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## SUNFLOWER IN THE USSR: ACHIEVEMENTS AND PROSPECTS

Sunflower oil accounts for about 90% of all vegetable oils produced by the USSR oil-fatty industry by processing oil-crop seeds and is the main edible oil in this country. It is difficult to overestimate the role of sunflower in solving the protein problem of animal husbandry. Sunflower-seed meals are the cheapest components with a high protein content used in preparation of combined fodder.

Sunflower as an oil plant is an age-old Russian crop though its native land is North America. It is in Russia that the possibility of producing vegetable oil from seeds of this crop was proved for the first time. In 1929, this possibility became a reality in the village of Alekseevka in today's Belgorod Region. Industrial production of sunflower oil was started in the Voronezh and Saratov Gubernices, and then in Northern Caucasus, the Ukraine and other areas of the country.

In pre-revolutionary Russia, the area sown to sunflower amounted to 1,000,000 ha. After the Great October Socialist Revolution this area was expanded to reach 3,500,000 ha in 1940. Oil mills were reconstructed and their productivity increased.

Considerable damage was caused to the raw material base of the oil and fat industry during the Great Patriotic War (1941-1945): oil seed yields and cultivation areas decreased. After the War this situation was improved and in the last five-year period the area sown to sunflower averaged 4,500,000 ha.

Attention to sunflower has lately increased on the part of researchers, experts and business men in different countries of the world.

Romania, Bulgaria, Hungary, and Yugoslavia, in addition to the USSR, have considerable areas sown to sunflower. Spain, Argentina, Turkey, USA, and Iran also grow this crop in large amounts.

About half the world's area sown to this crop and about 58% of the world's total sunflower seed yield are concentrated in the USSR.

Areas sown to commercial sunflower are concentrated in Northern Caucasus, the Ukraine, Moldavia, Georgia, Central Chernozem zone of the RSFSR, Volga area, and partially in Kazakhstan and Western Siberia. Sunflower is being grown by 11,000 collective and state farms.

Over 2,000,000 tons of sunflower oil are produced annually in the USSR for food and technical purposes. Appreciable amounts of sunflower oil are used by the food industry to produce margarine, canned fish and vegetable products, and confectionery.

The significant role of sunflower in meeting the requirements of the national economy for vegetable oil is explained by its growing productivity and considerable achievements in oil seed production.

This has been promoted by the enormous help rendered by the state to collective and state farms in strengthening their material and technical base. The Communist Party and the Soviet Government have been displaying constant concern for further development of sunflower production, for the fulfilment of the principal economic task of the tenth five-year plan period - the rise in people's living standards also depends on its development rate.

Research institutions engaged in sunflower breeding, seed production, and agrotechnics has contributed much to the solution of this problem.

Sunflower breeding at experimental stations of this country began in 1912 in Krasnodar (by V.S. Pustovoit), Saratov (by E.M. Plachek), and Kharkov (by B. K. Enken), and somewhat later

in Rostov (by L. A. Zhdanov) and Voronezh (by N. A. Uspensky).

Soviet breeders have created sunflower varieties resistant to diseases and developed varieties with 50-52% of oil in absolutely dry seeds, which is a 20% increase over the initial farmers varieties. It is Soviet scientists who transformed sunflower from a wild plant to one of world's valuable oil crops.

The sunflower cultivation system has undergone appreciable changes. At present, practically all technological processes and operations from sowing to harvesting are completely mechanized. Sunflower, that was a very labour-consuming crop in the past, now approaches cereals in terms of labour inputs. The intensification of production and improvements in agrotechnics allowed to raise the yielding ability of this crop. In the years preceding World War II, the sunflower seed yield per hectare was 0.62 tons, in 1961-65 1.12 tons and in 1971-75 1.32 tons, i.e. sunflower yields almost doubles.

The expansion of areas sown to sunflower and increase in its yields have boosted the gross output and state purchases of sunflower seeds (Table 1).

In the 1970-75 five-year period. The gross seed yield grew almost 7.5-fold over the 1913 level. The oil yield per hectare has increased from 196 kg to 623 kg, or more than 200%.

Agricultural science has contributed greatly to the solution of this problem. Soviet scientists have done much to promote scientific and technological progress, raising the efficiency of sunflower cultivation. Breeding for higher seed oil content has become especially important. About 20 research and educational establishments are being engaged in these studies. The scientific results obtained by the All-Union Research Institute of Oil Crops (VNIIMK) have gained wide recognition.

