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USSR: Improving Agricultural
Performance Reduces
Grain Import Needs

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An Intelligence Assessment

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USSR: Improving Agricultural Performance Reduces Grain Import Needs [Redacted]

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An Intelligence Assessment

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may be directed to the Chief, Strategic Resources
Division, OGI [Redacted]

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USSR: Improving Agricultural Performance Reduces Grain Import Needs [Redacted]

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Key Judgments

Information available as of 7 November 1986 was used in this report.

Soviet agricultural performance has improved in 1986 and may exceed the record 1983 production, an accomplishment General Secretary Gorbachev will undoubtedly highlight as a turnaround in the agricultural sector. The improved performance is due to continued growth in the livestock sector combined with increased production of several major crops. [Redacted]

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Recently, Politburo member Yegor Ligachev predicted that the Soviet grain crop would be roughly 210 million metric tons. This figure, however, is a preliminary estimate as harvesting is still not completed and final results will not be known for some time. On the basis of meteorological data [Redacted] and fertilizer production statistics, we would have expected a grain crop closer to 195 million tons. A higher figure would indicate, among other factors, greater success with the intensive technology program than we have estimated. [Redacted]

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Depending on the final grain outturn, the need for imported grain will fall to between 10 million and 25 million tons, compared with the almost 30 million tons imported during the 1985/86 marketing year (MY). Soviet grain purchases to date total about 10 million tons. Livestock feed supplies are currently adequate and the growing glut of grain on world markets is increasing the prospects that already low grain prices will fall still further. By playing a waiting game, Moscow will be able to obtain grain at discount prices from grain suppliers desperate to sell. [Redacted]

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In our view, the Soviet Union will probably limit its purchases of US grain to corn, a commodity that the United States holds in great supply, can sell at fully competitive prices, and can reliably deliver at any time of year. Recent purchases of EC and Canadian barley and feed wheat and Yugoslav corn, however, may signal a decision to limit US corn purchases. Moscow's failure to exploit US subsidy offers on almost 4 million tons of wheat—even while purchasing Canadian and EC wheat—probably indicates that Moscow will continue to buy from other, cheaper wheat suppliers before coming to the United States. Given the outlook for sizable wheat export availability from US competitors, the USSR may not purchase any US wheat during the current marketing year. [Redacted]

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USSR: Improving Agricultural Performance Reduces Grain Import Needs [redacted]

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Introduction

Overall agricultural output in the Soviet Union is expected to recover from the downward slide experienced over the past two years. We believe that 1986 output may well exceed the previous record achieved in 1983.¹ Continued growth in the livestock sector—which accounts for over half the total—combined with increased production of potatoes, vegetables, and grain will more than offset projected declines in output of sugar beets, cotton, and sunflower seed. As the first year of the 12th Five-Year Plan (1986-90) comes to a close, General Secretary Gorbachev will undoubtedly point to a turnaround in the agricultural sector, long a drag on Soviet economic growth. [redacted]

Since assuming power, Gorbachev has assigned high priority to improving the efficiency of food production. Among several moves, he has further revised and enhanced organizational aspects of the Food Program by merging five ministries and one state committee into a state agroindustrial committee that is intended to have broad authority over the production and processing of food and natural fiber. He has also issued a decree on agroindustrial management that is intended to give local authorities and farms more control over disposal of above-plan production and that makes financial rewards for workers somewhat more dependent on results. Potential gains from these measures, however, will be constrained by traditionally strong bureaucratic resistance as well as by the more fundamental problems plaguing Soviet agriculture. For example, farms will continue to face chronic shortages of agrochemicals and equipment, low labor productivity, and high production costs for the foreseeable future. [redacted]

¹ Estimates of the value of total agricultural production are derived from the gross output of crops and livestock products, less feed, seed, and waste, using 1970 average realized prices. [redacted]

Grain Crop Developments

Growing Conditions Mixed. Despite a mixed performance in various areas, the Soviets appear to have done well overall with their grain harvest this year. Our analysis shows that, following a promising start last fall, the outlook for 1986 Soviet grain yields worsened through the spring and summer because of adverse weather in some key grain-growing regions. In addition, the area sown to grain this year continued the drop begun in 1980 as the Soviets further expanded the area devoted to fallow. [redacted] very good yields from some late maturing spring grain regions in Kazakhstan and Siberia have brightened prospects for what appeared to be a poor grain crop. [redacted]

