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Solving the Soviet Livestock Feed Dilemma: Key To Meeting Food Program Targets

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A Research Paper

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A Research Paper

This paper was prepared by
Office of Soviet Analysis. Comments and queries are welcome and may be directed to the Chief, Economic Performance Division, SOVA

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Solving the Soviet Livestock Feed Dilemma: Key To Meeting Food Program Targets [redacted] 25X1

Key Judgments

Information available as of 23 October 1985 was used in this report.

In large measure, Soviet consumers will judge General Secretary Gorbachev's commitment to their well-being by his ability to put more meat on the table. The Food Program—advanced by Brezhnev in 1982, strongly endorsed by Gorbachev, and largely repeated in recently published targets for the 12th Five-Year Plan (1986-90)—calls for boosting per capita meat consumption by 17 percent over the next five years. Such an increase would contrast sharply with the near stagnation in meat availability over most of the last decade. Achieving this goal—and we believe the chances are good, barring bad weather—would go a long way toward boosting popular support for Gorbachev's regime and, by implication, his calls for greater effort on the part of the Soviet work force. [redacted] 25X1

Between 1975 and 1983 Moscow was unable to sustain annual increases in per capita meat availability even with record imports of grains and meat. Despite outlays of hard currency for these commodities averaging nearly $5 billion annually since 1975, Soviet consumers have only a little more meat than they had then. Moreover, the domestic budgetary drain has been increasing rapidly. The leadership has insisted on maintaining stable, relatively low prices in state retail stores even in the face of rapidly rising costs of producing meat. As a result, subsidies paid to farms for producing meat increased from about 13 billion rubles in 1975 to 21 billion rubles in 1984. [redacted] 25X1

Chronic shortages of all types of animal feeds have been a major constraint on domestic meat production, but meat output also has suffered from a substantial imbalance among those feeds available—high-protein feeds such as soybeans, concentrates such as grain, and roughages. Because of this dietary imbalance—due, in part, to misplaced emphasis on the importance of grain in animal diets—Soviet livestock take twice as long to achieve market weight as those in the United States while requiring 1.5 to 2 times as much feed to do so. [redacted] 25X1

To increase the output of product per farm animal, Gorbachev has moved aggressively to implement Food Program initiatives that emphasize the use of roughages and protein in animal diets, provide the resources—including additional fertilizer—for increased production of these components, and enhance feed quality by improving facilities for processing and storage of feeds. [redacted] 25X1

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We believe that Moscow will make enough progress on these initiatives to result at least in larger supplies of better balanced feed rations per animal. Thus, even with little or no improvement in the rate at which farm animals convert feed to product, larger supplies of feed per animal, together with greater proportional use of roughages in the feed ration, should result in an increase in meat per animal and milk per cow. This, in turn, should both help hold down steadily rising meat production costs and put more meat on the table.

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Nonetheless, under most scenarios, Western grain will still be needed to achieve the ambitious 1990 meat production goals. The amount of required imports, as always, will depend in large measure on weather conditions:

- Our most likely scenario is for *average weather* and a continuation of the recent trend in fertilizer deliveries. Meeting 1990 meat production targets under these conditions would require some 40 million tons of grain imports, even with increased quantities of domestic feed per animal. A qualitative improvement in the composition of feed rations, however, particularly an increase in the protein content, could lower feed conversion ratios slightly and, in turn, reduce import demand to some 30-35 million metric tons of grain and save increasingly scarce hard currency.

- *Very good weather*, complemented by a boost in yields of grain and roughage from more fertilizer and accompanied by a smaller share of grain in feed rations, could totally obviate the need for Western grain imports.

- *Poor weather* during the period, particularly if accompanied by failures to boost fertilizer supplies, would force Moscow to cut back on its meat production goals. Hard currency constraints alone would preclude importing the quantities of grain needed—some $8 billion worth (in 1985 prices) in 1990—to offset domestic production shortfalls.

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Solving the Soviet Livestock Feed Dilemma: Key To Meeting Food Program Targets

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Introduction

General Secretary Gorbachev is continuing the Soviet leadership's longstanding emphasis on developing the livestock sector and increasing per capita consumption of meat. Progress toward these goals has long been hindered by factors such as unsuitability of livestock breeds; lack of adequate veterinary service and supplies, daily care, and sanitation; shortages of skilled labor, machinery, and equipment; and shifting government policies. The most limiting factor, however, has been a chronic shortage of feeds and an imbalance among the major feed components. The imbalance in feed rations includes a serious protein deficit, which in large part explains why the fattening process takes twice as long as in the United States and requires 1.5 to 2 times as much feed.

Importance of the Livestock Sector

Food accounts for about half of Soviet household expenditures on consumer goods and services. The availability of meat—together with increasing variety in the diet—is a key factor by which Soviet consumers judge their well-being. Although money incomes have grown steadily, the leadership has continued its policy of maintaining stable, relatively low prices in state retail stores—where most meat is sold—in the face of stagnating meat output. Consequently, demand for meat has grown far more rapidly than supply. Consumer dissatisfaction with the resultant queuing and chronic shortage has negatively affected labor productivity.

Keeping retail prices constant—the last increase was in 1962—has also led to substantial budgetary drain. Subsidies for meat alone reached 21 billion rubles in 1984, compared with an estimated 13 billion rubles in 1975. According to one Soviet economist, the cost of production and procurement of beef was quadruple and that of pork double the retail price in 1983.

To reduce the disparities between supply and demand for meat, the Food Program, first put forth by Leonid Brezhnev in 1982 and supported by his three successors, calls for boosting per capita meat consumption from the present 60 kilograms to 70 kilograms in 1990.[1] Gorbachev clearly recognizes the need for increased labor productivity throughout the economy and sees an improved quality of diet as an important factor in meeting that need. At an April 1985 Central Committee plenum, he stated that the Food Program "required particular attention" and "could not be put aside." His numerous complaints about foot-dragging and "departmental interests" thwarting the development of agriculture and related industries highlight his concern. Moreover, Food Program proponents are encouraged by his repeated statements on the need to improve support services not only to farm production but also to the transportation, storage, and handling network.

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Past Performance

Successful grain crops allowed Moscow to increase meat supplies during the last half of the 1960s (table 1). In 1972, however, in an effort to sustain annual gains in meat production in the face of a crop shortfall, the leadership resorted to major grain imports. In 1975 the USSR responded to a widespread, drought-driven grain crop failure by importing record quantities of grain and by reducing herds drastically to cut the demand for grain. Smaller herds led to reduced meat output in 1976. Not until 1978 did meat output regain the trend level implied by 1960-75 data.

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[1] Meat consumption is stated in terms of the Soviet definition, which includes poultry meat, edible offals, and slaughter fat.

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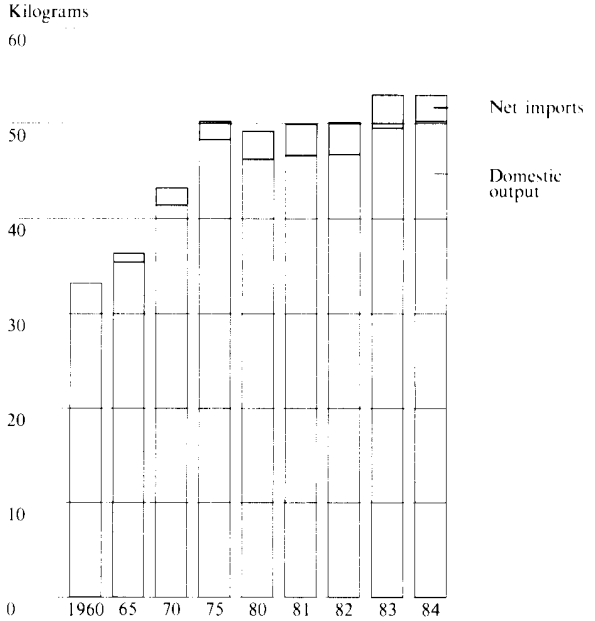
Table 1
USSR: Output of Livestock Products, Selected Years

	Meat [a] (*million metric tons*)	Milk (*million metric tons*)	Eggs (*billions*)
1965	10.0	72.6	29.1
1970	12.3	83.0	40.7
1975	15.0	90.8	57.4
1976	13.6	89.7	56.2
1977	14.7	94.9	61.2
1978	15.5	94.7	64.5
1979	15.3	93.2	65.8
1980	15.1	90.9	67.9
1981	15.2	88.9	70.0
1982	15.4	91.0	72.4
1983	16.4	96.5	75.1
1984	17.0	97.9	76.5
1985 [b]	17.3	99.2	77.4

[a] In addition to beef, pork, mutton and lamb, rabbit, and game, the Soviet definition of meat includes poultry meat, edible offals, and slaughter fat. To be comparable to Western measures (retail weight), the quantity should be reduced by roughly 18 percent.
[b] Estimated. Based on 10-month results.