Academician V. S. Pustovoit, the creator of sunflower varieties with world's largest oil

Table 1

Production and State Purchases of Sunflower in the  
USSR

Years	Area (000 ha)	Yield (t/ha)	Total yield (000 tons)	Purchases (000 tons)
1940	3,543	0.74	2,636	1,500
1961-65	4,495	1.12	5,068	3,372
1966-70	4,837	1.32	6,339	4,565
1971-75	4,474	1.32	5,971	5,565
1976-80 (plan)	4,724	1.61	7,596	6,926

content, whose name is borne by the Institute of Oil Crops, is popular with the scientific communities of Europe, Asia, and America. At present, only high oil content sunflower varieties - populations, where oil accounts for 48-52% of seeds, are being cultivated in the USSR. However in a number of scientific establishments, including the VNIIMK, heterosis breeding is carried out. Interlinear hybrids have certain advantages over varieties-populations for they are fairly productive and their height, growth rate and some other indices are more even. But at the same time varieties-populations are superior to interlinear hybrids for a number of indices. They have greater ecological elasticity and more stable productivity than that of hybrids under fairly severe climatic conditions of the USSR; moreover epiphytosis causes them a considerably less damage. Therefore Soviet Scientists using linear hybridization do not reduce but step up their effort develop varieties-populations.

Breeding varieties with a high oil content has called for new methods of seed production. Research institutions have developed a new system of improved seed production and annual strain renovation with elite seeds. Scientific recommendations on sunflower seed production are widely used on collective and state farms. A vivid example is the experience of Ukrainian farms where practically all areas under sunflower is sown to high-grade varieties. The majority of Ukrainian farms, have accepted the system of annual strain renovation and seed breeding methods recommended by scientific institutions.

It is known that the oil percentage of seeds is the result of cultivation, it depending on varietal peculiarities, agrotechnics, and weather conditions. In zones of sunflower growing for commercial purposes precipitation, air temperature and humidity, as well as soil moisture reserves are irregular, and the oil content of sunflower seeds therefore varies. However,

the oil content of sunflower seeds supplied to oil mills for a number of years has increased on the average due to breeding of new highly-productive varieties, an organized system of seed production, and annual strain renovation, though the increment rates have decreased in recent years (Table 2).

It is difficult to overestimate the economic efficiency of the Soviet breeders' achievements. Owing to the increased seed oil content the country annually obtains 70,000-80,000 tons of sunflower oil extra. This shows that science becomes a direct productive force increasing the material resources of the national economy.

The results of studying crop varieties within the network of the State Commission on Strain Testing of Farm Crops show that the oil content of seeds has some scope for growth. In 1975, new tested varieties had a high seed oil content amounting to 52-54% and on some testing plots 59% (in terms of absolutely dry matter). Their oil yield per unit of area has also surpassed that of existing varieties. New fast ripening hybrid varieties, having a complex immunity to fungous diseases and resistance to broom rape are undergoing tests.

The areas sown to Voskhod and Salyut, varieties introduced in recent years, will be expanded. However, during the tenth five-year plan period (1975-1980 the bulk of land will be under old varieties improved in the process of seed production. Therefore the oil content of commercial sunflower seeds will not increase appreciably and will apparently remain at the 1975 level. At the same time, completely new varieties and hybrids of sunflower with a higher productivity are expected to be introduced in the years to come. But they will not substitute the existing varieties in these years.

The requirements of the national economy for vegetable oil are steadily rising. In the current five-year period we should therefore make a big in increasing the production of sunflower seeds.

Table 2

Oil Percentage of Sunflower Seeds Supplied to Oil Mills  
(at actual moisture content and dockage)

Area	1940	1950	1955	1960	1965	1966-70	1970-75	1975	IV quarter 1975
USSR	28.55	30.40	34.65	39.70	43.96	49.05	45.70	46.99	47.74
REFSR	28.54	30.55	34.89	39.32	43.08	44.10	44.10	46.48	47.36
Ukrainian SSR	28.72	30.26	34.75	40.68	45.12	46.03	46.18	47.58	48.28
Moldavian SSR	-	29.89	33.75	39.94	45.89	47.46	48.16	47.98	48.38
Kazakh SSR	26.49	28.45	30.58	32.44	42.79	43.48	46.02	45.36	45.29
Georgian SSR	-	31.17	32.51	34.30	40.72	41.10	42.00	41.06	40.59

The Principal Directions of Economic Development of the USSR for 1976-1980, approved by the 25th Congress of the Communist Party of the Soviet Union, provided for an increase in the average annual production of sunflower seeds in the tenth five-year plan period by 1,600,000 tons or 27% as compared to the previous five-year plan period (1970-1975). This task is now being fulfilled with practically the same arable area. Measures are taken to increase sunflower yield by 9.9 c/ha over the 1971-75 level by introducing new varieties, advanced technology of cultivation, improving seed production, effective use of fertilizers and strengthening the material and technical base of sunflower production.

To obtain seed yields several measures will be implemented, seed as intensified effort in improving seed production, increased application of fertilizers, means of plant protection from pests, diseases and weeds, new technologies of soil cultivation, sowing and harvesting, and new machines for cultivating and harvesting sunflower and appliances to them.