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In a recent Kremlin speech, Politburo member Yegor Ligachev stated that the Soviet grain crop would be roughly 210 million metric tons—a harvest that would be the fourth largest ever. This figure, however, is a preliminary estimate. Harvesting is only now being completed in Western Siberia, and it will be some time before actual results are known. [redacted]

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Given the evidence [redacted] meteorological data, we would have expected a grain crop closer to a 195-million-ton level, about 3 million tons more than last year's output and about 2 million tons above the officially reported average for the 1976-85 period.² The US Department of Agriculture currently forecasts the crop at 195 million tons. Estimates by other Western grain analysts range from 165 million to 200 million tons. [redacted]

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² The 195-million-ton figure is our best estimate of the 1986 crop, but one that is subject to statistical uncertainty. On the basis of our analysis of best and worst case scenarios, there is a 98-percent probability that the crop will come in between 180 million and 210 million tons, and a 75-percent chance that it will range between 190 million and 200 million tons. [redacted]

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Table 1
USSR: Grain Production,^a 1976-86

Million metric tons

	1976-85 Annual Average	1981	1982	1983	1984	1985	1986 ^b
Total	192.7	158.2	186.8	192.2	172.6	191.7	195.0
By crop							
Wheat	88.8	81.1	84.3	77.5	68.6	78.1	85.0
Coarse ^c	92.8	69.4	91.8	101.9	90.5	100.0	97.0
Other ^d	11.1	7.7	10.7	12.8	13.5	13.6	13.0
By republic							
RSFSR	106.4	78.8	105.2	111.5	92.4	106.6	106.0
Ukraine	41.3	36.1	41.9	36.5	41.7	40.5	42.0
Kazakhstan	24.4	23.8	19.5	23.2	15.9	24.2	27.0
Other	20.6	19.5	20.2	21.0	22.6	20.4	20.0

^a Measured in bunker weight, that is, gross output from the combine, which includes excess moisture, unripe and damaged kernels, weed seeds, and other trash. For comparison with US or other countries' grain output, an average discount of 11 percent should be applied. In 1986 the USSR, for the first time in five years, released grain production data.

^b Estimated.

^c Coarse grains comprise rye, barley, oats, corn, and millet.

^d Other grains include pulses, buckwheat, and rice.

[Redacted]

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We believe the outlook for the 1986 crop is generally good because of the good-to-excellent prospects in parts of the Soviet grain belt that together account for about one-fourth of grain production:

- In the Central and Northwest regions, in the northern Ukraine, and in Belorussia, favorable weather throughout the crop season augurs well for bumper harvests.