Figure 1
USSR: Availability of Meat Per Capita, 1960-84 [a]



[a] Soviet official statistics on meat production are adjusted to conform to Western definitions of retail weight (trim, including slaughter fat and bone, is removed).

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During 1979-82, annual meat production lagged below the 1978 peak. High import levels of grain could not offset a four-year period of poor-to-mediocre grain crops. The regime—anxious to avoid a repetition of the 1976-78 experience—chose to sacrifice growth in meat production to maintain herd numbers, accepting the lower animal productivity associated with smaller feed rations. Only by importing record quantities of meat—an average of about 900,000 metric tons annually during the 1980-82 period—did Moscow keep per capita meat consumption close to the previous record achieved in 1975 (figure 1).

The shift in emphasis from distress slaughter to herd maintenance was a gamble; disease or bad weather could have killed large numbers of animals weakened by reduced feed rations, particularly as production of other feeds also stagnated. The gamble paid off. Meat output reached a new high in 1983, aided by record forage production in 1982 and 1983, a better grain crop in 1983, and large imports of grain. In 1983 per capita meat availability—domestic production of 16.4 million tons, adjusted for slaughter fat and trim, plus an increase of net imports to 960,000 tons—rose by almost 6 percent. Further growth occurred in 1984,

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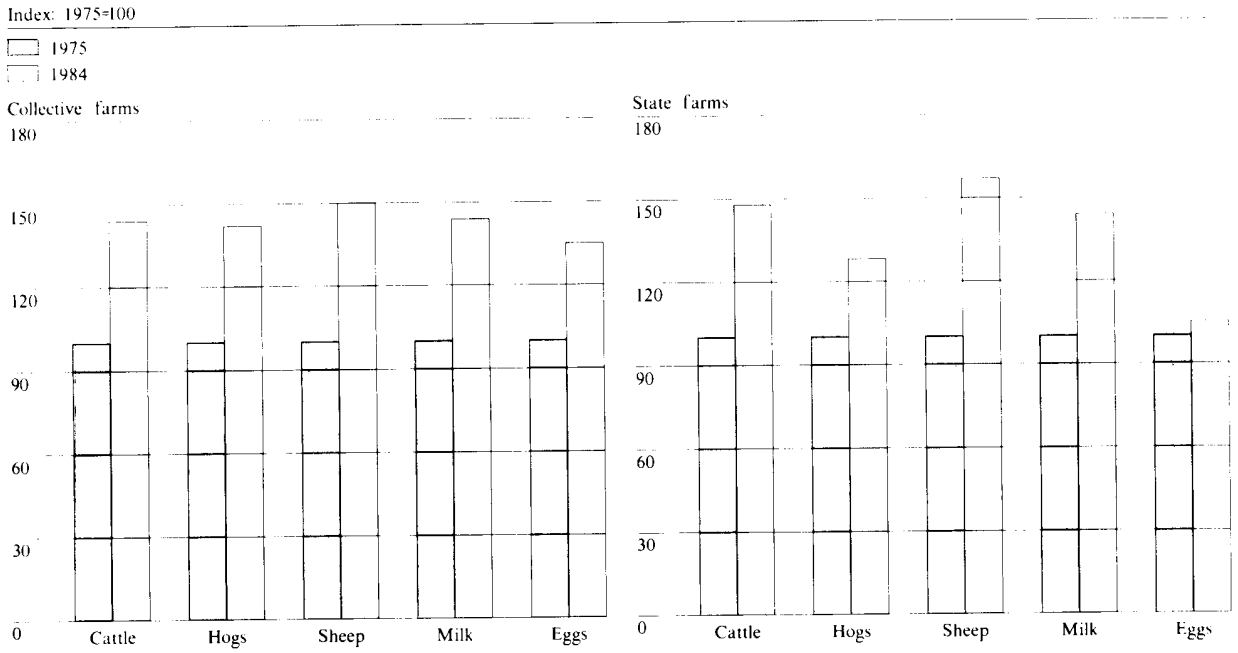
Figure 2
USSR: Growth in Cost of Production of Livestock Products, 1975 and 1984[a]



[a] Derived from Soviet statistics on the ruble cost of producing 1 ton of liveweight gain, 1 ton of milk, and 1,000 eggs.

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with meat output reaching 17.0 million tons. Yet, just to maintain per capita availability at roughly the 1983 level, production was again supplemented by large imports.

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Feed: Key to Livestock Productivity

Livestock feed comprises concentrates (feeds with high nutritive content such as grain and oilseed meals) and roughages (feeds with high cellulose and/or water content such as hay, silage, potatoes and other feed roots, and pasture) (see inset).[2] Animals gain weight more rapidly and require less feed per unit of gain when the feed ration contains sufficient energy (calories) and is correctly balanced between concentrates and roughages as well as in nutrient content—protein, minerals, vitamins, trace elements, and so on. A ration is considered fully balanced when it achieves the maximum output of product for a given quantity of feed units in the most economical combinations.[3]

[2] Concentrates as reported in Soviet sources exclude those that are of animal origin—meat and bonemeal, fishmeal, milk, and so on.

[3] There is no one balanced ration for each animal or group of animals. The same output can be achieved through varying combinations if adequate supplies of needed feeds and supplements are available. This is not the rule for Soviet farms, which often are forced to feed uneconomical rations because elements are not available. In market economies, farmers adjust their feed rations according to relative cost of the various feeds and supplements, thus assuring that balanced rations in effect are at minimum cost.

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Feeds Glossary

Concentrates
"Crop" feeds containing a large percentage of digestible nutrients and relatively small percentages of water or fiber:
- *Grain.*
- *Oilseed meals.*
- *Milling byproducts.*
- *Dried residues of the starch, beet sugar, and brewing-distilling industries.*
- *Dried grass meals.* [redacted]

Roughages (Forages)
"Crop" feeds high in moisture or fiber content and relatively low in digestible nutrient content:
- *Coarse feeds—"crop" feeds with a high fiber content:*
  - *Hay.*
  - *Haylage—chopped green feed partially dried after cutting. Must be stored in airtight facilities to preserve quality.*
  - *Straw.*
  - *Stover—cornstalks.*
- *Succulents—"crop" feeds with a high water content:*
  - *Silage.*
  - *Green chop—chopped green feeds such as grasses and tops from root crops, fed directly as they are produced.*
  - *Potatoes.*
  - *Sugar beets.*
  - *Forage roots such as turnips.*
  - *Melons.*
  - *Wet beet-pulp.*
  - *Distiller's mash.*
- *Summer green feed—a Soviet category of feed that includes pasture and succulent feeds such as silage.*
- *Pasture.* [redacted]

Animal and Synthetic Feeds
Surplus animal products, byproducts of the meat, dairy, and fish processing industries, and industrially produced protein supplements.
- *Milk.*
- *Skim milk.*
- *Buttermilk.*
- *Whey.*
- *Fishmeal.*
- *Meat and bonemeal.* 25X1
- *Single-cell protein.* [redacted] 25X1

Balanced Ration
A ration that provides the needed proportion and amount of all the required nutrients to produce the maximum quantity of product per unit of feed consumed in the most economical combination. [redacted] 25X1

Energy
Derived from feed and used to meet daily maintenance needs. Any surplus is used for growth or work. Energy is usually evaluated in terms of calories and is primarily supplied by carbohydrates (organic compounds composed of carbon, hydrogen, and oxygen) and fats, but also by protein. [redacted] 25X1

Calorie
The amount of energy as heat required to raise the temperature of 1 gram of water by 1 degree Centigrade. [redacted] 25X1

Protein
Essential to all plant and animal life. Comes, in varying amounts, from plant, animal, and industrial sources. [redacted] 25X1

Feed Unit 25X1
The USSR defines a feed unit as containing the quantity of energy available in a kilogram of oats. Other feeds are converted to "oat-equivalent" feed units by relating their energy content to that of oats. [redacted] 25X1

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Why Import Grain?

Moscow's need for grain imports results largely from the size of the domestic grain crop, although a number of other factors—such as size of animal inventories, availability of other feeds, changes in feeding efficiencies, and quantities of meat, milk, and eggs to be produced—help determine the need. Quantities of grain needed for seed, food, and industrial needs have been relatively stable over the past two decades and are not likely to change much through the 1980s. The effect on grain requirements of a steady decline in per capita consumption of grain products is being offset by the increasing share of higher quality flour being produced, a trend that is expected to continue. More high-quality white bread and assorted bakery goods needing low-extraction grades of flour are now available.

