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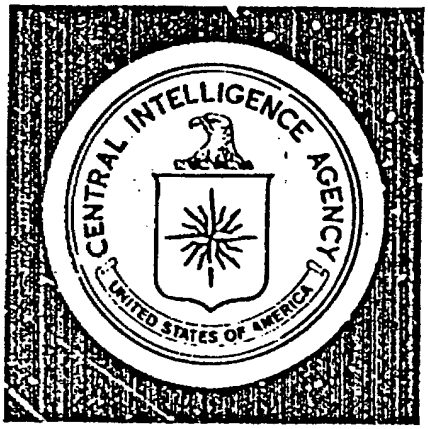

Scientific and Technical Intelligence Report

Soviet Efforts to Introduce US Agrotechnology

~~Secret~~

DSI-STIR/75-29
November 1975

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SOVIET EFFORTS TO INTRODUCE US AGROTECHNOLOGY*

Project Officer

OSI-STIR/75-29
November 1975

CENTRAL INTELLIGENCE AGENCY
DIRECTORATE OF SCIENCE AND TECHNOLOGY
OFFICE OF SCIENTIFIC INTELLIGENCE

PREFACE

The weakest and least productive sector of the Soviet economy is agriculture, and cooperative ventures with Western companies offer a good chance of improving it. The agriculture of our Western allies, viz. the United Kingdom, France, West Germany, and Italy is in an advanced state, and all of these countries plus Japan are willing and able to supply most of the USSR's needs. The Soviets, however, recognize the basic superiority of the United States in agrotechnology, and since the US-USSR agreements on science and technology in 1972/73 and US extension of long-term credit,* they have looked primarily to US firms to provide the advanced equipment, technology, and general know-how needed to reequip and modernize Soviet agriculture. This report focuses on the known agreements and negotiations since May 1972 between the USSR and US industry for agricultural-related equipment and technology, and on Soviet utilization of, or plans to utilize the acquired or desired technology. The Appendix points out areas of present and future Soviet procurement of US agrotechnology based on their expressed needs and national plans.

This report was prepared by the Office of Scientific Intelligence primarily from overt intelligence sources and the open literature, and coordinated within CIA. The cut-off date for information is 1 September 1975.

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*Export-Import Bank credit originally was granted from October 1972 to June 1974. It was not further extended because the Soviet Union failed to meet Congressional requirements for most-favored-nation trade status. Lack of a credit line, however, is not expected to be particularly detrimental to future US-USSR trade. Credit is less of a factor for the Soviets now that worldwide inflation has greatly increased the value of their gold holdings.[1]

November 1975

Soviet Efforts to Introduce US Agrotechnology

—
Project Officer

PRÉCIS

In an effort to modernize its agriculture the USSR is purchasing a wide variety of advanced agricultural technology from Western countries, particularly the United States. Soviet leaders place top priority on increasing agricultural production. An immediate goal is to improve the quality of the diet of the Soviet people. US agrotechnology is certain to prove valuable to the Soviets in attaining shorter development times for selected technical projects. It remains to be seen, however, if the Soviets can overcome such basic handicaps as a shortage of trained cadres and managerial skills, and the inefficiencies inherent in their centralized direction of agriculture.

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PROBLEM

To assess the efforts of the Soviets to introduce US agrotechnology.

SUMMARY AND CONCLUSIONS

The Soviets believe that modernization, essentially increased mechanization, of all aspects of farming is the answer to most of the problems retarding their agricultural development. An immediate goal is improvement in the quality of the diet of the Soviet people by 1980. To achieve the high increase in agricultural productivity called for, the Soviets have turned to Western countries for the latest agrotechnology, primarily that embodied in agricultural machinery and equipment. Whether these extensive importations of foreign technology will be sufficient, given the shortcomings of Soviet management, trained cadres, and organization to overcome the USSR's many agricultural problems remains to be seen.

Soviet interests cut across the entire field of agriculture, from the best seed and semen to the latest technology for processing and packaging plant and animal products. The highest priorities seem to have been placed on machines for growing, harvesting, storage, and processing of crops; mechanical and engineering aspects of large-scale animal operations; entire plants for increasing fertilizer production; and the technical know-how and equipment needed for huge irrigation and drainage projects planned to increase the amount of land usable for agriculture. Following are some specific, principal examples:

- Farm machinery

  Self-propelled forage harvesters, the total technology and equipment costs for which are estimated at $150 million. The Soviets want a turnkey plant capable of producing an extraordinary total of 20,000 machines per year.

  Technical assistance, licensing agreements, and/or turnkey plants for the production of various models of US agricultural-type tractors and trucks.

- Cattle feed and feedlots

  Manure recycling plants; 20 to 40 plants incorporating a new process for the production of a urea-based animal feed; 15 alfalfa processing plants at $2 to $3 million each with licensing rights to build an additional 100 to 200.

  A number of prototype feedlots for cattle which the Soviets plan to duplicate on a large scale.

- Agricultural chemicals

  A 20-year $20-billion deal with [redacted] involving ammonia plants and phosphoric acid is the prime example in the area of chemical fertilizers. US licenses and technology are also being sought for the construction of chemical pesticide plants to produce US trade-name compounds.

- Water management

  The Soviets seek a wide range of US technology and equipment for a multibillion dollar land reclamation program in which irrigation is emphasized. Proposals have been requested for such purposes as excavation work on a major canal for water diversion, jointless pipe, and ionic desalination plants.

The Soviets have gained a substantial amount of US agrotechnology to date and will continue to do so. The increasing importation of a wide variety of US machinery and equipment, together with cooperative ventures and bilateral agreements, could play a significant role in improving and extending the mechanized base of Soviet agriculture. The United States leads the USSR in practically every agricultural technology, and the Soviets through their purchases and contacts will avoid many "R&D-type" mistakes and thus achieve shorter development times for selected projects.

Nevertheless, Soviet progress in mechanization is still expected to be rather slow. Prototype machinery and showcase complexes must be duplicated and adapted on a large scale to have any real impact on agricultural production, and the Soviet record for rapid assimilation of foreign technology is not good. A shortage of trained cadres combined with a lack of Soviet experience in managing large technical complexes also can be expected to cause difficulties.