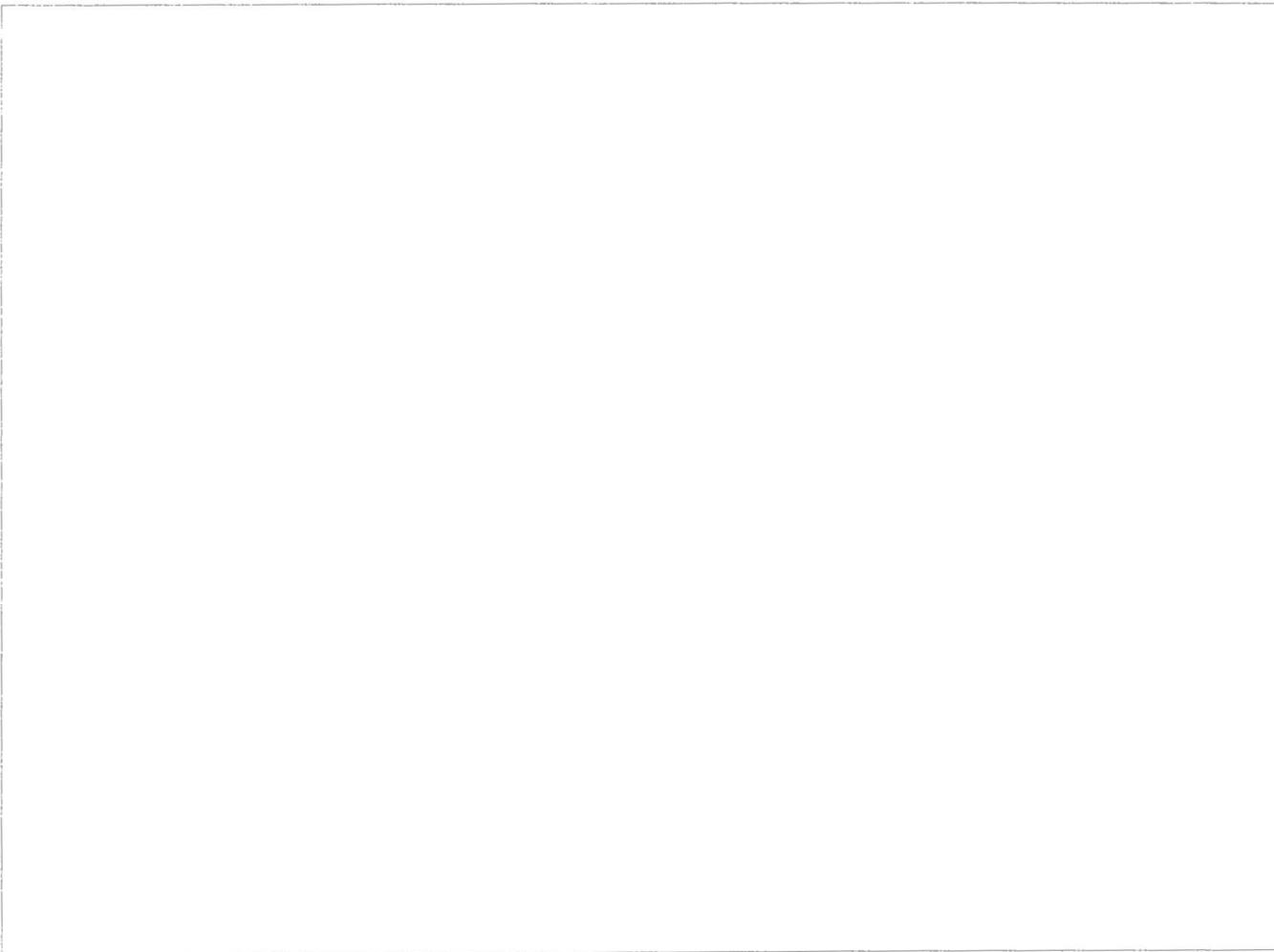
[Redacted] West Siberia, northern Kazakhstan, and parts of the Urals appear headed for above-average or near-record crops. Cool, wet conditions delayed planting of spring grains in many areas of the New Lands, but the abundant moisture allowed good spring grain emergence. Timely precipitation throughout the growing season boosted harvest prospects. Press reports indicate that "yield

increases are much higher than planned" in these areas. [Redacted] grain straw residue shows significantly more straw accumulations than the historical average in both northern Kazakhstan and West Siberia.

- Krasnodar Kray and Stavropol Oblast were not as seriously affected by drought as the more northerly areas of the North Caucasus. Yields reached record levels in a number of locales in these less affected regions and grain quality was reported as exceptionally good, particularly in Krasnodar. Overall, *Pravda* termed the harvest in these regions a "gratifying success." [Redacted]

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The outlook for the crop would have been even brighter but for sustained periods of dryness in important grain-growing areas. In the RSFSR, meteorological data indicated that below-normal April precipitation over the Volga Valley continued in May and spread to parts of the North Caucasus and eastern Chernozem. This was corroborated by May Landsat imagery that showed poor winter grain development because of inadequate moisture supplies, and poor spring grain emergence in the lower Volga region, especially in Volgograd Oblast and parts of Saratov Oblast. Farther west, prolonged dryness also occurred in the southwestern Ukrainian oblasts of Odessa and Nikolayev as well as in the Moldavian SSR. [redacted]

June rains brought relief in the northern Volga Valley, in parts of the Ukraine, and in Moldavia. Dryness, however, continued in the central and southern Volga Valley and spread to the southern and eastern Ukraine and Uralsk Oblast in western Kazakhstan. A weeklong period of hot, desiccating winds (a *sukho-vey*) in mid-June that spread across the southern Volga region, Rostov Oblast, and the eastern Ukraine caused additional problems. Because winter grains were in or near the critical flowering stage,³ potential yields were reduced. [redacted]

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³ Flowering is the stage of crop development where maximum potential grain yields are determined. [redacted]