In contrast, the livestock sector has been expanding rapidly since Brezhnev launched his first program to improve consumer diets in 1965. The emphasis on increased feeding of concentrates led to a more than doubling in quantities of grain feed since 1965. In the face of lagging grain output, central planners until recently did not emphasize the production of other feed crops sufficiently to meet the growing demand for feed. Consequently, Moscow has resorted to imports of grain to make up part of the shortfall in needed energy. Grain is widely traded, easily transported, and to an extent can be substituted for other types of feed in many feed rations. Roughly 55 percent of total available grain (production and imports) is now used as livestock feed. Clearly, the USSR's longtime goal of agricultural self-sufficiency is secondary to that of producing ever larger quantities of meat.

Rations that are out of balance add substantially to the cost of livestock products, because larger daily feed rations are required to achieve the same amount of product—meat, milk, and eggs. Soviet writers estimate the cost of feeding unbalanced rations may be higher by more than one-third. In an attempt to match US livestock feeding efficiencies, Soviet animal nutritionists have stressed—too strongly in our opinion—the importance of increasing the absolute amounts and the share of concentrates in livestock rations, without addressing the need to improve protein content.

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Moreover, costs of meat, milk, and egg production have risen substantially since 1975 (figure 2). In part this results from the increasing cost of feed, which makes up roughly 50 percent of the cost of production. For example, special prices for mixed feeds sold to state and collective farms were abolished in 1975. At the same time, however, Soviet agricultural researchers note that over the last decade most of the growth in production of livestock products has been achieved by increases in numbers of animals. This, in turn, requires additional expenditures for buildings, for operation of facilities, and for labor, which have contributed to the production-cost escalation.

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Feed Production Lags

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Despite some growth in production of nongrain feeds, Moscow has also been forced in recent years to import large quantities of other feedstuffs as well as grain (see inset).[4] During the five-year period of 1979-83, imports of nongrain feedstuffs averaged nearly $675 million per year and totaled over 7 million tons of soybeans, almost 3 million tons of soybean meal, 0.75 million tons of mixed feed, and 0.50 million tons of manioc.[5] Imports thus effectively constituted about one-fourth of *total* concentrates fed during the 1979-83 period.[6]

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Even with these imports, feed—in terms of energy available per animal—was still nearly 20 percent below announced Soviet standards.[7] The Soviets may have overshot their aim by focusing on expanding the use of grain in feed rations. Such increases did not

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[4] See appendix A for a discussion of growth in domestic production of feed.

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[5] Problems in the use of manioc (tapioca), the cessation of the US partial embargo on sales of grain and other feedstuffs to the USSR, and the world surplus of grain and consequent favorable grain purchase prices combined to turn Moscow away from continued large imports of manioc.

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[6] Some of the imported grain was used for food or other purposes, thus releasing domestically produced grain for feed.

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[7] Soviet standards appear reasonably comparable to US standards. Soviet feeding texts indicate 33 quintals of feed units annually per standard animal (cow equivalent); US feeding guides suggest 32 to 35 quintals annually for dairy cows.

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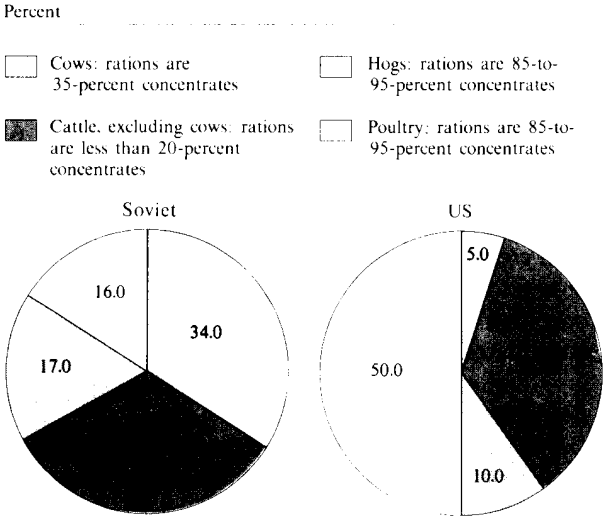
Figure 3
Structure of Soviet and US Livestock Herds, 1982-83[a]



[a] Total numbers of cows, cattle excluding cows, hogs, and poultry including broilers for each country are weighted by relative Soviet feed requirements per type of animal to derive share of total herds. Sheep and goats are not included in the calculations because they are primarily forage consumers. These animals account for nearly 10 percent of Soviet herds but less than 1 percent of US herds.

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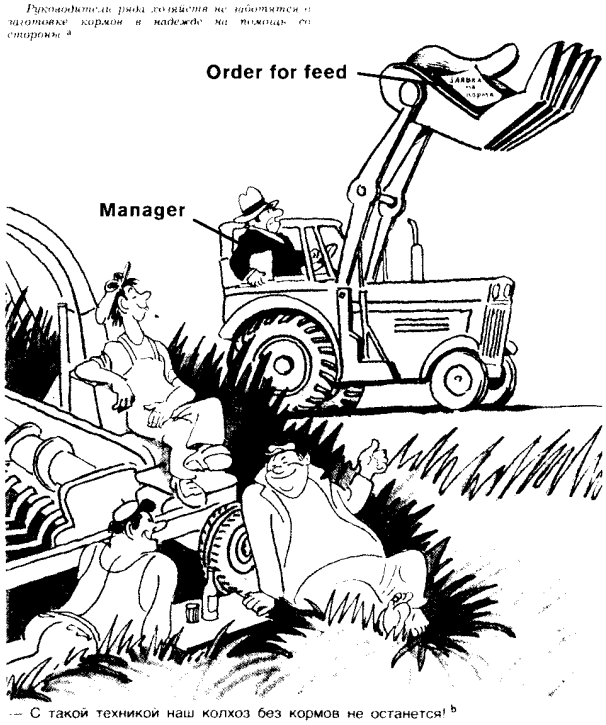
Figure 4



— С такой техникой наш колхоз без кормов не останется![b]

[a] Many farm managers neglect feed procurement because they think the state will provide.

[b] "With such technology, our kolkhoz won't be left without feed this year."

Krokodil, No. 17, June, 1983.

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result in corresponding increases in average animal productivity because of the continued shortage of energy and inefficiency of rations in terms of balance.[8] For example, during 1971-80 the use of grain for milk production rose by 17 percent, or nearly twice as fast as milk output; the use of grain for cattle feeding increased by 35 percent, while beef production grew by only 22 percent. The share of concentrates is now about 34 percent in the Soviets' overall livestock feed supply—close to the share in the US supply, which has ranged from 34 to 41 percent since 1975. However, the herd structure in the USSR differs markedly from that in the United States (figure 3). A simplified calculation indicates that, if cows, other cattle, hogs, and poultry in the USSR were fed the same concentrate-roughage balance as their US counterparts, concentrates would account for only 25 percent of the total—a reduction in their use from the 142-million-ton average fed during 1980-83 to 110 million tons.

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Perhaps recognizing that the steady increases in feeding of concentrates had not helped to achieve targets, Soviet leaders in recent years have stressed the importance of feeding forage crops and even of reducing quantities of concentrates fed. At the July 1978 agricultural plenum, then General Secretary Brezhnev highlighted the need to improve the quality and quantity of forage crops. But the several decrees

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[8] Our analysis also indicates that productivity gains from the proliferation of large-scale specialized livestock production facilities, which improve feeding efficiency by as much as 50 percent, according to Soviet agricultural specialists, were largely offset by lower efficiency in the remainder of the livestock economy, which suffered shortages of important feed supplements because the specialized facilities were given priority.

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that followed had little effect as even a cartoon published in *Krokodil*, the Soviet satirical journal, illustrates (figure 4).

By late 1982, however, the priority that farms gave roughage production apparently was upgraded. Three general factors undoubtedly contributed to this change:

- The Food Program directed that increased quantities of chemical fertilizer and additional investment in machinery and storage facilities be allocated to expanding roughage production.
- The repeated warning to farms not to count on state stocks of grain to cover onfarm feed shortages, combined with the series of poor grain crops, could have caused farms to devote more effort to production of harvested roughages.
- Good weather in 1982 and 1983 led to a quick payoff from increased emphasis on forage production, giving farmers the confidence to continue expanded production and use of forage.

According to the Soviet agricultural press, farm managers are well aware of the improved animal productivity that can be achieved by feeding better balanced livestock rations. At the same time, Gorbachev's complaints about foot-dragging suggest he feels that forage production has not been stressed sufficiently.

