Oilseeds and Oil in The People's Republic of China

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ABSTRACT AND SUMMARY

This article reviews some experiences and information gathered by the author on agricluture, cereal grains, oilseeds and oilseed production, oil and fat consumption, foreign trade, and oil extraction in the People's Republic of China.

INTRODUCTION

Most U.S. scholarly exchanges with the People's Republic of China (P.R.C.) are coordinated by the U.S. Committee on Scholarly Communications with the P.R.C. and the Chinese Scientific and Technical Organization. The U.S. Committee was formed in 1966 by the National Academy of Sciences, the Social Sciences Research Council, and the American Council of Learned Societies. Objectives of the Committee are to encourage gathering, exchanging, and publishing information on art, education, science, and technology in the two countries. I participated May 19 to June 16, 1976, in an exchange in which twelve U.S. scientists visited the P.R.C. to learn how the Chinese produce, process, and store wheat. We visited eleven agricultural experiment stations and ten communes in or around Peking, Naking, Shanghai, Sian, Shichiachuang, and Changchun (Fig. 1). A report of the team will be published by the committee in 1977. P.R.C. publishes few, if any, statistics for the whole country on oilseeds and oil. Some such information came to my attention during and following the trip. That information and a brief background review follow. For additional information, see the references at the end of this review.

AGRICULTURE IN CHINA

China's population is now estimated between 850 and 900 million—80 to 85 percent in agriculture. The total land mass of the P.R.C. is 973 million ha, compared with 768 million ha in the contiguous U.S. 48 states. Arable land is 156 million ha in the U.S. and 107 million in the P.R.C., but the sown area in China is 150 million ha compared with 116 million ha in the U.S. The Chinese double or triple

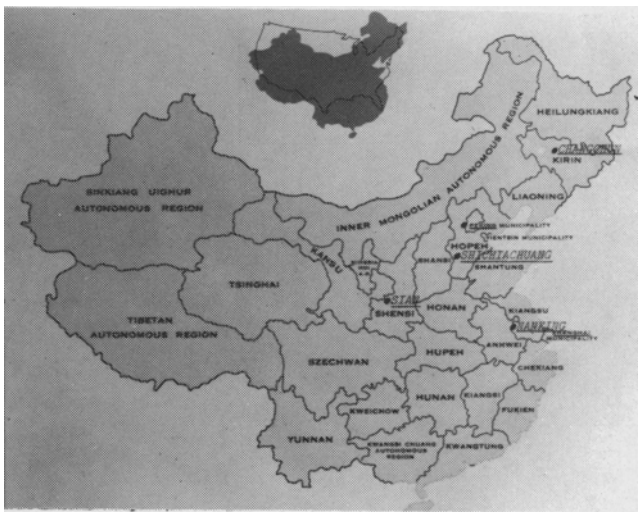

FIG. 1. Administrative divisions (provinces and autonomous municipalities) in The People's Republic of China. Cities visited by the wheat team are underlined. On the top, areas of U.S.A. and P.R.C. are compared.

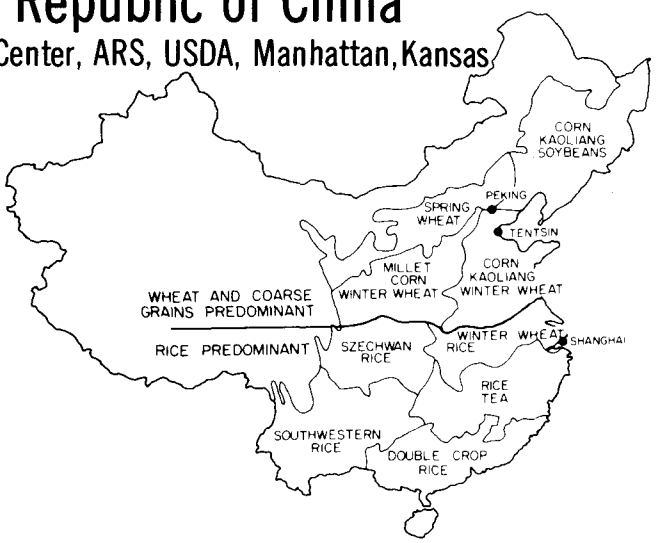

FIG. 2. Main agricultural areas in the P.R.C.