DISCUSSION

BACKGROUND

Despite 50 years of various agricultural programs and massive investment, the USSR has not managed to produce either the quantity or quality of farm products repeatedly promised the Soviet people. It was in this context that the Ninth 5-Year Plan (1971-75) inaugurated a new stage in Soviet agriculture. Emphasis was shifted from such programs as "hybrid corn" and "new lands" to industrialization; i.e., the reequipment and modernization of farming. In addition, more funds than ever before, approximately 35 percent* of the country's total investment, are to be spent under succeeding plans in support of farm production either directly or indirectly. The main components of this agricultural policy are (1) mechanization, (2) chemicalization, (3) land improvement, and (4) crop and livestock improvement.[2,3]

The Soviets are well aware that in order to modernize their agriculture, particularly in the areas of chemical fertilizers and new machinery, they will need foreign help. Soviet science policy has been characterized by the systematic exploitation of foreign technology. This is acquired in a number of ways, including perusal of the open literature, visits to Western firms, and formal agreements for collaboration in research and the exchange of information. But the major channel is the outright purchase of machinery and equipment, and in this the Soviets have been greatly aided by the US-USSR S&T agreements of May 1972 and June 1973. Besides providing for increased contacts and joint research programs in a variety of fields, these agreements encouraged the Soviet trade organizations to deal directly with US business firms for products, services, or cooperative ventures. The US government gets involved only if sales are in conflict with export controls or require government-backed credits.[4-6]

The Soviets were quick to take advantage of this trade breakthrough. In 1974 contracts worth $330 million were signed with US firms for agricultural machinery and equipment compared with an earlier average of only a few million dollars a year.

MECHANIZATION

The Soviets believe, correctly, that the future of agriculture is inseparably linked to its equipment, and they are attempting rapid conversion of all branches of their agriculture from partial to complete mechanization. Thus, agriculture and its mechanization have priority now and will continue to have priority in the Tenth 5-Year Plan (1976-80). The intent is to improve the diet of the Soviet people by 1980, a goal that can only be met by importing the technology of Western agricultural mechanization.

The problem is more than just increasing the number of machines. In fact, since 1960 the Soviet Union has led the world in numbers of tractors produced. But technical standards and quality are below those of Western and Japanese producers. Even after 50 years of production and field experience Soviet tractor models are poorly adapted to different soil and climatic conditions. Furthermore, Soviet planners have been concentrating on basic types of farm machinery, turning out the same models year

*US agriculture receives less than 3 percent of US investment

after year and neglecting the specialized machines for growing, harvesting, storage and processing of crops, and the mechanical and engineering aspects of large-scale animal operations.

In addition the Soviets have tremendous problems in the organization and maintenance of equipment. Without considerable improvements in the supply of spare parts and repair facilities plus more and better trained mechanics, a large proportion of the expanding farm machinery park will continue to be inoperative. Shortages of machinery, breakdown of farm equipment (due to both poor quality and inept use) and lack of spare parts are perennial problems for centrally directed Soviet agriculture and were considered by foreign observers to have been contributing factors in the disastrous grain harvest of 1972. The situation, in fac , is such that US technical assistance in maintaining *Soviet-produced* tractors and farm implements is a likely area of agrobusiness with the USSR.[7–9]

Tractors and Trucks

Since the early 1930s when US firms were instrumental in designing and equipping the first Soviet tractor plants at Khar'kov and Volgograd, the Soviets have looked to the US for assistance in the area of farm machinery. Some tractor models still in production in the USSR are only slightly modified versions of models produced in the US more than 20 years ago.[7] A principal goal of the Ninth 5-Year Plan was to upgrade tractor quality and performance, and to bring tractor design and technology closer to that in the West today. Plan directives call for delivery of 1,700,000 tractors that will be more powerful, more durable, and faster.

For years the Soviets have favored tracklaying over wheeled tractors. They now recognize that the tracklaying type is not efficient in agricultural applications. Consequently, they face the tremendous task of not only meeting their overall requirements for large numbers of additional tractors but of replacing the tracklaying tractors with wheeled types and of replacing low-powered wheeled tractors with more powerful machines.[10] To this end, the Soviets are actively in contact with US manufacturers:

(1) In late 1973 they approached a large US diesel engine corporation to obtain 450 horsepower engines for use in agricultural tractors. They want to buy the technology so they can produce these engines themselves.[11]

(2) In November 1974 they provided specifications to a US manufacturer for a proposed 500-horsepower wheeled tractor, possibly to be designed and manufactured with US assistance. Such a machine is needed for pulling heavier implements at high speeds.[12]

(3) They have expressed interest to US industrial representatives in such units as a 4-wheel-drive, 170 horsepower-range tractor featuring hydrostatic transmission. There is a gap in the Soviet line of tractors between the 70-80 horsepower conventional farm tractor and their circa 200 horsepower machine.[13]

Since 1972 the USSR has purchased several thousand tractors from the United States and Japan, but these have been construction-type, tracklaying machines for industrial projects such as pipelaying and open-pit mining. Little interest has been shown in purchasing large numbers of Western-made tractors for use on Soviet farms.[7] Trade discussions have typically centered on technical cooperation, participation in Soviet manufacturing facilities, licensing agreements, and construction of turnkey plants.[14 15] The Soviets strongly f vr the latter because of their problems in assimilating foreign technology piecemeal, despite the fact that labor skills and quality raw materials often required by these plants are lacking domestically. Current negotiations with US firms continue to stall on the point of turnkey plants. A turnkey operation is not desirable from the US standpoint because of the long time required between contract signing and the plant going on stream.[10]

Soviet agriculture has a serious transportation problem involving the movement of produce from the fields, farms, and feedlots to terminal storage and processing plants. Every year large amounts of produce are lost because of a shortage of transportation. During the summer harvest, the agricultural truck park of about 1.4 million vehicles must be supplemented with hundreds of thousands of trucks diverted from other uses. Furthermore, the assortment of trucks assigned to agriculture is inadequate. Specifically, more dump trucks and trucks with elevated bodies are needed for moving grain. These large, 3-axle trucks which can carry up to 11 tons of agricultural crops, 20 tons when used with semitrailers, will be produced by the Kama River truck plant; however, the construction of this huge Western-

equipped plant is behind schedule and may not be in production before 1980.[16]

Semitrailers designed for cattle are needed to transport the animals from feedlots to slaughter houses to minimize weight loss. Military-type trucks with low sideboards, currently being used for this, require that the cattle be tethered. The Soviets are particularly interested in semitrailers of the type furnished by a US contractor who is constructing the feedlots in the USSR. They say they will not import large numbers of these vehicles but want to discuss purchasing the technology required to produce them in the USSR. The Soviets like to purchase a few of each item desired and then try to copy the item or build it under a license agreement. In 1973 the Soviet Union took delivery on one or two vehicles each of a number of different models of agricultural-type trucks purchased from a US firm in September 1972.[17-18]