Improving the Protein Content

Although the USSR has recently made progress in achieving larger per head feed rations and a better balance between concentrates and roughages, headway in improving protein content has been lagging. Soviet livestock specialists indicated that feed rations in 1980 were roughly 15 percent short of the quantity of protein needed for fully balanced rations. Since then, protein content has been slowly increasing.[9] To have eliminated the protein deficit with soybean meal—a readily available high-protein feed—would have required almost 11.5 million tons of imports in 1980, far in excess of the 438,000 tons imported. Upgrading the protein content to the norm would have, in turn, reduced the 20-percent calorie deficit to 5 percent or less. The improved balance in the ration would have raised productivity, in turn lowering the ruble cost of production. Although the resulting reductions in amount of feed required and length of the period needed to bring animals to market weight cannot be quantified, the direction toward improved efficiency is clear. 25X1

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Western observers have long urged Soviet imports of soybeans and soybean meal as a "simple and quick" solution to the protein deficit.[10] Moscow, however, refused to do so until the end of the 1970s, perhaps because the mixed-feed industry did not have adequate mixing facilities and trained workers to process the meal efficiently. Moreover, shipping and handling losses could be substantial. The sharp reduction in soybean meal imports from 2.3 million tons in 1983 to an estimated 200,000 tons in 1984 indicates Moscow's earlier reluctance to import large quantities was well founded. Major domestic sources of high-protein feeds—those containing 20 percent or more of their weight as crude (total) protein—include nonprotein nitrogen (which converts to protein in the digestive process), oilseed meals, animal products such as meat and bonemeal, and single-cell protein.[11] Less concentrated but valuable sources of protein include milk and crops such as pulses, alfalfa, and clover. 25X1

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The USSR lacks the agronomic conditions to produce large quantities of soybeans; production averages about 500,000 tons annually compared with over a 50-million-ton average US crop during the 1981-84

[9] in most areas of the country the protein content was up to 100 grams, about 10 percent short. (We think this calculation refers to mid-1984.) See appendix B for a discussion of the protein problem.

[10] D. Gale Johnson, *The Soviet Impact on World Grain Trade*, British-North American Committee, USA, May 1977, pp. 12-19.

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[11] *Crude protein* refers to all the nitrogenous compounds in feed; *digestible protein* refers to protein utilized by the animal and is estimated by coefficients derived over time from feeding trials. *Single-cell protein* is a collective term including protein-rich microorganisms such as bacteria, algae, and fungi (yeast and molds) grown on byproducts of oil, on methanol, or on organic wastes from agriculture and industry. For a discussion of high-protein feeds, see appendix B.

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period. Substantial amounts of other oilseed meals (particularly sunflower and cottonseed) are produced, but the quantity is far less than needed to fully alleviate the protein deficit.

To increase domestic supplies of high-protein feed, the USSR, over two decades ago, chose to develop the single-cell protein (SCP) industry (see inset). Although both startup and operational costs are high for this specialized product, the long-run gains for the USSR, with its aversion to becoming dependent on the West, are substantial:

- Production is independent of the weather.
- Protein content of feed rations is increased with no dependence on foreign suppliers.
- The product is handled and stored with little difficulty and can be easily incorporated into feeds.
- Finally, there is an increasing body of test results in the United States indicating that the payoff in improved efficiency per gram of protein from SCP is higher than that from oilseed meals. Experimental work has not yet been able to explain this phenomenon.

Today, the USSR is by far the world's largest producer of SCP. By 1983, output had reached 1.3 million tons, and SCP supplied 22 percent of the protein available from high-protein feeds (figure 5).[12] In contrast, only comparatively small amounts of SCP are produced in the West, because the cost of production is at least double that of soybean meal, making it uneconomic for Western feeding operations. There also are widespread fears of the possible carcinogenic properties of SCP produced from hydrocarbon sources. Soviet specialists argue these fears are baseless.

[12] Soviet sources indicate that only a negligible amount of SCP is being used experimentally to develop foods suitable for human consumption.

Development of Single-Cell Protein in the USSR

The USSR began experimental production of cellulose-based single-cell protein (SCP) from hydrolyzed straw in 1936. A Soviet textbook reports that by 1943 industrial production had begun. The initial impetus was to provide high-protein food for human ingestion. After World War II, the emphasis shifted to supplementing annual feed. Experiments to produce SCP from liquid paraffin (obtained from crude oil) began in the mid-1960s.

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The USSR is in a good position to undertake development of the SCP industry. Raw materials, particularly hydrocarbon and agricultural wastes, are readily available. Until recently, however, production fell far short of plan. Average annual output during the 1976-80 period, for example, was at least 25 percent short of plan, and press comment noted that output in 1981 and 1982 also "failed to meet plan." In mid-1984, however, a Soviet official claimed that 1983 production—1.3 million tons—had exceeded the plan by 10,000 tons and that first-half 1984 production had met the plan. Output reached 1.4 million tons in 1984.

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Meeting the 1985 target of 1.9 million tons is not likely. In common with most industrial experience in the USSR, growth in production of SCP has been hindered by failure to commission new capacity on time and by shortfalls in supplies of raw materials, frequently because of transportation difficulties. Many of the raw materials—corn cobs, rice husks, straw, wood shavings, and sawdust—are comparatively bulky but lightweight, and trucking enterprises (which are paid by weight) are unwilling to haul them. Shortfalls have also occurred in deliveries of hydrocarbon raw materials. Finally, production of SCP has been held back by problems with equipment corrosion and the aging of the older plants.

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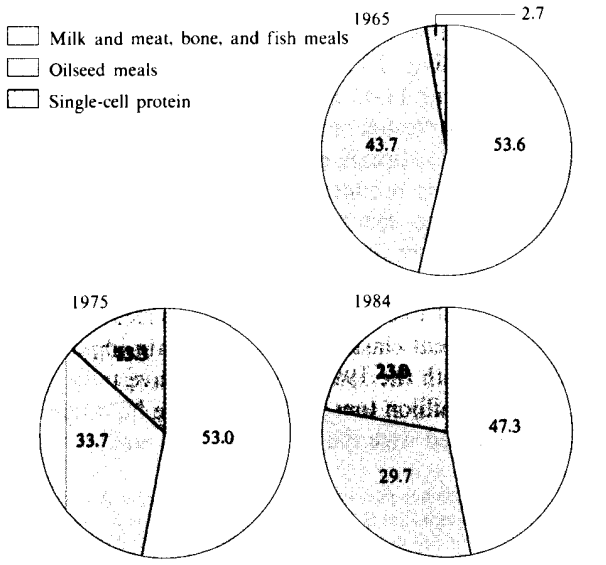
Figure 5
USSR: Importance of Single-Cell Protein in Supplies of High-Protein Feeds, 1965, 1975, and 1984[a]



[a] Soviet sources.

307640 12-85

Table 2
Projected Fulfillment in 1990 of Soviet Plans for Feed Availability [a]

	At Least 90 Percent of Plan	50 to 89 Percent of Plan	Less Than 50 Percent of Plan
Quantity			
Total feed	X		
Concentrates	X		
Roughages		X	
Quality			
Concentrate-roughage balance	X		
Protein content [b]	X		
Of which:			
Oilseeds		X	
Other high-protein crops			X
Single-cell protein [c]		X	

[a] Given our *most likely scenario*, grain imports of 40 million tons and no soybean imports

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[b] Norm level rather than plan. Total protein content is closer to plan than the components listed because several important components, such as milk and fishmeal, that already are in adequate supply are not included.
[c] Assumes planned growth for 1986-90 is the same as that in the revised 1981-85 Plan.

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Plans To Increase and Improve Feed Supplies

Growth in Production

The 1981-85 Five-Year Plan called for increasing the supply of feed to 500-509 million tons of feed units by 1985, and the Food Program extended the goals to 540-550 million tons by 1990. Achieving even the lower end of the targets for 1985 (500 million tons) and 1990 (540 million tons) is unlikely. Feed use during the 1981-84 period averaged nearly 415 million tons of feed units annually, far short of the 1985 target.[13] Late in 1985, supplies of feed—from a 200-million-ton grain crop, a new record in production of harvested roughages, and roughly 40 million tons of grain imports (calendar year)—suggest that total feed used during the year will be up roughly 3 percent over 1984.[14]

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Current feed conversion ratios indicate that about 500 million tons of feed units would be sufficient to produce the livestock products and support the herd growth targeted for 1990. Because this quantity is

[13] Total feed use reached a record 410 million tons of feed units in 1978 and then fell back to about 400 million tons for the next four years. Increased supplies of both grain and roughages in 1983 boosted reported feed use to a new record 424 million tons, which was followed by 431 million tons in 1984.

[14] Our estimated 40 million tons of grain imports in calendar year 1985 includes 28 million tons imported during January-June, needed because of the lower 1984 grain crop, and 12 million tons imported during July-December.

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somewhat less than the Food Program target, we may understate the Soviet potential to increase livestock production in the sections ("Concentrates" and "Roughages") that follow.[15] Alternatively, the Soviets may not attempt to rigorously follow an integrated plan. In a recent television interview, a leading academician of the Academy of Agricultural Sciences said, "We have not had balanced plans for years," and that the plan is used primarily to exert pressure on managers.