crop whenever possible. Chinese agriculture is garden type, labor intensive, which results in fairly high yields per unit of land and relatively low productivity per person. The intensive agriculture encompasses organic (and increasing amounts of chemical) fertilizers, irrigation, and water conservation on increasing areas of terraced land. Emphasis is on edible crops—mainly cereals and soybeans—as sources of carbohydrates and proteins for the huge population. Among industrial crops, cotton and tobacco are most important; among animal proteins, emphasis is on pork production—for both meat and organic fertilizer.

The agricultural system is based on a network of about 60,000 collective farms called communes. Each commune is organized into production brigades and production teams. The communes administer the political, technical, and economic policies of the government in rural areas. The policies include development of a local industry, irrigation, soil reclamation, meeting production quotas for food and industrial crops, etc. About 90 percent of the arable land is cultivated by communes; large state farms constitute about 4 percent small private plots, about 5 percent of the cultivated land.

The important food production areas are in the drainage areas and deltas of the three main river systems (Yellow, Yangtze, and Pearl), their tributaries, and the "Manchurian" Plain in the northeast (Fig. 2). About one-third of the total cultivated crop area is irrigated, much more than in any other country in the world and more than twice the irrigated area in the U.S.A.

CEREAL GRAINS

China has sustained an increase in grain production since 1949 by development high-yielding, disease resistant crop varieties; improved cultural practices (fertilization rates and dates of seeding and weed and pest control); effective intercropping and multicropping; and improved water use on increasing areas. The agricultural economy of China is geared to maximum crop production. We were repeatedly told that China's objectives are yield, resistance,and early maturity (to allow multiple cropping) rather than yield, resistance, and quality as in the U.S. Estimated yearly production of crops (including soybeans and tubers) in the P.R.C. is about 250 million tons. The rice crop exceeds 100 million tons; wheat 25-30 million, and all other grains (barley, buckwheat, corn, millet, oats, pulses, rye, and sorghum) 65 to 75 million tons. The annual, per capita grain allocation is about 450 pounds.

TABLE I

Harvest Estimates

Year	Soybean	Peanuts	Rapeseed	Sesame	Cottonseed
	Million metric tons				
1970	6.90	2.65	0.93	0.32	4.00
1971	6.70	2.58	0.99	0.32	4.44
1972	6.50	2.40	1.19	0.31	4.25
1973	8.00	2.60	1.31	0.32	5.10
1974	9.50	2.70	1.16	0.33	5.00
1975	10.00	2.80	1.40	0.35	4.80

OILSEEDS

Cotton continues to be the most important industrial crop. It is a source of lint, oil, and meal. Soybeans are grown throughout the country, except for the southernmost part. Manchuria (in the northeast) is the main soybean producer. Other oilseeds produced are peanuts, rape, and sesame. Production of peanuts expands to the north; of soybeans, to the south and west. Rapeseed, traditionally grown in the Yangtze River Valley only, is now grown in many parts of the country. Hunan, Kwangtung, Kwangsi, Fukien, Liaoning, Hopei, and Shansi have diversified their farming systems by including rapeseed.

OILSEED PRODUCTION

Estimated P.R.C. oilseeds and soybean harvests in recent years are shown in Table I (1).

Since 1971 considerable government direction and support have resulted in increasing the output of soybeans, primarily for domestic consumption. The drought in North China in 1972 restricted production, despite and increase in acreage. Since then, it is believed that both acreage and production have increased. Improvements in cultural practices, breeding, and technological developments appear to have increased yields considerably. An estimated increase of about 45 percent in the production of soybeans since 1970, to an estimated 10 million tons, resulted from a 15 percent increase in acreage and a 25 percent increase in yields (1).