Feedlots

Feed is the most important factor in animal husbandry. Its mechanization in general and properly coordinated mechanization in particular is a close runner up for large-scale operations. During 1971-75 the Soviets were to invest 6 billion rubles in the mechanization of animal husbandry and "feed procurement."[20 21] According to officials of the Soviet Ministry of Agriculture, the USSR plans to build over 1,000 cattle feedlots in the next 5 years. These will be located in the Ukraine and in Central Asia where extensive irrigation projects are under construction. In 1972 the Soviets contracted with a US firm, [redacted] for the construction of 3 feedlots: a 30,000 head facility near Krasnodar, and 20,000 head facilities near Volgodonsk and Tbilisi. While [redacted] is providing only equipment for the Krasnodar and Tbilisi feedlots, the Volgodonsk facility is a turnkey operation. Under the US company's supervision the latter went into full operation in 1974, and Soviet officials have been very pleased with the progress achieved so far. In fact, the Soviets have confirmed that they will pay [redacted] a minimum bonus of $130,000 in September 1975. The feedlots provide grain storage facilities, a feed mill, trucks for transportation, feedyard equipment, and the farming equipment to grow and harvest the needed foodstuffs locally. The contract also calls for [redacted] to provide technical assistance and to train a group of Soviet specialists at the [redacted] feedyards in Colorado in the operation and maintenance of feedlots. The price is about $3 million per lot.[22-25]

The Soviet goal of constructing more than 1,000 feedlots in 5 years appears overoptimistic. Although the Ministry of Agriculture has apparently received ample funding for this program, the Soviets lack sufficient technical and administrative understanding of the operation of large-scale cattle feedlots to enable them to accomplish such an extensive program. Their ability to implement the complexities of proper animal feeding is inadequate for such a program, trained operating personnel are insufficient, and the size of their operations will necessarily be limited by the unavailability of the small process control computers which are utilized in the United States to control the apportionment of multicomponent feed rations and other such operations. In this initial sale, [redacted] sold the Soviets what it termed a relatively simple feedlot package which requires little or no computerized operations. The company felt that a gradual introduction of modern cattle feeding operations to the Soviets would have the most long-term potential. As the Soviets adapted themselves to the new methods, it was reasoned, the company could gradually push more sophisticated, essentially more computerized, equipment. Because of the inability of the Soviets to adapt themselves to the initial packages, the company has indefinitely postponed any efforts to sell them more advanced equipment. Rather than one-thousand 20,000- to 30,000-head feedlots, a more likely achievement would be the construction of 200 to 300 smaller feedlots on the larger state farms each with the capability to feed perhaps 2,000 to 3,000 head.[22 23]

Storage Facilities

Fodder—Storage is one of the most neglected areas of agriculture in the USSR. At the beginning of 1971, there were only 123,000 silos with a maximum capacity of 22 to 23 million metric tons of processed silage. The amount of silage and cured hay produced in the USSR in 1970, however, was 160 million metric tons. Thus, a deplorable 85 percent of the country's fodder was inefficiently stored. Much of it is simply piled by the roadside or put into barns and sheds where it soon rots. Almost one-third of state-procured fodder was estimated as being spoiled in 1970 and more than half of its feed value lost. Storage improvement, then, offers a tremendous potential for

reducing feed shortages which the Soviets have only recently begun to emphasize.[20]

Several years ago the USSR initiated a concrete silo building program aimed at the eventual production of 5,000 silos per year. [redacted] of Alpena, Michigan, was awarded a $2 million contract for the delivery of five completely automatic plants for the manufacture of concrete blocks for silo construction. The first plant was constructed, with [redacted] technical assistance, at Baranovichi. The other four plants were to be constructed in the Baltic area, the Kiev area, a region of Georgia near the Black Sea, and on the Volga, probably in the vicinity of Kazan. The Baranovichi plant was turning out an initial run of concrete blocks in late 1972. The first silo constructed with these blocks, also with the assistance of US specialists, was on an experimental farm near Minsk. Early in the negotiations the Soviets insisted that [redacted] provide them not only with plant machinery but with full technology (on-the-scene specialists) for silo construction. The contract specified, however, that the Soviets are not to manufacture the machinery nor transfer the technology to third parties. Soviet officials stated that after the performance of the initial plants have been evaluated, they may purchase additional [redacted] plants. [redacted] estimates they will need at least 25 plants nationwide.[27] [28]

Another US firm reached an agreement with the Soviets to supply metal accessory parts for concrete silos. In 1973 the firm sold a number of machines to fabricate the accessories and also the know-how. The Soviets should be easily able to manufacture the machinery and accessories in the future.[29] [30]

GRAIN—The USSR suffers large losses of grain each year because of inadequate storage facilities. The problem was especially acute in 1973 when Soviet agriculture achieved a record harvest of 222.5 million tons of grain. Large quantities of grain had to be left in the open exposed to the weather, and resulting losses were estimated to be about 10 percent of the harvest. Moreover, the substantial, although erratic, growth of grain production in recent years is likely to continue in the future. A recent USDA study projects an increase in the Soviet grain crop of almost 90 million tons, or just short of 50 percent of the average harvest for the past five years, during the 15-year period 1971-85.[21] To overcome their serious storage deficiency the Soviets have greatly increased grain storage capacity in recent years. Elevators with total capacities of 4.3 million tons, 5.7 million, and 6.3 million are scheduled for completion in 1975, 1976, and 1977, respectively. Party officials throughout the country have been told by Moscow to consider the development of a technical base for grain-receiving enterprises and the construction of grain storage facilities for state grain resources as one of their most important tasks.[31] [32]

The Tenth 5-Year Plan calls for the completion of grain storage facilities with an overall capacity of 40 million tons, raising the country's total capacity to 180 million tons by 1980. This is a highly ambitious undertaking and an especially serious one for the Ministry of Rural Construction whose organizations will have to provide for 73 percent of this planned increase.[33] The Soviets are well aware of their need for foreign help in achieving this goal. Two years ago they purchased [redacted] two US metal farm buildings designed for grain storage. When constructed over recessed concrete pits, each building has a capacity of 200,000 bushels of grain. No further Soviet purchases of US storage facilities are known to have been made, but the Soviets have inquired about a licensing agreement to produce the [redacted] metal building in the USSR.[34]

Feed Production Plants

The most important shortcoming of the Soviet cattle feed industry is not so much a shortage of good feed as it is inadequate processing and distribution. The short growing season which prevails in the USSR makes early harvesting imperative, and the roughage that results is utilized in a green, unconcentrated state that has a very high water content. This not only increases the amount of roughage an animal requires, but it also reduces the nutritive value of that received. Thus, weight gain is greatly reduced in the average Soviet cattle herd. The second deficiency is that the bulky, unprocessed roughage cannot be shipped the long distances from where much of it is grown to the areas where it is needed, and while this type of feed may be abundant in one area it can be in short supply in another.[35]