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Subsequently, conditions in the affected area—which produces about 20 percent of Soviet grain—continued to worsen:

- Meteorological information in mid-July showed that most of the Volga Valley and western Kazakhstan, particularly eastern Saratov, Volgograd, and Uralsk Oblasts, were struck by another *sukhovey*.
- Since that time, persistent dryness in these heavily stressed regions along with Rostov Oblast and the southern Ukraine resulted in further grain losses. [redacted] the amount of grain straw residue in harvested fields—a generally reliable indicator of yields—indicates that the winter grain harvest in some of these areas was fair and that the spring grain harvest was poor.
- In addition, analysis of August Landsat imagery indicates that the 1986 corn crop—of particular interest as a livestock feed supplement—was probably reduced because of persistent dryness when many plants were in the grain filling stage. [redacted]

The size of the 1986 grain crop is also limited by the area sown. On the basis of statistics released by the USSR's Central Statistical Administration in July, we believe that the final harvested grain area will total only about 117 million hectares, well below the 121.5 million hectares averaged during the past five years.⁴ Assuming average yields, such a decrease in area reduces potential grain production by some 7 million tons. [redacted]

Harvest Uncertainties. If the final Soviet figure is close to the 210-million-ton mark announced by Ligachev, it would suggest:

- The Gorbachev-backed intensive technology program to increase grain production has been more successful than we estimated.

⁴ The cutback in grain area appears to be a consequence of Moscow's policy to expand the amount of arable land put into fallow. Between 1977 and 1985, the harvested grain area of the USSR declined steadily from a record high of 130.4 million hectares to 117.9 million, while fallow increased from 12.4 million hectares to 21.3 million. During this period about 3.6 million hectares were taken out of both fallow and production and allocated to other uses, most likely to forage. [redacted]

Impact of Chernobyl'

Analysis of data from a wide variety of sources indicates that the Chernobyl' nuclear accident in April had a negligible effect on Soviet grain production:

- *Agricultural land in the evacuated zone is minor compared with the overall area of Soviet crop production.*
- *Very little grain is produced within the affected area, which consists largely of forest, grassland, and swamps.*
- *According to Soviet press reports [redacted] [redacted] planting of spring crops was not delayed and, as of mid-July, field work on both farms and private plots appeared to be normal outside the evacuated area.*
- *Grain harvested from regions close to the evacuated area may be slightly contaminated by windblown radioactivity, but it can be mixed with clean grain during milling to reduce contamination to acceptable levels.* [redacted]

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- The Soviets have made gains in cutting the substantial harvest losses that have plagued agriculture in the past. [redacted]

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It is our view that Soviet grain production has benefited from a large-scale "intensive technology" program that was applied on some 29 million hectares this year—roughly a quarter of the area sown to grain—compared with about 17 million hectares in 1985. The program is aimed at boosting average yields by almost 1 ton per hectare on lands with a high content of fertile chernozem (black earth) soils. These lands are located primarily in the RSFSR, the Ukraine, and Kazakhstan. In support of the intensive technology program, the USSR substantially increased imports of Western herbicides, insecticides, and fungicides during the last

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The Soviet "Intensive Technology" Effort

The USSR is expanding its massive intensive technology program in grain production. According to Soviet economists, the effort—now in its third year—grew out of Soviet frustration that agricultural production during 1970-85 grew by only 15 percent despite a more than doubling of investments over the same period. Intensive technology, as defined by the Soviets, includes many farm management practices routinely performed in the West. These include using high-yield varieties, planting where possible after fallow, implementing efficient transportation routes and schedules, and the more extensive use of agrochemicals including fertilizers and pesticides. The program commenced in 1984 on selected test sites scattered over the Soviet Union and totaling only 20,000 hectares. The impressive results of these trials encouraged Soviet planners to dramatically increase the intensive technology area to almost 17 million hectares in 1985. In 1986 the area has been further expanded to 29 million hectares.

Soviet comments on the success of the intensive technology program must be approached with caution. Reported grain yields from areas under intensive technology—averaging 40 to 50 quintals per hectare, approximately 20 quintals higher than on comparable lands—are selective and not representative of results over the entire area. In 1985 Soviet officials credited the program with adding 16 million metric tons to Soviet grain output. We believe this figure, however, represented the increased output on the lands where intensive technology was employed but did not take into account offsetting production declines in areas from which resources were pulled.