USDA Foreign Agricultural Economic Report No. 124 noted, "Production of most of China's major vegetable oilseeds (rapeseed, peanuts, cottonseed, and sesame) increased again in 1975, with rapeseed exceeding the 1974 output by a large margin. Output of rapeseed, the leading source of cooking oil, has increased substantially since 1971. Although previously confined primarily to the southern portion of China as a winter crop, acreage has been expanded as far as Liaoning Province. In the northern and western areas, it is grown as a summer crop.

"In 1975, acreage of rapeseed increased 60 percent over the 1970 level and production was 50 percent greater. Production of two other major vegetable oilseeds, peanuts and sesame, both summer crops, reportedly was slightly up in 1975. Output of cottonseed was down for the second year, following the record crop in 1973. Little has been reported on the minor oilseed crops (sunflower, castor beans, and others). Sunflower acreage has been expanded only slightly in the north and northwestern areas, while castor beans, whose oil is used primarily for industrial purposes, have been increasing during recent years."

OIL AND FAT CONSUMPTION

According to F.A.O. Food Balances for 1964-1966, total calories per person per day were as shown in Table II.

TABLE II

Calorie Consumption

Country	Total	From cereals	From pulses, nuts, and cocoa	From fats and oils
U.S.A.	3,156	649	103	530
Developed countries	3,043	1,127	82	419
P.R.C.	2,045	1,383	134	65
Less developed countries	2,097	1,300	146	105
World	2,386	1,247	127	201

TABLE III

U.S. Exports to P.R.C.

Item	1,000 Dollars				1,000 Metric tons			
	1972	1973	1974	1975	1972	1973	1974	1975
Wheat & corn	59,085	448,683	329,686	–	941	4,315	2,759	–
Soybeans	–	55,396	138,242	9	–	251	619	–
Soybean oil	2,200	17,863	–	–	10	58	–	–
Total Agricultural	61,284	625,605	664,282	79,689	–	–	–	–
Total	63,537	739,733	818,659	303,636	–	–	–	–

Fat and oil consumption inthe P.R.C. is very low, and in the same range as in East Asia and Pacific (85 calories/day) and in Southeast Asia (71 calories/day).

U.S.-P.R.C. Foreign Trade

U.S. exports to P.R.C. in 1972-75 are shown in Table III.

P.R.C. exports to the U.S. in those years were as shown in Table IV (1).

U.S. exports for exceeded imports. The U.S. exports

TABLE IV

P.R.C. Exports to U.S.

Item	1,000 Dollars			
	1972	1973	1974	1975
Tung oil	–	705	102	1,580
Other vegetable and nut oils	5	23	234	325
Total agricultural	16,416	21,631	26,404	28,193
Total	32,422	64,900	114,700	158,340

were mainly agricultural; exports from P.R.C. were, basically, nonagricultural. Cereal grains and cotton comprised the bulk of U.S. agricultural exports; soybeans were much smaller and the volume of oil was negligible.

The main oil exported from the P.R.C. to the U.S. is tung oil; according to China's Foreign Trade magazine (2):

"The original home of the tung tree, China was the first country to manufacture and export tung oil. Besides being highly waterproof, China's tung oil is the most ideal of all drying oils containing such valuable properties as rapid drying and condensation. It is used extensively in the paint and other industries, and is important in surface paint especially in waterproofing and wall and floor varnishes. The oil has strong adhesive properties when applied to metal or wood surfaces, dries to a tough transparent film highly resistant to alkalies and has insulating properties. Tung oil is also used in brake linings, as an additive in plastic paints and as modifiers for synthetic resins, as well as manufacturing linoleum and printing ink. It also is widely used as a chemical modifier.