In May 1974 the USSR requested US quotations for 1975 delivery on five complete plants incorporating a new process for the production of a urea-based animal feed. In September the request was reemphasized and

increased from 5 to 20 plants. A contract was finally signed on 9 June 1975 for 20 plants with an option for an additional 20 plants which must be exercised by 30 November 1975, the deadline for delivery of the first 20 plants. Each plant will contain five extruders and associated storage bins to provide a guaranteed production rate of 1.4 metric tons per hour (mt/h) of protein concentrate. Total capacity is 2 mt/h assuming proper management. The extruders combine grain (wheat, barley, or corn), urea, and bentonite premix into an animal feed which can contain as high as 85 percent protein equivalent for ruminant animals. The process is under high temperature which permits the nitrogen from urea to be combined in the starch of whatever grain is used in the mix. This eliminates the problem of rapid release to the animal's system associated with urea feeding which can cause sickness or death. The USSR will have to import bentonite premix from the US if the chemical composition of their own deposits, significantly different from that mined in the US, proves to be unsuitable. Full production of the 20 feed plants if operated 21 hours/day, 6 days/week as planned will daily consume 100 tons of urea and 30 tons of sodium bentonite. Production would totally satisfy the protein requirements for one million cattle, assuming half dairy (2 lbs/day/cow) and half beef (1 lb/day/animal). The extruders in these plants also give the Soviets an opportunity to produce other animal feeds. One of the US company's major products using these extruders is a starter feed for baby pigs which permits early weaning. The total price for the feed plants, technical assistance, and 2 years of spare parts is approximately $2.5 million.[36 37 10x]

The greatest high-level emphasis is being placed on acquiring a manure recycling process developed by [redacted][35] The process can produce silage, pellet feed for range cattle, and a protein supplement feed. The protein produced by this process is equivalent to that found in soybeans, but it can be produced at approximately one-eighth the cost of soybeans. A [redacted] official estimates that if the manure produced annually by only one-half of the US (or Soviet) cattle population were processed by the [redacted] method, the protein produced would be equal to that of the annual US soybean crop. A proposed plant using the process in the US in conjunction with an 18,000 head feedlot is estimated to cost $1 million. Primarily, the Soviets wish to license the process, but because of extensive commitments, both domestic and foreign [redacted] has attempted to discourage them by quoting excessively high prices. The Soviets, however, continue to show interest in licensing even at a price of $20 million.[25 38 39] The Soviets also have repeatedly asked for bids on different sized turnkey facilities and are very interested in a recent proposal submitted by the US company. This would call for the establishment of a plant utilizing the company's process for recycling manure into cattle feed in conjunction with an appropriately sized feedlot. In addition, US equipment for cutting, drying, and briquetting alfalfa and other roughages would be provided. Roughage could thus be thoroughly processed and cubed so that it could be easily shipped throughout the USSR and stored for as much as 2 years. Only US companies make equipment in this field on the scale in which the Soviets are interested. [redacted] has obtained exclusive 10-year dealerships in the USSR from several other US companies for the sale of silage and roughage processing equipment. Two million dollars worth of this US equipment was exhibited, at Soviet request, in Moscow in 1974 and purchased afterwards by the Soviets. Included was a $700,000 dehydration plant.[27 45]

Forage Harvesters and Processing Plants

In April 1975, following a "groundwork" trip to the United States the previous October, the Soviet Minister of Machine Engineering for Animal Husbandry and Fodder Production, K. N. Belyak, met with officials of a US agricultural equipment manufacturing company to discuss licensing for the production of self-propelled forage (largely alfalfa) harvesters in the USSR. The discussions centered on product licensing, including blueprints of the equipment reduced to metric units, which is expected to cost the USSR $10 to $15 million. Negotiations for a manufacturing license involving a turnkey plant are planned and will be tied to the purchase of 40 to 50 machines as an act of good faith by the Soviets. Total technology and equipment costs are estimated at $450 million.

Soviet interest in the harvester developed during the June 1974 Moscow Trade Fair when the largest of two US models won a gold medal. The Soviets want a plant capable of producing a total of 20,000 machines per year, both large and small models. This is an unusually large annual production. The US

manufacturer only produces about 100 harvesters a year, and total US capacity for all models of forage harvesters is approximately 5,000 per year. Belyak stated that the USSR wants to "catch up" by producing in 5 years what it previously took 10 years to produce. In addition to insisting on a factory capable of producing 20,000 units annually, the Soviets insist on building all components on site, including diesel engines, hydraulics, transmissions, power steering, and cutters. This is highly impractical considering the technological requirements for production of such items as engines and hydraulic gear. Also, licensing would be required from about 10 US companies some of which are only lukewarm about doing business with the USSR.[40]

The Soviets are also interested in alfalfa processing plants. Belyak said that the USSR has a need for 350 of these plants but would settle for 100-200. Initially, they would like to buy about 15 plants—one for each Republic—and acquire the licensing rights to build the rest. The plants come in 3, 5, and 10 mt/h capacities. The cost of the plants is $1.9, $2.1, and $3.5 million, respectively. The cost of the license will depend on the number of plants purchased. Initially, the Soviets were only interested in the largest size, but because of width limitations imposed by railroad tunnels through the Urals, it was agreed that the smaller 3-mt/h plants would have to be used east of the Urals. The Soviet requirement is for a machine that will dry a raw product from 78-80 percent humidity to 10-16 percent humidity at 10 mt/h, with lors of carotene no more than 10 percent at drying and 5 percent at pressing. Belyak preferred a 65-mm pellet, but when advised that this is not a practical size to produce he accepted 10, 15, 25, and 30-mm pellet dies. Pellets of these sizes will give the Soviets the capacity to feed poultry, hogs, and cattle. The interest in a 65-mm pellet indicates they are more interested in feeding cattle than smaller livestock. The Soviets mentioned that they have only a few Polish dryers capable of 1 mt/h, and although they could develop their own technology they will save time by purchasing US technology. The development of this harvester/processing plant project has been scheduled over a 5-year period with a final goal of complete Soviet independence in this area. The Soviet State Planning Committee is expected to make a final decision on the alfalfa harvesters and processing plant project plus the manure recycling process by 1 September 1975.[41-44]

Cotton Gin Plants

The Soviets are making strong efforts to increase the production of cotton, a priority crop in the USSR. Production of the extra-long-staple cotton (similar to that grown in Arizona and New Mexico) is being emphasized and additional equipment is needed to process it. In early 1974 the Soviet officials signed a protocol with a US firm evidencing their intention to purchase two cotton gin plants for ginning long-staple cotton. For a price of approximately $1.8 million the Soviets will receive two 8-stand roller gin plants complete with baling presses, cleaning equipment, and steel strapping sufficient for 3 years of operation. Each gin will contain automatic strapping devices, a recent US innovation which the Soviets have never before used. The capacity of each gin is 5 to 6 bales per hour. Also to be contained in the purchase are two lint cleaners for existing saw gins (for short-staple cotton). Each of the lint cleaning units has a capacity of 12 to 15 bales an hour and costs approximately $40 thousand. The gin plants are destined for the Tashkent area and, all factors considered, probably will not be operating before September 1975 at the earliest. The contract, as contemplated, will not call for US technicians for installation but will ask that the US firm be prepared to send a representative to check out the equipment after installation should that be necessary.[45 46]

In May 1975 the Soviets also placed an order with the same US manufacturer for $50,000 worth of spare parts for a saw gin plant, a roller gin plant, a cottonseed delinting plant, and a cotton laboratory, all of which were purchased from the United States in 1968.[47]

Seed Processing Plants

In the USSR and Eastern Europe it is becoming increasingly uneconomical to hand-process seed. To achieve optimum results in planting and harvesting the seed must be dried, shelled, cleaned, sized, and chemically treated. The whole process is performed most effectively by machinery at central processing plants.