We believe that the Soviets will have mixed success in carrying out their ambitious plans for increasing the availability of feed. Our estimates of the likely degree of plan fulfillment for both the quantity and quality of major categories of feed are summarized in table 2. If Moscow continues importing large quantities of grain, roughly 90 percent of the 1990 target for availability of total feed will be achieved. Protein content will also come close to its target but will still be 5 to 8 percent short of the Soviet norm. Milk, meat and bonemeal, and fishmeal will continue to be major sources of high protein supplements, but availability of protein from domestically produced oilseeds, other high-protein crops such as pulses, and SCP will fall well below plan. A more detailed review of each of these feed categories is presented below.

Concentrates. The share of concentrates in total feed used dropped from 36 percent in 1980 to 35 percent in 1982 and to just under 34 percent in 1984.

[15] The difference may arise from a number of reasons. Perhaps the plans for feed production are not derived from planned product output but from plans for herd growth and normed quantities of feed per animal; perhaps feed production plans and feed consumption plans are not checked for consistency, particularly those for the private sector, which still produces about 30 percent of total meat, milk, and eggs; perhaps the current reported feed conversion ratios do not represent real averages but a better-than-normal situation. (Soviet animals are still largely marketed at lower weights than most Western animals and gain weight slowly, although, according to Soviet textbooks, weight is one of the criteria used in planning feed needs.)

Finally, it is also unlikely that feed for livestock not included in the calculation—camels, oxen, buffalo, mules, and reindeer—account for much of the difference. On 1 January 1971, the most recent data available, there were fewer than 4 million such animals, and well over half of these were reindeer. There were 7.5 million horses and almost 100 million cattle.

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The goal of maintaining the one-third share of concentrates in the overall livestock feed supply during 1986-90 implies an absolute increase planned in concentrate feeding of 13-14 million tons from 1985 to 1990 (including 11-12 million tons of grain). But if the grain area harvested remains constant and if our "most likely" estimate of the increase in grain yields is correct, grain production would increase only by some 10 million tons from the 1985 trend level (190 million tons) over the next five years.[16] Consequently, in the absence of improvements in feeding efficiency or adjustment to differing needs for concentrates among different classes of animals, grain imports associated with the 1990 crop would have to be roughly 10 million tons higher than the 30 million tons associated with the 1985 crop.[17]

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[16] Long-term weather patterns and trends in fertilizer delivery to agriculture suggest that Soviet grain production during the 1986-90 period probably will average 195 million tons annually, reaching roughly 200 million tons in 1990.

25X1

Largely because of unusually favorable precipitation during the crop season, we estimate 1985 grain output was about 10 million tons above the long-term trend. The estimate falls well within the 95-percent probability range or within 15 million tons of the projected crop (op. cit., p. 11).

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[17] These calculations are sensitive to assumptions about feeding efficiency—the change in quantity of feed required per unit of output. In view of the relatively stable feed conversion ratios in the USSR since 1970, we believe the conversion coefficients are likely to remain close to current levels for the balance of the decade unless plans to increase supplies of domestically produced high-protein feeds are at least partially achieved. If, however, feed conversion ratios for each type of meat, for eggs, and for milk were to improve by 0.5 percent per year over the five-year period, the decreased need for feed would reduce the requirement for grain imports by some 10 million tons in 1990. A 0.5-percent annual improvement is roughly the rate achieved by several West European countries in production of pork and eggs over the first half of the 1970s. Although the West European countries were generally at higher levels of feeding efficiency in 1970 than are currently observed in the USSR, many of their practices—such as the ways in which roughages were stored—were similar to present Soviet operations.

25X1

While there is much room for improvement in feeding efficiency, we believe that some of the gains anticipated—from, say, increased protein in the feed ration—could be offset by failure to improve other factors that have been affecting feed quality. For example, given past practice, upgrading and expansion of storage facilities sufficiently to preserve nutritional content of increasing quantities of harvested roughages is unlikely.

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Table 3
USSR: Roughage Availability—Plan and Actual

Million tons expressed in physical terms

	1975		1980		1985
	Plan [a]	Actual [b]	Plan [c]	Actual [b]	Plan [d]
Coarse feed	251	238	248	232	NA
Hay and haylage	142	NA	159	NA	187 to 192
Of which:					
Hay	NA	79	NA	79	NA
Succulent feed	449	502 [e]	436	586 [e]	NA
Of which:					
Silage	258	171	254	199	260 to 275
Pasture fed	NA	387	NA	363	NA
Summer green feed	762	NA	747	NA	690
Succulent and summer green feed	**1,211**	NA	**1,183**	NA	NA
Succulent feed and pasture fed	NA	**888**	NA	**949**	NA

[a] *Gosudarstvennyy pyatiletniy plan razvitiya narodnogo khozyaystva SSSR na 1971-1975 gody*, Moscow, 1972, p. 175.
[b] *Narodnoye khozyaystvo SSSR v 1980 g.*, p. 253.
[c] G. C. Gaponenko, *Osnovnyye napravleniya razvitiya sel'skogo khozyaystvo v desyatoy pyatiletke*, Moscow, 1976, p. 76.
[d] G. P. Rudenko, *Razvitiye agropromyshlennogo kompleksa v odinadtsatoy pyatiletke*, Moscow, 1982, pp. 42, 44. Ya. P. Ryabov, *Sotsial'no-ekonomicheskoye razvitiye SSSR v odninadtsatoy pyatiletke*, Moscow, 1981, p. 41.
[e] Includes a portion of summer green feed.

25X1

Roughages. Coarse feeds, primarily hay and haylage, are to supply 20 percent of total feed units in 1985—an increase from the 15-percent share in 1980. Together with the planned increase in availability of total feed units, this share implies a growth in coarse feeds of about two-thirds from 1980 to 1985. Plans for the second major category of roughages, succulent feeds, are difficult to interpret because of terminology and overlapping categories. Succulent feed *reported* by the Soviets as "used" includes silage and "summer green feed" but excludes pasture grazed. The plan category "summer green feed" in Soviet *planning* parlance, however, appears to include the "pasture fed" category of feed use (table 3). Plans for feed grazed from pasture are seldom published, nor (except in rare cases) do data appear on total summer green feed used. Consequently, any conclusions about meeting plans for these categories are highly tentative. The 1985 plan calls for the share of feed units from succulent and summer green feed to be roughly the same as that actually supplied by succulent and pasture in 1980, implying an increase of about one-fourth in supply.

25X1

The supply of roughages will probably improve, although targets are likely to remain out of reach. As in the past, several factors militate against meeting plans:

- Planned fertilizer deliveries are not yet sufficient to raise yields to the levels needed to meet output goals.

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- Yield increases from land improvement (irrigation and drainage) are slow in coming.
- Specialized equipment for harvesting continues in short supply.
- Storage facilities are woefully insufficient even for current production levels.

Nonetheless, the shortfall from plan in availability of roughages is likely to decline from 20 percent in 1980 to an estimated 12 percent in 1990.

A continued slow improvement in supplies of crucial inputs is probable. Conservatively, growth in production of harvested roughages will average about 2 percent annually, somewhat less than the unusually high average of 2.8 percent achieved during the 1981-84 period, but above the 1.1-percent average registered during the 1971-84 period. Quantities of feed from pastures—which will probably continue to be the residual claimant for fertilizer, seed, pesticides, irrigation equipment, and water supply—probably will be relatively unchanged.

Reducing the Protein Shortage

An obvious short-term solution to the Soviets' livestock-feed protein shortage is imported soybean meal; however, as we have noted, very large quantities would be required. Such imports would be expensive—for example, 10 million tons at mid-1984 prices would cost about $1.7 billion, an annual cost that Moscow could expect to repeat indefinitely—and would confront the mixed-feed industry with the technical difficulties inherent in incorporating the meal into feed rations. Reportedly, problems with handling, solidification during storage, and high "shrinkage" (losses) did cause Moscow to draw back sharply in 1984 from the 2.3-million-ton level posted by soybean meal imports in 1983. High-level Soviet officials continue to state, moreover, that the USSR does not want to become dependent on soy imports.