Net production gains probably did not exceed 5 million tons.

Despite the potential benefits of intensive technology, Soviet farmers were initially reluctant to implement this type of high-input, costly grain production. Numerous training seminars, along with educational articles in agronomic publications, seem to have won over more of the rural sector; press reports last summer made less mention of farmer resistance. Even if this problem is overcome, it is not yet clear whether the Soviets will be able to manage the inputs efficiently enough over large areas to assure a substantial net gain over the long term.

much of the equipment in use is not designed for proper agrochemical application, and perennial production and transportation problems have either prevented delivery of materials altogether or delayed their arrival past the time of optimal application.

Nevertheless, the Soviet leadership has endorsed the intensification effort and plans a sizable expansion over the next several years. In a recent speech delivered in Krasnodar, General Secretary Gorbachev mentioned plans that call for the program to encompass 36 million hectares next year and 50 million hectares by 1990. Although Moscow has serious problems to overcome if intensive technology is ever to approach its full potential, Soviet grain production will undoubtedly benefit from such expansion.

two years. We judge that net production gains of 10-15 million tons—factored into our estimate—were achieved this year with intensive technology despite the adverse weather in various parts of the Soviet Union, but this is admittedly only a rough estimate.

We have no hard information on Soviet efforts to cut harvest losses. They have recognized for some time, however, that improvements in this area could in

crease the amount of the crop ultimately available for use at relatively modest additional cost. The US agricultural attache reported that special efforts to avoid grain leakage from trucks were being made and as a result much less spilled grain was evident to travelers than last year. We believe that these conservation efforts have also been applied to on-farm

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handling. While we have no basis for judging the success of the efforts, their potential is certainly significant—clearly in the millions-of-tons range.

Outlook for Other Agricultural Products

Prospects for the major nongrain crops in the Soviet Union—sunflowers, sugar beets, potatoes, vegetables, and cotton—are mixed as of early November. Output of sugar beets, sunflowers, and cotton is expected to be less than last season, but vegetable and potato production should exceed last year's harvest:

- Although *sunflowers* are hardy and drought-resistant plants, the prolonged dryness in the North Caucasus, Volga Valley, and southern Ukraine—areas that account for about two-thirds of production—will reduce output somewhat. We estimate the 1986 sunflower harvest at 4.9 million tons, below the 1985 5.2-million-ton figure and just under the 5-million-ton average of the last five years.
- *Sugar beet* production this year in the Soviet Union is likely to be about 74 million tons, well below 1985's good 82-million-ton crop and short of the 76-million-ton average of the past five years. Generally dry conditions over the southern Ukraine and Central Chernozem during the spring and early summer hurt beet size considerably. USDA personnel traveling through the Ukraine in September reported that the beet crop was in very poor condition. The Ukraine normally accounts for over half of the USSR's sugar beet output.
- A good *potato* harvest of 81 million tons is anticipated for 1986, about 3 million tons greater than the last five-year average and 8 million tons more than the 1985 season. The weather remained generally favorable in the north European USSR—the principal potato-growing region—with mild temperatures and adequate precipitation. A favorable rain pattern in 1986 ensured that the soil did not become saturated, a condition that frequently gives rise to fungal diseases.
- Because of good precipitation and generally mild summer temperatures in most of the key producing areas of the Ukraine and the RSFSR, we estimate

Table 2
USSR: Nongrain Crops

	Area ^a (million hectares)	Yield (quintals per hectare)	Production (million metric tons)
Sunflowers			
1981-85 ^b	4.2	11.9	5.0
1984	4.0	11.5	4.5
1985	4.1	12.9	5.2
1986 ^c	4.1	12.0	4.9 ^d
Sugar beets			
1981-85 ^b	3.5	218.0	76.3
1984	3.5	247.0	85.4
1985	3.4	241.0	82.1
1986 ^c	3.4	214.0	74.0 ^d
Vegetables			
1981-85 ^b	1.8	161.0	29.2
1984	1.8	170.0	31.5
1985	1.8	157.0	28.1
1986 ^c	1.8	159.0	29.0 ^d
Potatoes			
1981-85 ^b	6.8	115.0	78.4
1984	6.8	125.0	85.5
1985	6.5	113.0	73.0
1986 ^c	6.7	121.0	81.0 ^d
Cotton			
1981-85 ^b	3.2	28.1	9.1
1984	3.3	25.8	8.6
1985	3.3	26.4	8.8
1986	3.3 ^c	24.2 ^c	8.0

^a Area figures are derived from production and yield values published in *SSSR v tsifrakh v 1985 godu*.
^b Annual average.
^c Estimated.
^d Production estimates are obtained by regression equations that take into account weather effects on a regional basis, and a trend term indicative of increased technological inputs over the years. Estimates have an error of about ± 5 percent.