In June 1975 a US company, in response to Soviet inquiry, prepared quotations on 30 to 40 hybrid corn seed processing machines. They are destined for two fairly large Soviet plants, location unknown, that are

scheduled to be built in time for the 1976 corn harvest. From the size of the order it can be assumed that each plant will process about 15,000 mt of corn seed during the 3-month processing season. The machines have the same basic flow as the several hundred units that were sold to the Soviets in 1966/67. That machinery was installed in approximately 100 small plants in southern USSR, each of which can handle about 2,000 mt per season.

The hybrid corn processing machines are being quoted at about $5,000 each. Competition from East Germany, West Germany, and Italy exists, but the Soviets are known to have recently inspected US machines purchased by the hundreds by East European countries which selected them over European competition. It seems likely, therefore, that the Soviets intend to buy from the US.[104]

Fruit and Vegetable Production

One of the areas of research in agriculture agreed upon by the US/USSR Commission on Cooperation in Science and Technology involved improved mechanization in the cultivation, harvesting, and handling of fruits and vegetables. Although the USSR's present annual production of vegetables exceeds that of the United States by 10 to 12 million tons, there is much room for improvement in quality and variety. Also, introduction of the advanced agricultural systems employed in the United States could reduce fluctuations in Soviet annual yields such as occurred in 1971 when the vegetable crop fell almost 6 percent from the 1970 level.[48 49]

In April 1975 the Soviets signed an agreement with a US company for the establishment of a 1,000 hectare demonstration vegetable production unit. The site, which will probably be located near Tiraspol in the Moldavian SSR or near Odessa in the Ukraine, will be prepared in the fall of 1975 for planting the following spring. The Soviets have been given full guarantees for the success of the project. Consequently, the US firm has considerable latitude in the conduct of the experiment, including selection of the equipment, seed, tractors, farm implements, and pesticides. As reduction of labor requirements is a principal goal of this experiment, operations such as weeding will be done chemically. Under the terms of the agreement the Soviets will purchase four US diesel-powered wheeled tractors and will provide four tractors of Soviet manufacture. The US tractors, valued at $25,000 each, are required for the project because the USSR does not produce tractors of sufficient horsepower at power take-off for row crop production of vegetables. Three Soviet trainees will work with each of the three US specialists assigned to the project.[50]

If the Soviets are satisfied with the outcome of this project they plan to start similar experiments in mechanized vegetable production in other locations. Krasnodar has been mentioned specifically. Eventually, if an agreement can be reached, they may also purchase complete food processing plants from the United States. They have already requested introductions to major US food processors plus help in market modeling. An inefficient distribution system and the lack of modern facilities and handling procedures results in losses of up to 25 percent of the vegetables entering the state trade network. Conceivably, the Soviets will be seeking everything in this sector from refrigeration facilities, warehouses, and canning plants (a protocol was signed in 1972 with American Can Company to provide technology) all the way up the line to high-speed supermarket checkout systems. The value of the experimental vegetable project is only about $2 million, but with expansion of acreage and introduction of processing plants the amount of machinery and equipment imported by the Soviets could exceed $50 million. One of the problems in negotiations for US food processing technology, currently stalemated, is payment. The Soviets prefer to make payment by bartering produce to US food processors.[50–53]

A Moldavian agricultural delegation visiting the United States in February 1975 expressed their intention to negotiate for US technical assistance in setting up an experimental fruit project similar to the one negotiated for vegetables but about twice the size. They showed particular interest in large-scale processing operations for grapes and oranges. Also, they were very impressed with drip or trickler irrigation systems, an Israeli development, that bring the water to each plant, a big advantage for vegetables and tree fruit. They want to employ this method of irrigation in the project. Orders for US pear and apple harvesters were placed in 1972.[54 55]

CHEMICALIZATION

In all industrially developed countries the need to produce food has given rise to a search for methods of

intensifying the use of technology and the application of chemistry to agriculture. Although the nature of the process is mainly biological, the steps needed to increase plant and animal production belong to the sphere of chemistry, primarily mineral fertilizers and chemical pesticides. In recent years the use of chemicals has produced an unprecedented growth in plant and animal production. The application of agrochemicals has increased food production in the agriculturally and industrially developed countries and improved the possibilities for a successful fight against famine in the developing countries.

Fertilizer

It is difficult to exaggerate the importance of fertilizer to agriculture. Of the numerous ways of increasing crop yields (fertilizer, improved varieties, irrigation, pesticides, farm machinery) fertilizer is probably the most important and financially rewarding. Within the Soviet Union it is playing an increasingly important role, particularly as a method of raising grain yields. For example, during the 5-year period ending in 1975 40 to 50 percent of the planned increase in grain production, i.e., an average of 10 to 15 million tons per year, was based on the use of increasingly larger amounts of fertilizer. Plans call for 32 million tons of fertilizer to be applied to grain fields in 1975, compared with only 15 million tons in 1970.

The Soviet Union has made definite progress in supplying the agricultural sector with fertilizer. The total availability of fertilizer was increased more than nine times between 1950 and 1971, compared to a three-fold increase in the US during the same period. In 1974 the Soviets produced over 80 million tons of fertilizer, roughly comparable in total nutrient to US production. However, acreage in the USSR is 60 percent greater than in the US and 80 million tons do not begin to meet Soviet needs. Also, the growth of production has slowed since the 77 percent increase in fertilizer output between 1966 and 1970. Moreover, the quality of Soviet fertilizer is poor, single-nutrient materials predominate, and phosphate fertilizers are in chronically short supply. The more efficient "complete" fertilizer common to the United States accounts for only about 17 percent of total Soviet output. Other shortcomings in the industry include delays in new construction, poor operating efficiency at existing plants, and transportation and storage problems.[50-59]

To alleviate some of these problems the USSR since the mid-1960s has purchased from foreign countries fertilizer production equipment, including complete plants for production of multinutrient fertilizer and key intermediates, such as ammonia. With the exception of $36 million worth of "fertilizer-related" ammonia compressors ordered in 1973/74, only one purchase from the US of equipment and technology for the Soviet fertilizer industry is known to have been made since 1972. That was a long-term agreement, however, and the largest ever made between a Western firm and the USSR. In 1973 [redacted] signed a 20-year barter deal with the USSR worth $8 billion involving the construction of eight ammonia and two urea plants in the USSR.* The ammonia plants will each have an annual production capacity of 500,000 tons. The largest known Soviet-manufactured ammonia plants now in operation have annual capacities of 200,000 tons or less. The barter portion of the arrangement provides for the annual exchange of ammonia and urea produced in the new plants, plus Soviet potash for US phosphoric acid. The Soviet plants will have a total nitrogen capacity of nearly 3.3 million tons, equal to roughly 50 percent of current Soviet nitrogen production. Fixed dates for startup of the project have not been announced, but the first four ammonia plants, to be constructed by [redacted] in the Tolyatti area, are scheduled for completion in 1978.[59-63 111]