Moscow plans to increase the protein content of animal rations in the longer term through three major domestic production efforts: oilseed meals; other crops that have a comparatively high-protein content, such as pulses, alfalfa, and clover; and single-cell protein. Plans for production of all three groups are ambitious, and goals appear to be beyond reach. Moreover, we do not expect substantial increases in the supply of animal-based protein feeds. If plans to supply the meat-processing industry with updated and complete equipment for processing byproducts are carried out, output of meatmeal and bonemeal could be increased by at least one-fourth, adding the equivalent of a few thousand tons of soybean meal as meat production continues to increase. 25X1

Oilseed Meals. The area sown to oilseed crops—sunflowers, cotton, soy, rape, and so on—has been fairly constant, averaging 10 million hectares annually during the 1979-84 period. Yields, however, have shown no increase during this period. The sunflower and cotton crops supply seed for roughly 85 percent of oilseed meal produced from domestic resources. 25X1 25X1

Production of *sunflower* seed averaged 5.1 million tons during 1981-84—well below the nearly 6-million-ton crops of the early 1970s and even further below plans to produce an average of 6.7 million tons during the 1981-85 period. Persistent hopes to improve sunflower yields have been thwarted by a lack of high-yielding and disease-resistant hybrid seeds; weather difficulties (particularly drought during periods crucial to growth); and increasingly frequent outbreaks of disease (mold and mildew), which are possibly the result of incorrect crop-rotation practices. For these reasons, plans to produce 7.2-7.5 million tons of sunflower seed annually during the 1986-90 period appear to be too optimistic. 25X1 25X1

In contrast, *cotton* production during 1981-84 averaged 9.4 million tons, somewhat above the 1981-85 plan for 9.2 million tons annually. Although currently available at roughly the planned level, cottonseed is not so desirable a source of oilseed meal as sunflower seed because it is low in lysine and several other important elements. It also contains the substance gossypol, which is toxic to nonruminant animals such as hogs and causes mottling of egg yolks if fed to laying hens. 25X1 25X1

Soybean production continues to disappoint Soviet agricultural planners. Agroclimatic conditions are generally unsuitable; where production is possible,

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yields are less than one-third US yields. Moreover, incentives for soybean production are lacking. Earlier plans to produce 1.4 million tons annually during 1981-85 and 2.2-2.3 million tons annually during the 1986-90 period were based on unrealistic expectations; production averaged only 530,000 tons annually during the 1981-84 period.[18] The 1986-90 Plan may be scaled down.

The USSR has usually used *rape*, which provides excellent forage, for grazing and green feed; it has used both the spring crop and an unreported but probably large area of the winter crop. Soviet plans call for output of rapeseed to increase to 500,000 tons in 1985 and 1.5 million tons in 1990. These goals, too, appear to be overly ambitious; winter rapeseed production reached a high of 35,000 tons in 1983; production of spring rapeseed is not published, but regional press reports indicate it is insignificant. We believe rapeseed meal will not add large quantities of protein to animal rations through the 1980s.

Pulses and Other High-Protein Crops. Plans to increase area sown to pulses to 7.0-7.5 million hectares in 1985—roughly 50 percent more than was sown in 1980—came close to being achieved. Preliminary data indicate 6.8 million hectares were planted to these valuable crops. Much of the increased area is in the Ukraine where yields have run as much as 50 to 80 percent higher than the countrywide average. Larger plantings in higher yielding areas and good moisture raised average yields to an estimated 14 quintals in 1985, only 5 percent short of the record yield achieved in 1970. Nonetheless, to meet the 1990 production target of 18-20 million tons, a yield increase of about one-third over the 1985 estimated level would be needed even if the area devoted to pulses reaches the previous record (10.8 million hectares in 1963). Yields will, however, remain relatively low, because chronic difficulties in seed selection and in maintaining seed purity are not likely to be overcome soon.

Similarly, longer range plans to raise the alfalfa area to 10 million hectares and the clover area to 8-9 million hectares by 1990 (from 1984's 6.8 and 6.2 million hectares, respectively) are not likely to be met. Another, perhaps key, factor slowing expansion of these crops is the limited development of high-yielding and disease- and pest-resistant varieties. Until recently, shortages of good-quality seed also hindered progress. The establishment of specialized seed-producing farms in the past few years, however, apparently has been beneficial. In December 1984, TASS reported that collective and state farms' needs for alfalfa seed will "now be basically satisfied."[19]

Single-Cell Protein. During the 1981-85 Plan period, nearly 3 billion rubles were scheduled to be invested in further development of the microbiological industry. The share to be directed to producing SCP has not been published, but it undoubtedly is large. SCP accounts for an estimated two-thirds of the value of the microbiological industry's production.

Production of single-cell protein was slated to reach 1.9 million tons by 1985—more than double the 1980 level and about one-third more than was produced in 1984. No plans for 1990 have been published. The numerous chronic shortages of raw materials (particularly of paraffins) for growing SCPs, the slowness in commissioning new capacity, and "acute problems in using available capacity" suggest that 1985 plans will not be met.

Although SCP is not a panacea for the protein deficit in livestock feed, it will contribute to raising the protein content of feed rations toward the established target. For many years to come, however, the availability of domestically produced oilseed meals and animal products (particularly milk and skim milk) will be more important determinants of the overall protein content of the feed supply.

[19] This is noteworthy—if true. In January 1984, *Sel'skaya zhizn*, the central agricultural organ, reported that the majority of farms producing seed failed to meet plans for selling seed to the state. The article did not quantify the extent of the shortfall.

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Outlook

Gains in Feed Availability

The Food Program's emphasis on expanding forage crop production and increasing meat output has not yet had a marked effect on productivity, that is, on the changing relationship between inputs of feed units and output of meat, milk, or eggs. When examined in quantitative terms by comparing aggregated livestock output with the appropriately weighted quantities of feed required to produce it, productivity increased by only 1.2 percent over the 1981-84 period. Since 1980, feed conversion ratios (state and collective farms only) for milk have gone up slightly, those for beef have been relatively constant, and those for pork have gone down.

Nonetheless, because programs of the past few years appear to be having an impact on increasing domestic supplies of feed, although to only a limited degree per animal so far, we believe that substantial progress toward meeting meat production goals may well occur. Indeed, if paired with good weather the demand for imported grain may be substantially reduced. Because the development of the farm sector to 1990 will depend strongly on weather and on how Gorbachev carries out his stated intentions, we present three scenarios: first, a most likely scenario and the gains for the consumer implied by this outcome, and then two alternatives, favorable and unfavorable.

The most likely scenario for livestock feed availability by 1990 suggests the USSR would have roughly 500 million tons of feed units—somewhat less than plan but enough to meet planned meat, milk, and egg goals and to support planned herd growth—if:

- Grain production increases at 2 million tons per year, the rate we project, on the basis of long-term weather patterns (average) and the trend in fertilizer delivery to agriculture.
- The supply of harvested roughages increases about 2 percent a year, somewhat slower than the nearly 3-percent growth achieved during 1981-84 but above the long-term rate.
- Current feed conversion ratios are unchanged.
- Grain imports equal roughly 40 million tons in 1990.

Because herds are planned to grow only slowly and we believe farm managers will adhere to this plan, this scenario implies a substantial gain in feed per animal and a slowdown in the rapid rise in production costs noted since 1975.[20] Moreover, the share of concentrates would be slightly under 33 percent, suggesting a further, albeit slight, improvement in achieving a concentrate-roughage balance similar to that which exists in the United States. If, in addition, plans for domestic production of high-protein supplements are partially achieved, the protein content will also increase. Achieving half the planned increases would, for example, raise protein content from the present estimated 98 grams to 100 to 102 grams per feed unit. 25X1

25X1

A more suitable concentrate-roughage balance and increased protein content should lead to improved efficiency. If herd growth is kept to the planned rate, the shortage of energy per animal would be cut in half, to about 10 percent. The increased protein content would also improve utilization of the available feed. As a result, producing the targeted quantities of livestock product would probably require grain imports of less than 40 million tons. Although quantities cannot be estimated precisely, the reduction could be as much as 5-10 million tons. At the same time, much of the gain from increased protein content may well be offset by other factors such as the lack of adequate storage facilities for maintaining high-quality harvested roughages through the winter months. 25X1

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Gains for the Consumer

Achieving the recently announced 1990 meat-output goal of 21.0 million tons would mean a 17-percent gain in production per capita from 1984, an average of about 3 percent annually.[21] Per capita meat availability, however, would grow less rapidly—2 percent

[20] Gorbachev has consistently argued the need to improve animal productivity, and planners appear to be incorporating this conviction into their plans. For example, according to the Soviet press, three-fourths of the gain in milk output during the 1980s is scheduled to come from increasing milk yield per cow. 25X1

[21] In Soviet terms, meat includes poultry and is defined as slaughter weight, including slaughter fats and edible offals. To be comparable to Western retail measures of meat, roughly 18 percent of the total—slaughter fat and trim— should be deducted. This goal represents a slight reduction from the 21.7 million tons announced in the Food Program but is still sufficient to cover the per capita consumption goal. 25X1

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annually—unless Moscow continues to import meat at the record near-million-ton level of recent years. Even this lower rate of growth far exceeds the 1-percent growth in availability achieved since 1975 and would help reduce shortages and queuing for meat. The leadership, in turn, would benefit from having proved its ability to successfully implement a program based on improving levels of living.

More Favorable Than Earlier Estimates . . .