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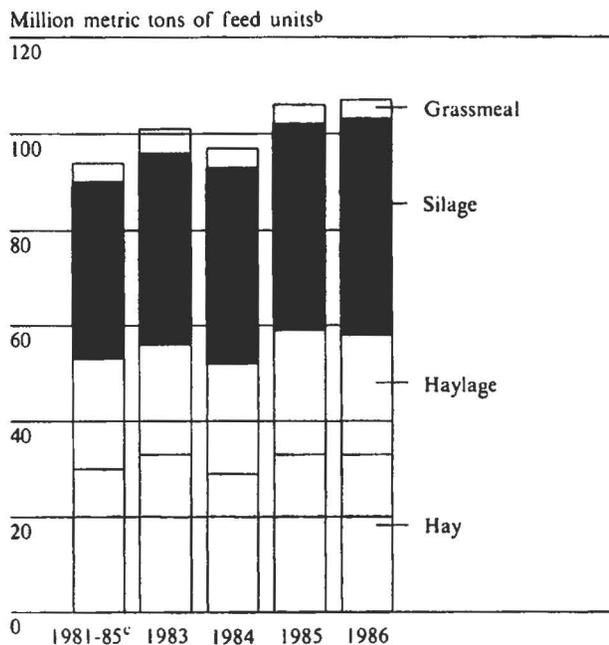
1986 vegetable production to be 29 million tons. This is about 1 million tons greater than last season but short of the 1984 record of 31.5 million tons. As in previous years, frequent reports relating problems with proper storage and distribution of the vegetable harvest continue to appear.

- The 1986 cotton crop reportedly dropped to 8.0 million tons, below both the 1981-85 average of 9.1 million tons and 1985's 8.8 million tons. The 1986 cotton crop was plagued by a variety of problems. The main growing areas of Central Asia experienced a cold spring that delayed planting and promoted the spread of some diseases. Subsequent hail and dust storms forced the replanting of 700,000 hectares. By far the greatest problem, however, was the shortage of water. Much-smaller-than-normal snowfall last winter in the mountains of Turkmenia and Uzbekistan—which produce three-fourths of the Soviet Union's total harvest—caused many rivers that supply irrigation water to dry up during the summer months.

By comparison, the outlook for selected forages—hay, haylage, silage, and grassmeal—is excellent. As of 6 October 1986, the last reporting date, with some 93 percent of the crop in, the forage harvest was running about 5 percent ahead of the record 1983 pace, according to data released by the Central Statistical Administration. Given this performance, forage procurement could finish at record levels. Because harvested forages in the Soviet Union comprise slightly more than one-half of the nutrient content of the livestock ration, the outlook for feed supplies into 1987 is very good.

With such an abundant forage crop, Moscow should be able to achieve the 1986 targets for meat, milk, and egg production. Soviet statistics show that, as of September, meat production on state and collective farms—which produce nearly three-fourths of all Soviet meat—is running 7 percent ahead of 1985 even though the number of animals is not increasing. Milk and egg production are also up by 5 and 7 percent, respectively. The Soviet press reports that the increases resulted from productivity gains.

Figure 4
USSR: Harvested Forages, 1981-86^a



^a As of 22 September of stated year. This is the date of latest complete data reported for 1986.
^b A 1-kilogram feed unit contains the nutrient value of 1 kilogram of oats.
^c Annual average.

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Soviet Grain Requirements and Imports

The Need for Grain. Whether the harvest reaches the 210-million-ton level or is somewhat less, it is likely that the Soviets will import much less grain during the current marketing year than they have in recent years. Indeed, Moscow could import as little as 10 million tons or as much as 25 million tons.

Uncertainty over the exact size of the grain harvest is not the only factor accounting for the relatively wide range in import expectations. Initiatives in the agricultural sector over the past few years have reduced the amount of grain required in meat production.