The agreement provides several specific advantages to the USSR:

> (1) Soviet industry will acquire the last technology and know-how in the United States for the production of ammonia, the basic ingredient of all synthetic nitrogen fertilizer.
>
> (2) The expansion of urea production will allow for its increased use as a feed supplement for cattle and thereby have a significant impact on the critical Soviet "feed protein" problem.
>
> (3) Importation of US superphosphoric acid will help to reduce the shortages of phosphate fertilizer. At least half of the arable land in the USSR is deficient in phosphorus and larger supplies are expected to increase crop yields, raise protein content, and speed the ripening of grain. The latter is an important consideration in regions that have a short growing season.

*The USSR [redacted] deal has evolved somewhat differently from the original agreement. Only four ammonia plants have been ordered so far (from [redacted] of the US), and the two urea plants probably will be purchased from Italy [redacted] under the latest arrangement, apparently will provide only phosphoric acid and port facilities. Also, as a result of soaring fertilizer prices present value of the barter agreement would be closer to $20 billion.

The priority now accorded fertilizer production by the Soviets is likely to continue into the 1980s or for as long as it can be justified in terms of improved living standards for the Soviet people. Domestic production of fertilizer is certain to increase greatly during those years; however, persistent Soviet problems suggest continuing interest in Western fertilizer production equipment ranging from additional plants for the production of raw material, such as ammonia, to granulating and packaging machinery.[67]

Pesticides

Soviet agriculture also needs assistance in developing pesticides. Losses from insects, weeds, and plant diseases may be as high as 30 percent of potential yields.[58] This is largely attributable to the fact that because of a shortage of pesticides only about half of the total sown area is being treated. Also, with the exception of cotton and certain other industrial crops which receive special attention, the rate of application for those crops that are treated is necessarily less intensive than that recommended in the West. Supplies of pesticides continue to fall short of requirements despite increased production over the past decade. In 1970 the USSR reportedly met its needs for insecticides and fungicides by only 60 percent, and for herbicides by only 50 percent. Prospects are poor for filling this gap between supply and demand in the next 5 to 10 years.[59]

Although the major types of pesticides are manufactured in the USSR, the variety of products available to agriculture is very limited. Only 150 basic pesticide chemicals are produced in the USSR compared to 900 in the United States.[64] This is largely due to the superiority of the US agrochemical industry. But a contributing factor is the Soviet attitude toward toxic preparations which has limited the number of pesticides available at any one time and slowed the introduction of new compounds into Soviet agriculture. Their stringent interpretation of toxicity in relation to the environment has resulted in the phasing out of certain highly toxic compounds in favor of less toxic types. This attitude limits sales of both pesticides and manufacturing plants to the USSR, and aggravates the problems caused by a high level of crop losses and pesticide shortages.[65 66] It has also led to a strong interest in the use of pheromones, i.e., biologically active substances, for pest control. Soviet capabilities in this area are by their own admission backward. When the Soviets learned at an international conference in July 1974 that a US firm was in the initial phases of marketing a sex attractant for the codling moth, they soon placed an order for a small quantity of the material.[67]

The structure of Soviet purchases of pesticides from the West has changed in the last few years from large quantities of formulated pesticides to supplement domestic production to smaller but increasing amounts of more expensive, highly active ingredients for formulation in the USSR. In the same vein a Soviet trade agency has expressed an interest in purchasing US licenses and technology for the construction of a chemical pesticide plant capable of producing at least 1500 tons of a particular fungicide per year.[68] The Soviets have also requested a US firm to quote on a turnkey chemical plant that could produce 5,000 tons per year of a trade-name pesticide, plus the training of the Soviet personnel required to operate the plant. Another US firm attempting to sell a nematocide to the Soviets is resigned to the fact that if a sale is negotiated they will be selling the technology, not the product.[70 71]

The pattern is clear. Despite their obvious preference for purchasing a manufacturing plant rather that a ready-mixed product, however, it does not appear that the Soviets are attempting to become self-sufficient in pesticide production any time soon. On the contrary, it would be to their advantage to continue to purchase the new compounds, and/or the technology for their production, developed through more advanced Western research in this area. In support of this line of reasoning, a major Soviet study on pesticides, initiated following a period in which their pesticide production quintupled, was to determine, among other things, which pesticides would be produced in the USSR and which would be purchased abroad.[68]

The present limited variety and known pesticide shortage in the USSR almost assure that the Soviets will be looking to the United States and other Western countries for the advanced technological help they need, at least until 1980 and probably beyond. Although several negotiations for pesticide technology have been reported in the past few years, a contract with a US firm is not known to have been signed until April 1975. At that time the Soviets signed a formal "umbrella" agreement [redacted] that calls for cooperative

efforts in agricultural chemicals, plastics, fluid processes, and other specialty chemical fields. The USSR Ministry of Agriculture was specifically interested in acquiring the technology for an insecticide for mite control, a mildew fungicide, and a newly developed rodenticide. The Soviets are developing formal specifications requesting bids for the construction of an agricultural chemical facility utilizing US technology. Details of the new plant are not known, but Soviet officials did mention that their plans included a large unit to produce 3,000 to 5,000 tons per year of a fungicide, dinitro (1-methylheptyl) phenylcrotonate. The chemical is used to control mildew on fruits and vegetables.[105]

From the Soviet point of view, the primary value of the agreement with Rohm and Haas is that their technical people will have extensive contact with US commercial researchers. The express purpose is to keep them abreast of Western developments in their areas, to give them ideas and suggestions on which areas to concentrate, to evaluate Soviet chemical development, and to provide access to Western markets through the marketing arm of [redacted][106]

LAND IMPROVEMENT

Agriculture is possible in one-third of the USSR, but only about 10 percent of the arable land is cultivated because the rest lies in areas without sufficient rainfall. Thus, the problem of developing agriculture in the USSR depends on the reclamation of land and especially on irrigation. Drainage, a less expensive method of reclamation, has had considerably less emphasis during the course of the 5-year plans. But both irrigation and drainage are now being brought to the fore because of lack of alternative opportunities for a major expansion of cropland. One-third of the planned increase in grain production during 1971-75 was to have originated on irrigated or drained land.[21 72 73]