Export specifications for Chinese tung oil of F.A.Q. are as follows:

Colour: Not darker than a freshly prepared solution containing 0.4 gm $K_2Cr_2O_7$ in 100 ml conc. H_2SO_4 (sp. gr. 1.84).

Specific Gravity (20/4 C)	0.9360-0.9395
Refractive Index (20 C)	1.5185-1.5220
Iodine Value (Wijs)	163-173
Saponification Value	190-195
Moistured and Impurities (max)	0.30%
Acid Value (max)	8
Worstall's Heat Test (max)	7½ min

Beta Tung Oil Test Negative (no crystalline precipitate)

Exports of tung oil are usually supplied both in bulk or in seaworthy 53-gallon iron drums, with a net weight of 185-190 kilos each."

In the United States tung oil has been replaced almost completely with resins and oil modified resins. (Fig. 3).

OIL EXTRACTION

To the best of our knowledge, oilseeds in P.R.C. are pressed mechanically-hydraulically; little, if any, oil is solvent extracted. The oilseed cake is used as a feed or as organic fertilizer. Oil expellers (Fig. 4) produced in the P.R.C. are described in the following advertisement (3):

FIG. 3. Tung nut harvest.

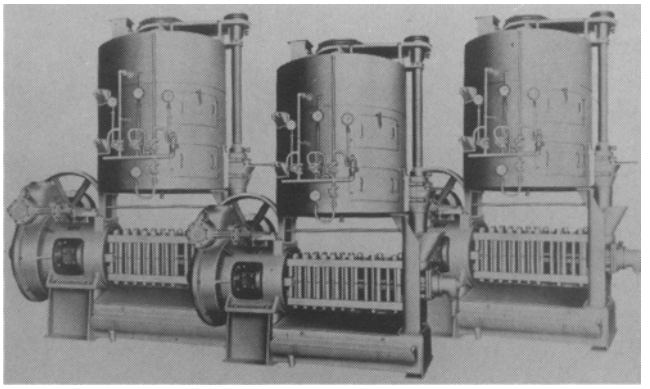

FIG. 4. An oil expeller.

"Model 200 is an ideal oil expeller for extraction of vegetable oils from oil bearing seeds and nuts such as copra, groundnuts, soybeans, cottonseed, rapeseed, sesameseed, etc.

Equipped with a 2-stage, 3-stage or 4-stage kettle, this model is suitable for heating different seeds (or meal) to varying temperatures for higher extraction of oil. Each stage of the kettle has a steam jacketed bottom and a stirrer mounted on a vertical shaft for stirring the meal during heating. The temperature and the moisture content of the meal in each stage are individually adjustable by using steam valves, steam pressure gauges and direct damping spray.

The main shaft, on which different sized pressing worms are mounted, rotates inside the pressing cage. On the end of the main shaft a pressure cone regulates the thickness of the residual cake discharged from the cage. For long service, all parts subject to heavy wear are heat treated while the main shaft, made of high quality alloy steel, has a water cooling device.

Oil extraction takes place by an automatic and continuous process. The meal is fed through an inlet opening into the top stage of the steaming kettle and gradually passes from one stage to another. After coming out of the final stage, it falls into the feed head and is delivered to the pressing cage. The extracted oil flows through the bars of the pressing cage into an oil collecting through to an oil reservoir. The cake is discharged from the rear of the machine. When the temperature and the moisture of meal, rate of feed into the pressing cage, and thickness of cake have been set, the operator needs only to watch the feed indicator, steam pressure gauges, and ammeter to carry out necessary adjustments.

Model 200 deals with copra, rapeseed, groundnut kernels and cottonseed at a rate of 9,000-10,000 kg/hr, sesameseed at 6,500-7,500 kg/hr and soybeans at 8,000-9,000 kg/hr.

Model 200 is driven by a 17 kw, 3-phase, 50 c/s electric motor with a speed of 960 rpm."

For general background information on agriculture in China, see references 4, 5, and 6.

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