Soviet farmers have been encouraged to boost forage production as part of a greater campaign to increase the amount of overall feed per animal while reducing the share of grain in livestock feed rations. With the probable shift in feed composition that a large forage harvest will support, the level of grain imports needed to meet Soviet livestock production targets could be reduced by as much as 2-3 million tons. In addition, if Moscow continues to restructure livestock herds in favor of animals that are not heavy grain consumers, the demand for imported grain could fall by another 2-3 million tons.

Moscow also seems to be reducing the amount of grain required for other uses:

- Lowered alcohol production could trim overall grain needs by as much as 1 million tons.
- Recent increases in the availability of other foods have reduced overall consumption of grain products such as bread and cereals.
- The decision to reduce the area sown to grain in favor of fallow has resulted in a 2-million-ton decline in the use of grain for seed.

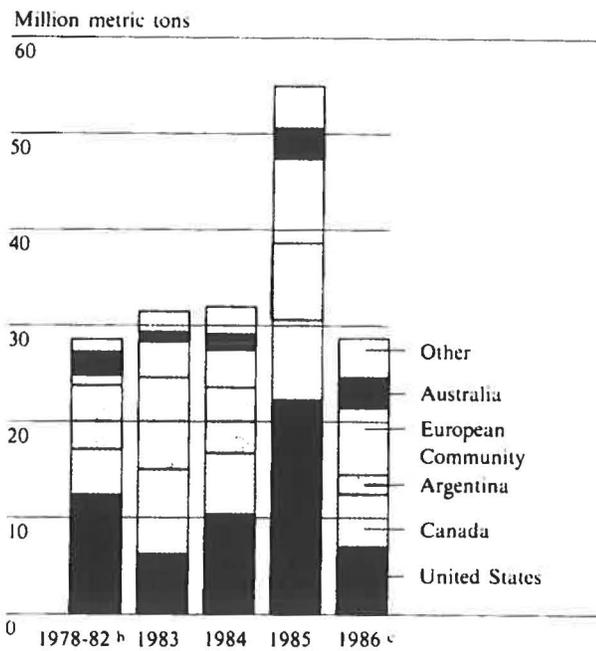
Grain Purchasing Activity. Soviet grain purchases in the marketing year that began 1 July 1986 now total about 10 million tons. Last year, 15 million tons had been purchased by November.

Moscow has shown little interest in its long-term agreement (LTA) obligations. Canada, with recent sales of 2.5 million tons of wheat and 1 million tons of barley, has been the only Soviet trading partner to sign any major deals under an LTA. In the third year of the US-USSR LTA, the USSR bought only 153 thousand tons of its 4-million-ton wheat commitment, despite the subsidy authorized by the US Government in early August.⁵ Soviet coarse grain purchases against an Argentine pact also fall far short of the stipulated obligations, reflecting both limited Soviet demand and an unusually poor-quality 1985/86 Argentinian corn crop.⁶

⁵ The US-USSR LTA year runs from 1 October to 30 September. Thus Moscow had nearly two months to take advantage of the subsidized price. The subsidy offer expired at the conclusion of the LTA year. The agreement specifies that the USSR purchase 8-9 million tons of grain from the United States annually—4 million tons of wheat and 4 million of corn. The remaining 1-million-ton commitment can be met with wheat or corn, or with 500,000 tons of soybeans.

⁶ Coarse grains include corn, barley, oats, rye, sorghum, and millet.

Figure 5
USSR: Grain Imports, 1978-86^a



^a Data based on a market year ending in June. Includes wheat and coarse grains.
^b Annual average.
^c Estimated

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Moscow Biding Its Time. Moscow does not face any great pressure to increase the pace of its grain purchases. In part, the Soviets can delay acquisition because of adequate supplies of livestock feed. But financial constraints also may be holding grain purchases down. Plunging world oil prices have cut into Moscow's principal hard currency earner; sales of oil to the West this year are likely to be only about one-half the peak level of \$16 billion just three years ago. Thus, the USSR may be covering only immediate grain needs while waiting for even lower prices.

With the current abundance of global grain stocks, prospects are good that already low grain prices will fall further. At present, the world grain market is

holding record wheat stocks; Australia, Canada, and the EC have nearly 40 million tons available to export. Large stocks of coarse grains also exist, with the United States holding 75 percent of the total. The market will be further glutted as this year's crops are harvested.