Primary water sources are damned reservoirs, rivers, and irrigation ditches. The Soviets have developed an excellent canal system to channel snow-melt and rain from the mountains into the desert regions. The major drawback to their system is insufficient reservoirs and inadequate distribution systems on the farms. In fact, the USSR has a poor record in maintaining drainage and irrigation systems in operating conditions. For example, in the past the covered and tiled drainage systems, which are scheduled to expand rapidly and to account for more than half of total drained acreage in 1975, have been built with inferior tile that collapsed under the weight of heavy farm machinery. In irrigated areas about two-fifths of the land is subject to salination to some degree. Annual washings carried out in rotation to lower salinity remain partially ineffective because of disrepaired and uncleaned collection and drainage networks. As a result of these and other problems, the rate of retirement of reclaimed land from production has been high enough in the past to nullify the sizeable acreage added annually.[73 74]

The Soviets now have some 30 million acres under irrigation, compared with 50 million in the US. Five million acres are under sprinkler systems, about 250,000 acres of which are central pivot systems manufactured in the USSR under license from a [redacted] The Soviet factory, near Pervomaysk in the Ukraine, is now producing about 900 central pivot systems a year and it is planned to triple production. By the end of 1975 production is expected to reach 1,500 systems a year. Each system is 1,164 feet long with 12 towers and can irrigate 125 acres. The Soviets claim that where central pivot systems have been installed crop yields have increased two to three times. The Soviets paid [redacted] $300,000 for its technology several years ago and have visited the US plant at least twice since then to review production techniques. They now want to negotiate for (1) a licensing agreement on a new add-on system that irrigates the corners of a field not covered by the circular pivot system, and (2) the technology for a plant to galvanize the steel pipe required for these systems.[35 74–77]

The USSR is working on a plan to extend to 1990 to irrigate an additional 50 million acres, a large proportion of which lie in the non-black soil region of the Russian Republic. In 1974 the Soviets spent more than 3 billion rubles on capital investments for melioration and irrigation; in the next 15 to 18 years 150 billion rubles will be required to reach their land reclamation goals. The USSR would like to fulfill its goals by utilizing only Soviet resources and equipment, but the scale of work and the technology required are too great. Consequently, they have turned for help to [redacted] a US engineering firm with an outstanding international reputation. The Soviets have requested the US firm to submit proposals on a pumping plant, excavation

work for diversion of water from the Ob River to the Caspian Sea area, canal lining techniques, jointless pipe, trickler irrigation, and ionic desalination plants. They are also interested in full automation of the irrigation systems. If [redacted] participation is acceptable to the Soviets the US company will be asked to contribute at increasing technical levels.[72]

CROP AND LIVESTOCK IMPROVEMENT

Seed/Germ Plasm

In order for the Soviets to utilize efficiently other agricultural inputs, they badly need to improve their crop varieties, especially grains. A lack of improved varieties, particularly wheat varieties,* may already be the most serious shortcoming in Soviet grain production. Thus, the development of high-yield, nonlodging varieties of grain with drought and disease resistance is the major objective of Soviet plant breeders. Interest in improved varieties has been further stimulated by problems encountered in recent years. For example, the increase in wheat yields that has been achieved has been accompanied by a decline in protein and gluten content, and hence in suitability for milling and baking. Also, yields of forage crops have stagnated placing the burden of supporting the expanding livestock program on feed grains. The Soviets have a heavy commitment to the livestock industry for which high protein feed is urgently needed and there is an avid search for suitable sources.

To help achieve their breeding goals, the Soviets have solicited germ plasm and improved varieties from US agricultural experiment stations and US seed companies. The major requirement is for shorter season corn hybrids which are usually in short supply in the US because of limited demand.[55-107] Quantities of wheat and corn seed have already been purchased, and the Soviets plan to purchase additional seed of US varieties of these and other crops, viz., soybeans, alfalfa, and sorghum. The latter is a logical substitute for corn, the Soviet's principal feed grain. In the southern regions of the USSR where rainfall is too limited for good corn production. At present, sorghum is produced in only small quantities in the USSR and Soviet breeders lack the knowledge and experience to deal with the problems involved in attempting to expand production. The principal problem is that the USSR's growing season is too short for available sorghum varieties to mature sufficiently to produce the required quantities of seed. Consequently, seed must be imported from the United States or Egypt, or varieties developed that are adapted to prevailing climatic conditions.[78-80]

In purchasing foreign seed the Soviets first priority is extensive trial programs in the USSR to identify the best varieties for their growing conditions. Following successful trials the Soviets desire is to purchase foundation seed and distribution rights for East Europe from the foreign company(s) involved. Several US seed companies have offered package deals to manage Soviet seed production as an alternative to repeated Soviet requests for foundation seed. The Soviet Ministry of Agriculture has rejected all such management proposals, but appears close to a major decision to invest $10 to $12 million in US corn and sorghum germ plasm, technical assistance in a breeding program, and seed processing plants. The use of US germ plasm in their breeding programs should increase Soviet yields of corn and sorghum by at least 20 percent. Purchase of the germ plasm and technical assistance will cost $3.5 million. For this the Soviets will receive the best US hybrid seed, and 5 years of technical assistance in a breeding program. If a contract is soon concluded, a small quantity of US parent stock would be available for planting in 1975; commercial seed production could begin in 1976 with the first hybrid production beginning in 1977. The seed processing plants—two for corn and two for sorghum—with a capacity of 500,000 bushels per year will cost approximately $3 million each. The final price will depend on how many of the plant facilities the USSR is able to provide. The sale will be concluded only on the condition that the USSR will not release the parent stock to other countries.[81-85]

Livestock Breeding

Feed supplies and an enlightened approach to genetic progress are the two biggest problems the Soviets face with respect to livestock production. The USSR needs to restructure its livestock breeds, especially cattle. Soviet agriculturists are only beginning to realize the advantages in feed conversion efficiency and cost reduction which specialized breeds and improved technology offer. They also realize that genetic improvement of their livestock is necessary

*See OSI-STIR [redacted] October 1973, for additional information on Soviet wheat varieties.

before they can reach the quality standards achieved in the United States. To narrow this quality gap the Soviets want to import thousands of US breeding cattle. They believe that US and Canadian cattle are more adaptable to the Soviet climate than those of Western Europe. They have also dismissed the breeds of Argentina and Australia as not being the type animals they require. Besides US beef and dairy cattle, swine and goats also have been added in recent years to the existing foreign breeds in Soviet herds. All will be used in a long-range (10-15 years) program. In addition to these purchases the Soviets have a number of agreements with US cattle industry organizations whereby they receive livestock technology and methodology to assist them in their breeding programs. The primary goals of livestock research in the USSR are the development of a higher level of fertility, greater productivity, and a disposition which makes an animal amenable to confinement in large livestock complexes.[58 86-89 108]

The majority of the cattle in the Soviet Union are dual purpose (milk-beef) animals in which productivity is generally very low. Their quality is roughly equivalent to that of poor-grade Holstein in the United States. They suffer severe inbreeding problems and are susceptible to all the common livestock diseases.[90] The high quality US and Canadian beef cattle imported in 1971/72 and earlier are being used with these dual purpose cattle in a program of crossbreeding and selection. Crossbreeding is an effective way of improving quality in spite of past mistakes. The Soviets do not plan to adopt the US system of raising one breed of cattle for dairy products and another for meat, but the trend definitely will be toward the development of better dairy cows and better beef cattle rather than better dual purpose animals.[90-93]