This scenario presents a far more favorable outlook for the USSR than our previous analysis predicted. This outlook is based largely on the excellent roughage outturns of the past few years. Continuing the roughage expansion will require steady yield increases, a continuation of the current government policy that allocates resources toward their production, and continuation of current incentives for farms to produce roughages.[22]

. . . But Other Outcomes Are Possible

In the *first alternative scenario,* unusually good weather throughout the balance of the 1980s would allow increases in production of all crops. Very good weather and the meeting of planned targets for fertilizer deliveries and application—up 6 percent a year—would increase grain production to 230 million tons, about 30 million tons higher than our *most likely scenario,* thus substantially reducing the need to import grain for feed.[23] Because Moscow would continue to emphasize the necessity to produce roughages and to direct resources toward that end, the scenario also assumes that roughage output plans—as well as those for adequate harvesting and storage of these crops—would be met. These levels of grain and roughages production would provide more than enough feed units to produce—at present feed-conversion ratios—planned output of meat, milk, and eggs.

[22] The overall area devoted to roughages cannot be expanded substantially except at the cost of other crops, although limited gains can be achieved through shifting crop patterns. This calculation assumes a 2-percent annual increase in feeding of roughages, somewhat less than the 2.8-percent average growth achieved during the 1981-84 period, but equally above the 1971-84 average rate.

[23] The likelihood of this outcome—which implicitly assumes that equipment, labor, and facilities to handle these large crops are available—is estimated to be about 1 in 20.

Indeed, the increase in availability of roughages would be sufficient to offset the need for any grain imports if planners finally realize the extent to which an increased share of roughages in a larger ration can improve the balance and thus raise milk and meat yields. Under these circumstances, farmers would be told to reduce the share of grain in feed rations substantially below current planned levels. Moscow, in turn, would be able to reallocate domestic grain from feed to stock building and possibly to export. Gains in efficiency arising from ample supplies and better balance of feed per animal would ultimately make even more grain available for alternative uses. It is unlikely that Moscow would use this dividend to boost meat and milk production in the next five to six years; processing and handling even the planned quantities may strain the system. 25X1

In the *second alternative scenario,* unfavorable weather would approximate conditions like those in 1961-65, with precipitation equal to the lowest five-year average of the 1961-65 Plan period. Grain production would be 30 million tons less than our most likely estimate. Moscow would talk about the importance of roughages but fail to continue increasing the allocation of resources necessary to their production. Growth in availability of roughages would continue at the 1971-84 rate of roughly 1 percent. Consequently, output would be some 20 million tons (in terms of feed units) less than if the supply grew at the 1981-84 rate. The likelihood of this outcome is estimated to be less than 1 in 20. Even with the ongoing improvement of port capacity, the USSR probably could not handle the more than 75 million tons of grain imports that would be needed—in the absence of marked improvement in feed efficiency—to compensate for both lower production of grain and slower growth in availability of roughages. Purchases of such magnitude would have a marked upward effect on world grain prices, further increasing the USSR's hard currency burden. 25X1

As in the past, the consumer would bear the brunt of the adjustment. Growth in per capita production of meat would be noticeably slower than planned growth 25X1

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of disposable money income, and the current gap between supply of and demand for meat would widen. Measures to cope with the situation and curb consumer discontent might include providing large quantities of other desired goods to reduce the demand for meat, expanding even further the specialized food distribution networks, and increasing meat imports substantially above the nearly 1-million-ton average of the early 1980s. The last alternative would not necessarily add substantially to hard currency spending because only one-third of the meat now imported is from hard currency trading partners. [redacted] 25X1

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Appendix A

Production of Livestock Feed

Production of livestock feed, in terms of energy available per animal (feed units), is still nearly 20 percent below announced Soviet standards. It has consistently fallen short of the target. The impact on the average feed ration of those gains in total availability of feed that did occur has been largely offset by the strong emphasis on expanding livestock herds (table A-1). Soviet farms, however, did come fairly close to meeting targets for feeding concentrates throughout the 1970s. In part, this was possible because of the substantial growth in grain production before 1979 (table A-2). Since then, of course, massive grain imports have played a key role. Growth in production of roughages was much slower, and farms fell far short of roughage feeding targets. These crops were slighted in allocation of yield-enhancing fertilizers and pesticides and suffered from a lack of specialized equipment for harvesting. Moscow apparently did not realize that the growing imbalance between roughages and concentrates—particularly in rations for cattle (which require substantial quantities of roughages for efficient use of concentrates)—was as much a hindrance to increasing animal productivity as the chronic shortages of feed.

Soviet animal nutritionists used to stress the importance of increasing the quantities of concentrates fed to livestock, both in absolute amounts and as a share of the ration. Brezhnev's initial agricultural programs outlined in 1965 and 1966—particularly the purchase-price increases for livestock products and the removal of sliding-scale crop purchase prices—encouraged farms to do so. From 1965 to 1980, the quantity of concentrates fed more than doubled, and the share increased from about 23 percent (in terms of feed units) to 36 percent. According to the Soviet press, in some areas (such as Estonia) the share of grain—the major concentrate fed—per standard animal reached 60 percent of the feed rations.[24] Such rations are not only expensive but also lead to serious digestive problems and poor reproduction. These extremes occur because of a lack of other feeds (including other concentrates) particularly in winter and early spring.

25X1

In the late 1970s—perhaps finally recognizing that the traditional stress was misplaced—Soviet statements began to emphasize the importance of forage crops and the need to reduce the use of grain. *Pravda*, 20 June 1978, stated: "The use of concentrates to make up for shortages of hay, silage, haylage, and root crop in feed is unacceptable." At a July 1978 agricultural plenum, Brezhnev again stressed the importance of improving the quality and quantity of forage crops, as he had done repeatedly since 1964. The several decrees that followed this plenum, however, had no more effect than earlier exhortation. Feeding of harvested roughages increased by only 40 percent during the first 15 years of Brezhnev's leadership. Reported feed derived from pasture declined by 3 percent despite an 8-percent increase in total farm pasture area (figure 6).[25]

25X1

25X1

[24] Animals are aggregated to standard units according to feed requirements. A standard unit is equivalent to a cow. Various technical publications indicate that Soviet animal nutritionists consider the optimum concentrate share for cattle rations to be about 20 percent; for hog rations, about 75 percent; and for poultry rations, about 80 percent. These percentages imply an average concentrate share of about 30 percent—given the current Soviet herd structure—but planners continue to reiterate the 33-percent share.

[25] Official statistics on feed from pasture must be used with caution because, according to Soviet textbooks, they are partly approximated and may overstate or understate true quantities used.

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Table A-1
USSR: Selected Statistics on Feed and Livestock Herds [a]

	Total Feed Used (*million feed units*)	Feed per Standard Animal [b] (*quintals of feed units*)	Growth in Livestock Herds,[c] Yearend (*index: 1970=100*)
1965	278.5	22.5	92.1
1970	328.2	24.8	100.0
1971	344.5	24.8	103.6
1972	344.1	24.6	103.5
1973	366.2	25.6	106.6
1974	387.0	26.3	109.7
1975	368.5	25.1	106.4
1976	365.0	25.5	107.7
1977	403.0	27.3	112.1
1978	409.6	26.9	114.4
1979	403.3	26.1	115.6
1980	398.1	25.7	115.7
1981	397.5	25.5	116.6
1982	402.6	25.6	118.4
1983	424.0	26.4	121.2
1984	431.4	26.5	121.9

[a] *Narodnoye khozyaystvo SSSR v 1984 g.*, Central Statistical Administration, Moscow, 1985, pp. 279, 293, and earlier years.
[b] Animals are aggregated to standard units according to feed requirements. For example, a standard unit is equivalent to a cow, and a hog being raised for slaughter is given an equivalent weight of 0.5.
[c] Cattle, hogs, sheep and goats, and poultry weighted by respective average prices paid all producers in 1970.

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During 1981 and 1982, absolute quantities of both concentrates and roughages fed remained essentially constant. By the end of October 1982, however, procurement data indicated record quantities of forages were going to be harvested. In part, this resulted from a longer, more favorable growing season that year, but it was also a result of increased quantities of chemical fertilizer and specialized machinery being allocated to forage production.

In 1983 and 1984 forage production continued to expand. Indeed, the supply of harvested roughages in 1984—despite a later start to the harvest and somewhat less favorable weather conditions—was still some 6 percent larger than in 1982. The increased availability of forage meant a substantial increase in overall supplies of feed even though concentrate feeding remained constant. Late October procurement statistics indicated that a new forage crop record was being achieved in 1985. Apparently, the Food Program emphasis on increased supplies of fertilizer and equipment, combined with slowly expanding storage facilities for forage crops, continues to have a positive effect.