[redacted] A drop in US wheat production this year will be offset by an expected near-record corn crop. Larger expected 1987 corn supplies from Argentina and China will add to the downward pressure on coarse grain prices that already stand at 10-year lows.

[redacted] In addition, Moscow has been at odds with major grain exporters since July over contractual terms that sellers consider unreasonable, including a 30-day grace period on payments for deliveries and the right to refuse shipments upon arrival at Soviet ports.

[redacted]

Implications

Ample grain supplies worldwide mean that the USSR could obtain most of its needs from non-US sources if it so chooses. Soviet press statements that a substantial portion of domestically procured wheat is of good quality suggest that imports of milling-quality wheat will be relatively less important than in earlier years and that coarse grains will be favored.

The United States may again supply a substantial share of Moscow's corn imports. The United States is more reliable than the other major suppliers of corn, has much greater supplies on hand, and can export

year round. Moreover, US corn prices are fully competitive. Recent purchases of EC and Canadian barley and feed wheat and Yugoslav corn, however, may signal a decision to limit US corn purchases.

[redacted]

Moscow's failure to exploit the US subsidy offer on almost 4 million tons of US wheat—even while purchasing Canadian and EC wheat—indicates that Moscow will continue to buy from other, cheaper wheat suppliers before coming to the United States. Given the outlook for sizable wheat availability from other wheat exporters and their readiness to better US price offers, Moscow is not likely to purchase any US wheat during the current marketing year.

Soviet hard currency outlays for grain will, in our view, be substantially less than the \$3.2 billion spent during the period 1 July 1985–30 June 1986. Because grain prices are expected to drop as much as 10 percent from the current average level of \$90 per ton, we believe Moscow could cover the upper end of our estimated need for grain with less than \$2 billion.

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Appendix

Methodology Employed in the Soviet Grain Estimate

Our estimate of Soviet crop production is prepared by a multidisciplinary team that includes agronomists, agrometeorologists, and imagery analysts. This team makes periodic assessments of Soviet grain yields and production during the course of the growing season using the following information and techniques:

- *Landsat Vigor Analysis.* Landsat satellite imagery is utilized to assess the vegetation vigor—plant growth intensity—of agricultural areas. Vegetation vigor in an oblast, kray, or republic at flowering time is closely related to the grain yields of that area. Vigor is determined by visual comparisons of the redness (a measure of the near-infrared response) of the crop area to nearby natural vegetation.
- *Meteorological Analysis.* Daily precipitation, temperature, potential evapotranspiration, and soil moisture conditions are entered into a computerized agronomic model that estimates reductions from a maximum potential oblast grain yield. In addition, regression equations relating yield and monthly meteorological parameters (precipitation and temperature) are employed in areas where available historical yield data have permitted the derivation of such equations.

- *Collateral Information.* During the crop season this consists mainly of Soviet newspaper reports and broadcasts on planting progress, crop status, harvesting progress, procurement status (grain sold to the state), and, occasionally, reported and expected yields. We also obtain field trip reports from US Department of Agriculture travelers and staff from the US and other embassies who are allowed limited, controlled visits to some of the major Soviet agricultural areas.



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Recent Soviet disclosure of grain production and yields for the 1981-85 period—information that had been previously withheld—allows comparison with the accuracy of our methodology (table 3). The data reveal that our coordinated process yielded final estimates that, on the average, varied only about 2 percent from reported figures. 

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Table 3
USSR: Reported Versus CIA-Estimated Grain Production

Million metric tons

	Reported Grain Production				Final Estimated Grain Production				Percent Error USSR
	RSFSR	Ukraine	Kazakhstan	USSR	RSFSR	Ukraine	Kazakhstan	USSR	
1981	78.8	36.1	23.8	158.2	80	36	24	158	-0.1
1982	105.2	41.9	19.5	186.8	101			180	-3.6
1983	111.5	36.5	23.2	192.2	110	39	24.8	195	1.5
1984	92.4	41.7	15.9	172.6	97	44	17.5	178	3.1
1985	106.6	40.5	24.2	191.7	110	43	21.1	196	2.2
Annual average	98.9	39.3	21.3	180.3				181.4	2.1



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