, the numbers of ruminant animals increased by 8 percent and monogastric animals by 20 percent. The latter are almost entirely dependent on concentrates and the rapid increase in their numbers, together with more intensive feeding of some ruminant livestock, (dairy cows and beef-cattle), had a major impact on the pattern of feed use, with the consumption of concentrates increasing by 2.6 percent a year, compared with an estimated 1.2 percent a year for other feeds.

4. Although roughages are a small proportion of the total feed resources used, they are about three quarters of the total. Most of this feed is obtained from crop residues and permanent or temporary pastures that are grazed by ruminants. The development of most of the world's grassland resources has proceeded only slowly. In most developing countries, priority for resources has had to be given to the production of food crops. Only in recent years and only in some countries has some emphasis been placed on increasing livestock production through the development of roughage resources.

5. The primacy of roughages as a source of feed energy is due to the fact that cattle and buffaloes which depend on roughages consume over 70 percent of all feed resources. Pigs and poultry consume only 17 percent of the total (Table 2).

6. Although roughly the same volume of feed is utilized in developed and developing countries, over 40 percent of the total was fed as concentrates in 1983 in developed countries compared with under 15 percent in developing countries. However, concentrate feed use in developing countries is increasing by some 5 percent a year due to fast expansion of the livestock sectors in a few countries which experienced rapid income growth, particularly in North Africa, Latin America and Asia.

#### Utilization of the Main Concentrate Feeds

7. Information on feedstuff utilization is the most complete for cereals, milling by-products and oilseed meals which account for some 85 percent of the total. However, the pattern of utilization in many developing countries is not fully known.

8. World utilization of concentrate feeds has risen rapidly over the past two decades - i.e. 4.5 percent per year - under the impact of increased demand for livestock products. The developed countries in 1972-74 used three-quarters of the world's concentrate feeds. Although increased technical know-how has led to more efficient conversion of grains to meat and milk, the fast growth in animals numbers has resulted in continued rapid exposure of the utilization of grain. This expansion was checked in 1973-75 by the high prices of grain and by a lower demand for animal products during the economic slowdown in the mid-seventies. The expansion in concentrate-feed utilization fell from the high rate of 4.5 percent per year in the 1960s to less than 3 percent annually in subsequent years.

9. The rapid expansion and intensification of livestock production, especially of poultry, resulted in a sharp increase in feed requirements in many developing countries. As the expansion was concentrated in the pig and poultry sectors, concentrate use grew more rapidly than total output of livestock products.

10. Although there has also been some increase in the quantities of concentrates fed to ruminants in a few developing countries, on the whole ruminants have continued to depend on roughage resources. Most of the growth in concentrate feeding is due to commercial pig and poultry enterprises near major urban settlements. Only in Africa has the use of concentrate feed remained relatively low, i.e. at an estimated 9 million tons or less than 5 percent of the concentrates fed in all developing countries combined in 1983. This reflects the

slower growth of large-scale intensive animal production in Africa, due to priority use of basic foods by humans and the limited growth in effective demand.

11. Fourteen countries accounted for 80 percent of the concentrates fed in developing countries in 1983. With the exception of China and India, most of these countries have relatively high levels of income and, as a result, relatively rapidly growing livestock sectors. In all but four of them per caput income is twice as high as the average for all developing countries combined.

12. Among the cereals fed in developing countries, coarse grains accounted for more than 90 percent of the total. Feed use of coarse grains more than doubled between 1972 and 1983. Although the quantities of wheat and rice used for animal feed have also risen, their share of the total has remained under 10 percent. Among the coarse grains, maize accounted in 1983 for about 60 percent of all cereals fed. This reflects both the high nutritional value of maize for non-ruminant livestock and its availability on the world market. Barley is widely fed in the Near East. In Africa relatively small quantities of cereals are fed to animals. Differences in grain utilization in developing countries heavily reflect traditional patterns of both production and feeding.

13. During the past decade there has, overall, been a rapid increase in cereal production in developing countries. This has increased the availability of cereal-milling by-products for possible feed utilization. However, it is apparent that the full potential for cereal-milling by-products has yet to be exploited due to problems associated with wastage, storage, transportation and marketing systems.

14. Developing countries produce large quantities - 60 to 70 million tons - of oilseeds a year and the share which they process into oil and oilmeal has increased steadily with the gradual expansion of their crushing capacity. Oilmeal consumption in developing countries accounts for only one-fourth of world consumption but it has increased at a rate of 6.6 percent per year over the last decade, roughly maintaining its share of total feed consumption at about 12 percent of energy supplies and about one-third of those of protein. As the demand for oilseed meals is directly linked to the compound feed industry, which is still relatively small in most developing countries, demand for oilseed meals remains limited in the developing countries taken as a whole.

15. In addition to the main concentrate feeds, many other products provide significant quantities of energy and protein for livestock in developing countries, but inadequate data make it difficult to assess their contribution. The feed use of cassava in these countries is estimated to have accounted in 1983 for some 40 percent of world

consumption (Table 3). Among the factors which appear to have limited the utilization of cassava for feed are its important role as a staple food in many countries, lack of processing facilities, high cost of transporting cassava from producing areas to the areas where compound feed is manufactured, a shortage of local supplies of protein-rich feeds and price relationships which have tended to favour the use of grain.