The experience of leading collective and state farms demonstrates the great possibilities of increasing the yield of this valuable crop. In the Donbass Collective Farm, Krasnoarmeisky District, Donetsk Region, the team led by I. V. Kartashov obtained in 1974 a yield of 3.32 t/ha from the area of 155 ha; in the Pobeda Collective Farm, Pokrovsky District, Dnepropetrovsk Region, the group led by P. T. Tsybulko obtained in 1974 a yield of 3.33 t/ha from the area of 100 ha; the Leninsky Komsomol Collective Farm, Ungensky District, Moldavian SSR, obtained in 1975 a yield of 3.48 t/ha from the area of 300 ha; the Kuban Collective Farm, Krasnodar Territory, obtained in 1975 a yield of 3.19 t/ha from the area of 900 ha, and Group 4 of this farm obtained a yield of 3.57 t/ha from the area of 160 ha.



In the USSR, sunflower production is founded on a scientific basis. Research on this crop is carried out in a number of scientific institutions: the V.S. Pustovoit All-Union Research Institute of Oil Crops, N.I. Vavilov All-Union Research Institute of Plant Growing, All-Union Selection and Genetics Institute, V. Ya. Yuryev Ukrainian Research Institute of Plant Growing, Selection and Genetics, South-East Research Institute of Agriculture and a number of regional experiment stations. The research institutions have modern equipment, the requisite laboratories, experiment and production base, and are stuffed by highly skilled research workers and specialists.

The scientific establishments have carried out a number of important studies of great practical value. Much has been made to improve the technology. A really leading role in sunflower breeding, cultivation and harvesting is being played by the All-Union Research Institute of Oil Crops which is solving major scientific and technical problems in the field of sunflower physiology, biochemistry, agrotechnics, plant protection and mechanization of cultivation.

Various methods of increasing sunflower productivity are being developed and introduced by scientists and specialists on the farms.

The elaboration of rational methods for main seed bed preparation acquires great importance. In recent years, methods of soil cultivation for sunflower have been developed for regions with wind erosion of soils. Subsurface cultivation of soil, application of herbicides and fertilizers reliably protect soil from wind erosion and ensure practically regular yields of soil seeds. The possibility of obtaining high yields of sunflower with a minimal number of soil treatments has been proved. This has become possible thanks to the application of herbicides ensuring reliable weed control.

Optimal time of sowing, areas of supply and rates of sowing, as well as proper maintenance

of crops have been established and recommended for collective and state farms. Recommendations have been given as to the most effective application of fertilizers.

The method of localized and band application of a base fertilizer under sunflower in autumn ploughed field cultivation or sowing in spring has been developed. The response of sunflower varieties to fertilizers, particularly to effective mixtures of combined fertilizers, has been specified.

It is best of all to start sunflower harvesting when the back of 75-80% of heads becomes brown. If one re-equipped combine harvester is available for every 50-60 hectares of sunflower crops the harvesting may be completed in 5-7 days. In the course of harvesting sunflower seeds are cleaned in cleaners and transported to state purchasing organization where they are dried and stored at a humidity of no more than 6.5-7%. The harvesting technology used allows to obtain high-quality edible oil from sunflower seeds.

Much attention is paid to further improving the technology of sunflower harvesting and using crop residues for feeding purposes. Hopper bulk grading wastes and crushed heads are used for preparing feeding meal or granules in drying plants.

However not all problems of increasing sunflower seed production are solved completely. Scientists, managers and experts of agricultural organizations, collective and state farms face important tasks in this field. Sunflower breeding should be aimed not only at the increase of oil percentage of seeds, but also at strengthening resistance to new broomrape races, making varieties and hybrids immune to fungous diseases, at making sunflower fast ripening, and improving the fatty-acid composition of the kernel.

In the current five-year plan period, the area sown to new varieties annually increase by an average of 300,000 hectares. This makes it possible to use the material and technical resources invested in agriculture more efficiently and profitably. In the current, tenth five-year plan period, sunflower breeders should create varieties of the intensive and semi-intensive type with a yield of 3-3.5 t/ha.

The methods of removal and after-removal processing of heap should be considerably improved to preserve the quality of the raw material stored.

The fertilizers will come to play greater role in boosting yields and improving oil seed quality as highly-productive varieties and hybrids have been bred and introduced. Accordingly, fertilizers will be applied in greater quantities.

The amount of yield greatly dependent on the quality of seeds sown. Measure will therefore be taken to further improve sunflower seed production.

It will be transferred to an industrial basis, its material and technical base will be strengthened, and it will be concentrated on specialized farms.

Sunflower cultivation practices applied on collective and state farms will be considerably improved.

Soviet scientists work in contact with their foreign colleagues. They render assistance to Indian researchers and practical workers in growing sunflower, the crop that is relatively new for India. Agreements on joint research with scientific institutions of the COMECON member-countries have been concluded, and joint studies are being carried out with scientists from the USA and ARE.

The all-round discussion of all the problems of sunflower production at the VIIth and preceding International Sunflower Conferences is undoubtedly of great practical importance.

The new forum of scientists and experts will be a substantial contribution to international co-operation of scientists and practical workers in the field of sunflower cultivation.