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Proper storage facilities for harvested forages are crucial, because the nutrient value of forages depends not only on initial quality but also on final quality when fed. In the USSR, proper storage facilities are limited, and physical losses as high as 40 percent have

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Table A-2
USSR: Production of Grain and Selected Feed Crops [b]

Million tons expressed in physical units

	Grain	Corn for Silage and Green Feed	Feed Roots	Hay and Green Feed Excluding Corn, in Hay Equivalent [b]
1965	121.1	181	23.8	82.5
1970	186.8	212	35.7	110.3
1975	140.1	193	34.4	115.8
1976	223.8	277	50.0	131.2
1977	195.7	247	45.3	135.3
1978	237.4	251	45.7	151.7
1979	179.3	230	38.4	134.4
1980	189.1	266	41.6	148.0
1981	158.0 [c]	232	36.6	149.0
1982	180.0	294	45.5	160.0
1983	195.0	298	48.1	177.4
1984	180.0	312	58.3	168.8

[a] *Narodnoye khozyaystvo SSSR v 1980 g.*, Central Statistical Administration, Moscow, 1981, pp. 201-203, and other years.
[b] Several feeds combined on the basis of Soviet equivalent feeding values.
[c] Unofficially reported.

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been cited in Soviet literature dealing with agriculture. According to Soviet specialists, total annual storage losses for silage and haylage average 20 million tons (physical units) and for hay, 6 million tons (physical units). These losses are equivalent to 8 percent of total average annual silage and haylage use and to 7 percent of average annual hay use, respectively. In 1980, for example, only 40 percent of silage, 80 percent of haylage, 10 percent of root crops, and 8 percent of hay were stored in facilities intended for that purpose.

One part of roughage production is still neglected—pasture. In the USSR, pastures occupy well over 300 million hectares—roughly half the total agricultural land—and reportedly provide about 18 percent of animal feed (nutrient value).[26] Soviet agricultural specialists have long noted that little chemical fertilizer is used on pasture, that manure is applied at half the recommended rates, and that the large sums devoted to providing water for pasture have had only limited results. Indeed, lack of attention to pasture in the desert and semiarid parts of the country—about two-thirds of total pasture—has caused serious declines in feed quality and yields, slowing growth of mutton and beef production. In 1983 one-third of Kirghizia's natural pasture was "covered" with harmful grasses that livestock would not eat. The Soviets are likely to

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[26] See footnote 25, p.17.

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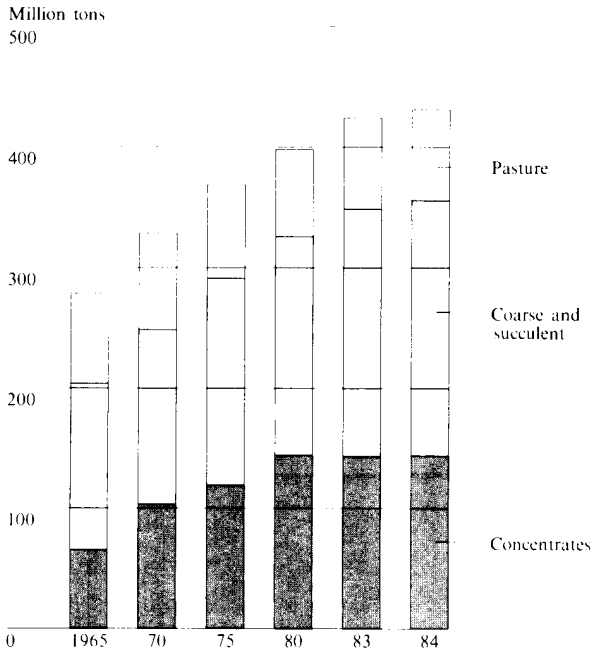
Figure 6
USSR: Feeds Used by Major Category, 1965-84[a]



[a] Feed supplies are aggregated in feed units, using oats as the standard; that is, one feed unit contains the nutrient equivalent of 1 kilogram of oats.

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be slower to change pasture management than they have been in recognizing the need to increase harvested roughages. According to the USSR Minister of Agriculture, there is "widespread opinion that pasturing of livestock has lost its importance now that animal husbandry is being conducted on a more industrialized basis."

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Appendix B

The Protein Content of Soviet Livestock Feed

In 1980 a Soviet livestock specialist wrote that the average feed ration contained 95 grams of digestible protein per feed unit, compared with the long-established Soviet norm of 105 to 110 grams. According to a later source, in most areas of the country the protein content was up to 100 grams (probably in mid-1984). Our calculations suggest that average protein content reached 98 grams per kilogram of feed units in 1983.

The Soviet focus on average or "norm" protein content probably is misguided. Providing the correct quantity of protein for the specific animal is far more important in raising productivity. Rough calculations indicate the Soviet protein norm is reasonably comparable to the recent average ratio of protein content to total feed in the United States. If adjusted for herd structure, however, the Soviet norm is somewhat high according to our estimates of a US recommended average for each class of animal. US textbooks on feeding present protein needs according to weight, age, type of animal, and desired productivity rate; the needs are not aggregated or averaged, and recommended amounts vary from 44 grams per kilogram of metabolizable energy for dairy cows to as much as 300 grams or more for young poultry. Recently, US specialists have questioned the validity of listing aggregate protein requirements. Crude measures of the amount of protein do not take quality—the amino acid composition—or digestibility into consideration.

In the United States, major feed users and the many centralized computer systems for individual farmers are determining least-cost feed rations increasingly on the basis of amino acid content (basic components of protein) rather than protein. In the Soviet Union, systems to help farms mix their own feeds most efficiently do not exist. In addition, the farms do not have direct relations with suppliers but are forced to take the feeds allocated to them. In 1984, for example, about half the mixed feed prepared for hogs was fed to cattle, even though they have different requirements for various supplements.[27]

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In the USSR the major sources of high-protein feeds—those containing 20 percent or more of their weight as crude (total) protein—are nonprotein nitrogen (which converts to protein in the digestive process), oilseed meals, animal products such as meat and bonemeal, and single-cell protein.[28]

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Nonprotein nitrogen. This feed, mainly urea, is used routinely in rations for ruminants (cud-chewing animals such as cattle) in the United States and Western Europe to replace small amounts of plant protein. Western authorities note that the USSR makes little use of this feed because of the risk of poisoning and even death from its incorrect addition to rations or overdoses. During the 1980-83 period, the USSR used annually an average 115,000 tons (nutrient value) of urea in feed, or about 15 percent of the quantity used in the United States, which had a 2-percent smaller cattle inventory during the period. Because urea is used most efficiently in well-balanced, high-energy rations—and not as a supplement to low-quality roughages—the USSR, given its generally poorly balanced and energy-deficient feed rations, is probably wise not to strive for substantial increases in urea use.

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Oilseed meals. These feeds currently make up about one-third of high-protein feeds, down from about 44 percent in 1965. For much of the period, oilseed meal from sunflower and cotton accounted for over 90 percent of total oilseed meal. From 1978 to 1983, the

[27] *Ekonomika sel'skogo khozyaystvo*, no. 2, 1985, p. 12.

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[28] *Crude protein* refers to all the nitrogenous compounds in feed; *digestible protein* refers to protein utilized by the animal and is estimated by coefficients derived over time from feeding trials. *Single-cell protein* is a collective term including protein-rich microorganisms such as bacteria, algae, and fungi (yeast and molds) grown on byproducts of oil, on methanol, or on organic wastes from agriculture and industry.

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importance of soybean meal increased to a peak of nearly 45 percent in 1983.[29] The cutback in imports of both soybeans (which are processed into meal) and soybean meal in 1984 reduced the share to an estimated 30 percent. 25X1

Animal products. These feeds—mainly whole and skim milk, buttermilk, whey, meat and bonemeals, and fishmeals—supply about half the estimated protein available from high-protein feeds in the USSR. The USSR uses roughly 11-12 million tons of whole milk (12 percent of total production) and more than 20 million tons of fluid skim milk, buttermilk, and whey annually in feeding livestock, roughly the same quantities used in 1970. Efforts to reduce these quantities—considered unjustifiably large by Soviet specialists—have not been successful. Growth in production of starter feeds and fluid milk substitutes has been slow in the USSR. By 1983, for example, annual production of fluid milk replacers such as dried skim milk and whey had reached only 310,000 tons, equivalent to 2.4 million tons of milk. 25X1

Production of fishmeal, meatmeal, and bonemeal grew steadily from 1965 to 1975, but it has held constant since then. Fishmeal output has been constrained by the effects on Soviet fishing of other countries' expansion of offshore economic zones in recent years. Meatmeal and bonemeal output have been limited not only because of the relative stagnation in meat output in some years (notably 1979-82) but also because more than one-fourth of the meat-processing enterprises lack facilities and equipment to process these byproducts. Complaints in the press and in the technical journals about the resulting waste are common. 25X1

The USSR chose to develop the SCP industry because domestic sources of high-protein feed supplements are limited. Moscow is firm in its desire to remain free of permanent dependency on foreign suppliers. 25X1

[29] The increase was a result of large soybean and soybean meal imports. Imports of soybeans during the early 1970s were more closely related to the need for vegetable oil than to that for oilseed meal. 25X1

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