16. The feed utilization of molasses, which is the most widely used binding agent for compound-feed pellets and which is increasingly being used as supplements (i.e. in molasses/urea) to roughage-based feeds, has increased during the past decade at just under 5 percent a year in developing countries, nearly twice as fast as in developed countries. In contrast to cassava, the domestic food demand for molasses is limited and sugar-producing areas often adjoin major livestock areas. However, there is a major tendency for molasses to be used in production of fuel.

17. Around 12 percent of pulses harvested in developing countries are fed to animals, chiefly in India and as by-products and damaged seeds.

Other concentrates fed to livestock in developing countries to a minor extent include whole oilseeds, sugar and dried fish, but the feed use of these appears to be declining. Near cities, the use of distillery and brewery grains is increasing, as is the use of animal processing by-products which are increasingly being used as a supplementary protein. Pulps and other by-product meals from fruit, vegetable and coffee processing are used for feeding in countries where production of these crops is large.

#### Compound-feed manufacturing

18. Utilization of a wide variety of concentrate feeds in livestock rations has been promoted by the growth of compound-feed manufacturing.

19. Despite setbacks to the expansion of compound-feed use during the recessions of the early 1970s and early 1980s, world production is estimated to have risen by over 4.5 percent during the past two decades to around 380 million tons in 1983. Nearly 90 percent of this was produced and consumed in developed countries.

20. In developing countries, concentrates are still mainly fed directly or after on-farm mixing, but compound-feed production has, since the mid-1970s, increased at an average rate of over 13 percent per year, albeit from a very small base. However, the farm mixing of feed is still widespread in Brazil as well as Mexico and the Republic of Korea, which are the second and third largest compound-feed producers among developing countries, accounting together for 20

percent of the total. In addition, compound-feed production and utilization expanded particularly rapidly in China (from a very small base in 1974-76) and in parts of the Near East where Egypt and Turkey are the largest producers.

21. The composition of compound feeds varies considerably among countries though most rations broadly consist of 50-60 percent grains and 10-15 percent oilmeals, with milling by-products and crop residues accounting for most of the remainder.

In areas where the compound-feed industry produces mainly complementary feeds for on-farm mixing with grain, as in parts of the United States, Brazil, and Canada, the proportion of the cereal-based products in the mix is low (often under 10 percent). Where the industry produces complete feeds and is largely dependent on imported components, the proportion of grains varies according to the relative prices of grains and substitute products. For instance, in a number of developing countries, where only a narrow range of ingredients is utilized the proportion of grain products in compound feeds is 70 to 80 percent.

22. An important factor in compound-feed production is that it can enable a greater variety of ingredients to be used for livestock feed. This can be especially important in developing countries where some agricultural crops and many processing by-products are neglected or underutilized.

#### Implications for international trade in feedstuffs

23. The growth in the consumption of concentrate feeds has been accompanied by a relatively more rapid expansion in international trade during the past decade. Growth in locally produced feedstuffs has been insufficient to meet expanding demand which has led to a widening gap between domestic supply and utilization in many parts of the world. At the same time, abundant supplies of feed, especially grain and oilmeals, have been available at relatively low prices and, in many cases, import financing has been available at easy terms.

#### Grains

24. The growth in grain feed use has exceeded that of production in many countries so that there has been a rapid increase in import demand. Most of the trade in grains for animal feed is in coarse grains. Little feed wheat is traded internationally, though imports of bread quality wheat into several countries, including the USSR and some in eastern and western Europe, release lower grades of domestic wheat for animal feed.

Although not all imports of coarse grains are used for feed, it is the demand for feed which mainly influences the level of world trade, and which has been the driving force behind the increase in coarse grain trade over the past decade.

25. World trade in coarse grains has increased at a rate of 4.5 percent a year during this period reaching a peak of 115 million tons in 1981 (Table 5). In developing countries, where feed use accounts for about 80 percent of coarse grain imports, a fast and sustained growth of nearly 14 percent a year over the decade has raised the volume of imports during the 1970s to over 30 million tons a year as a result of rapid population growth, lagging domestic grain production, coupled with the demand for more varied diets. Some two-thirds of these imports go to only 10 countries, mainly oil-exporting and rapidly industrializing countries, including Mexico, Saudi Arabia and the Republic of Korea. While some of the lower income countries, such as China and Egypt, have also rapidly increased their imports of coarse grains, for most of these countries import demand has, to some extent, been restricted by balance of payment problems and credit limitations. These difficulties have also been exacerbated in many cases by the rise in the relative value of the United States' dollar resulting in higher prices in many local currencies.

#### Oilmeals

26. World trade in oilmeals also increased at the annual rate of about 6.6 percent from the early 1970s to 1983.

27. Oilmeal imports into developing countries remain relatively small, but, because they have grown at a much faster rate than in developed countries, their share in the world total has increased. As in the case of coarse grains, a high proportion of the oilmeal imports was accounted for by only a few, primarily higher-income and particularly petroleum-exporting, developing countries.