The Soviets will probably continue to import bulls from the US in support of this breeding program. They are also interested in importing semen from US bulls. In 1973 7,000 dairy cows in Moldavia were inseminated with US semen of the Black and White breed. The goal of the Moldavian Council of Collective Farms is to have all Black and White dairy cattle based on US breeding stock as rapidly as the conversion can be made. In September 1974 a Soviet trading company issued an order for 5,000 doses of frozen semen, 3,000 for the Holstein dairy breed, and the balance for the Zebu Brahman. This was followed by another large order for semen (breeds unknown) in April 1975 with a request for immediate delivery. An average dose of semen costs $4 to $5. Actually an artificial insemination (AI) program using frozen semen from superior sires is a more rational approach to the vast crossbreeding program necessary to solve the Soviets chronic meat shortage. The Soviets claim that 50 percent of their cows are now bred from frozen semen and that by the end of 1980 AI is to be extended to the entire livestock program. The claim is questionable, but indications certainly point to an emphasis in this direction; e.g., inquiries were made in 1974 about US AI equipment; completion of a new AI research center, the USSR's second, in Kalinin Oblast was announced in January 1975; and a high-level Soviet delegation arrived in the US in May 1975 for a 20-day study of US work on livestock at large AI centers.[17 58 94-97 108]

While Soviet emphasis in US livestock purchases has been on beef cattle, they are equally interested in improving pork and poultry production with US assistance. In their program to increase meat production, in fact, poultry has top priority, followed by swine and then cattle. Equipment and techniques for a large broiler operation were purchased from a US firm in the early 1960s, followed by the announcement in 1964 of a program for the development of the poultry industry. Since then the Soviets have made impressive advances in poultry breeding, but their birds are still poor feed converters. They have expressed interest in purchasing large numbers of US hybrid chicks, and last fall the Soviet Embassy in Washington requested preliminary US bids on technical assistance in dairy cattle, pigs, sheep, and poultry. If the US report meets with Soviet approval, on-site inspections will be made in the USSR in 1975 followed by the development of specific programs.[58 98-102]

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APPENDIX

The Soviet Union is interested in a wide range of Western agrotechnology.* Of the following agricultural or agriculture-related items, incorporating the best US technology, the Soviets either have purchased the item from a US firm within the past few years, have expressed an interest in purchasing, or are known to have a need for such machinery, equipment, or technical assistance in their campaign to modernize their agriculture:

Mechanization/Modernization—General

1. Tractors and trucks
   a. various types of wheeled tractors and trucks designed for specific agricultural purposes
   b. design and production of 150 hp all-purpose row crop tractor (to be built at Minsk)
   c. improvement and expansion of production of Belorus tractors (at the Minsk Tractor Works)
   d. design and production of a 450/500 hp, four-wheel drive tractor, or construction of a turnkey plant
   e. technical agreement to improve Soviet parts system organization
2. Livestock raising and processing facilities
   a. large-scale cattle feedlots and related equipment
   b. technical assistance in establishing huge livestock "factories" that will produce, fatten, slaughter, and process the meat and by-products
   c. equipment for handling wastes of animals raised in large, concentrated units
   d. process for recycling manure for livestock feed
   e. aerating equipment to reduce odors of animal wastes in disposal systems
   f. poultry raising facilities including equipment for processing meat and eggs
   g. automated feed mixing equipment and technical know-how
   h. milking machines
   i. machinery for drying and briquetting alfalfa and other roughages
   j. automatic plants for manufacturing concrete blocks for silo construction and technical assistance in erecting the silos
   k. metal buildings for grain storage, livestock, and other agricultural uses
   l. sophisticated hay and forage handling equipment
3. Miscellaneous planting and harvesting equipment
   a. combines, swathers, strippers, and other advanced harvesters
   b. various planting and harvesting implements such as direct drillers, preemergent herbicide applicators, cornheads, and row-crop cultivating attachments
   c. specialized equipment for the planting, cultivation, harvesting, processing, and storage of fruit and vegetables
   d. minimum tillage ("stubble-mulch") equipment
   e. liquid fertilizer applicators
4. Food and fiber processing, storage, and merchandising
   a. food processing plants
   b. canning plants
   c. refrigeration facilities
   d. warehouses
   e. supermarket check-out systems
   f. cotton gin plants
5. Miscellaneous
   a. laboratory equipment for agricultural research, viz. a cotton research laboratory and amino acid analyzers
   b. biological pest control technology
   c. mini computers for use in livestock breeding, dairy operations, soil analysis, and early warning pest control
   d. assistance in organization and maintenance of equipment
   e. specific ion electrodes for soil and fertilizer analysis

Chemicalization

1. Fertilizers
   a. ammonia compressors plus entire plants for the production of ammonia
   b. plants for producing urea
   c. plants for producing high analysis, multinutrient mineral fertilizer

*It should be emphasized that the Soviets are primarily interested in obtaining designs for new Western agrotechnology representing large inputs of research and development. If successful in negotiating for this technology, they are not likely to make large purchases of the actual machinery or equipment.

d. equipment for granulating and packaging mineral fertilizer

2. Pesticides
   a. plants for the production of US pesticides
   b. various trade-name US products plus the technology for production
   c. sex attractants for insects
   d. microbial insecticides
3. Other
   feed additives such as vitamins, amino acids, and antibiotics

Land Improvement

Various items relating to land clearing, irrigation and drainage
   a. irrigation systems—central pivot and trickler
   a. pumping plant
   c. techniques in irrigation canal construction
   d. canal lining techniques
   e. jointless pipe and prestressed concrete pipe
   f. ionic desalination plants
   g. plant for galvanizing pipe used in irrigation systems
   h. equipment for manufacturing drainage tile
   i. equipment for laying drainage pipe
   j. land clearing machinery and equipment such as tree cutting blades, rakes for loaders, and heavy duty brush burners
   k. land leveling machinery

Crop and Livestock Improvement

1. Seed/germ plasm
   a. seed of improved varieties of various crop plants, particularly grains
   b. germ plasm and technical assistance for breeding programs
   c. facilities and technology for processing and storing seed
   d. cotton seed delinting plant
2. Livestock
   a. high quality animals and technical assistance for breeding programs
   b. frozen semen from superior sires for artificial insemination programs, and cryogenic containers for long-term storage of semen
   c. large numbers of hybrid chicks.
   d. equipment and techniques for a large poultry operation

REFERENCES

The source references supporting this paper are identified in a list published separately. Copies of the list are available to authorized personnel and may be obtained from the originating office through regular channels. Requests for the list of references should include the publication number and date of this report.

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