#### Other feedstuffs

28. International trade in other feedstuffs is characterized by narrow markets and few sources of supply. These include, *inter alia*, cassava, cereal bran, corn gluten feed, maize germ cake, citrus pulp and pellets, beetroot pulp, brewers' and distillers' grains and many industrial by-products. Due to the lack of adequate and sufficient data it is impossible to fully evaluate global trade of these products. Tentative estimates indicate that in 1983 around 140000 tons of cassava chips and pellets, or about 2.1 percent of world

imports, were imported by developing countries. The Republic of Korea is the major importer and accounts for virtually all the developing countries' share. Other importers include Malaysia, but the quantities involved remain small, both in absolute and in relative terms. In respect to cereal bran the developing countries share of world imports is around 10 percent, Singapore and the Republic of Korea being the major importers. On the whole, therefore, the limited growth and small amounts of imported grain substitutes appears to reflect the fact that given present technology and price relationships, grain remains the cheapest and most versatile of the energy concentrates.





Table 2: Consumption of feed by livestock groups (% available ME)

|                         | Cattle &<br>buffaloes | Sheep<br>and<br>goats | Pigs | Poultry | Draught<br>animals |
|-------------------------|-----------------------|-----------------------|------|---------|--------------------|
|                         | (.....percent.....)   |                       |      |         |                    |
| Total feed concentrates | 56                    | 12                    | 10   | 7       | 15                 |
| Cereals                 | 35                    | 2                     | 32   | 27      | 4                  |
| Oilseed meals           | 21                    | 3                     | 28   | 45      | 3                  |
| Others                  | 37                    | 7                     | 39   | 13      | 4                  |
| Roughages               | 63                    | 15                    | 2    | 1       | 19                 |

Table 3 Trends in feed use of cassava and molasses in developing countries

|                               | 1972-74                | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | Growth Rates<br>1972-74<br>to<br>1983 |
|-------------------------------|------------------------|------|------|------|------|------|------|---------------------------------------|
| <u>1/</u><br>Cassava          | .....million tons..... |      |      |      |      |      |      | percent per year                      |
| Total developing<br>countries | 13.5                   | 13.5 | 13.1 | 12.9 | 13.5 | 13.3 | 12.7 | -0.6                                  |
| World                         | 19.8                   | 34.1 | 31.4 | 30.3 | 35.0 | 42.2 | 29.4 | 3.7                                   |
| <u>2/</u><br>Molasses         |                        |      |      |      |      |      |      |                                       |
| Total developing<br>countries | 2.7                    | 3.3  | 3.4  | 3.4  | 3.8  | 4.1  | 4.2  | 4.7                                   |
| World                         | 10.4                   | 12.9 | 12.9 | 12.1 | 12.6 | 13.4 | 14.0 | 2.9                                   |

1/ Root equivalent

2/ product weight

Table 4: Imports of coarse grains

|                             | 1972-74<br>average | 1979  | 1980  | 1981           | 1982  | 1983    | Growth<br>rate<br>1972-74<br>to 1983 |
|-----------------------------|--------------------|-------|-------|----------------|-------|---------|--------------------------------------|
| <u>World</u>                | 69.2               | 103.6 | 108.9 | 115.2          | 103.7 | 100.3   | 3.8                                  |
|                             |                    |       |       | (million tons) |       | percent |                                      |
| <u>Developing countries</u> | 10.8               | 23.6  | 30.4  | 31.1           | 31.0  | 36.0    | 12.8                                 |
| Algeria                     | 0.1                | 0.5   | 0.4   | 0.4            | 0.8   | 0.7     | 23.0                                 |
| Brazil                      | 0.1                | 1.6   | 1.7   | 1.1            | 0.1   | 0.4     | 17.6                                 |
| China                       | 3.0                | 6.6   | 5.3   | 4.5            | 5.4   | 6.8     | 8.5                                  |
| Egypt                       | 0.2                | 0.5   | 1.0   | 1.3            | 1.3   | 1.6     | 24.1                                 |
| Korea, Rep. of              | 0.9                | 2.8   | 2.4   | 3.1            | 3.2   | 4.3     | 16.6                                 |
| Iran                        | 0.3                | 0.9   | 1.0   | 1.3            | 1.3   | 1.5     | 19.5                                 |
| Malaysia                    | 0.3                | 0.4   | 0.4   | 0.5            | 0.8   | 0.8     | 12.6                                 |
| Mexico                      | 1.2                | 2.1   | 6.2   | 6.0            | 2.7   | 8.1     | 22.0                                 |
| Morocco                     | -                  | 0.1   | 0.1   | 0.4            | 0.3   | 0.1     | 11.5                                 |
| Saudi Arabia                | 0.1                | 1.0   | 1.9   | 3.0            | 4.8   | 2.3     | 39.0                                 |
| Tunisia                     | -                  | 0.2   | 0.2   | 0.4            | 0.3   | 0.2     | 16.4                                 |
| Venezuela                   | 0.6                | 1.0   | 1.7   | 1.8            | 1.7   | 1.7     | 10.5                                 |