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**SUNFLOWER PRODUCTION IN THE U.S.S.R.**

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Sunflower, as one of the most important oil crops has been practised on a large scale. Nowadays sunflower is cultivated in all the continents of the world. It takes third place in acreage, yielding to soybean and peanut. In 1970 sunflower seeded area was 8,4 mln. hectares. Main production more than 6 mln. hectares is located in West European countries and the rest - in the countries of North and South America, Africa and Australia (Table 1).

Table 1 - World sunflower seeded area.  
(thousand hectares)

Continents	Years			
	1965	1968	1969	1970
Total	7 547,0	7 774,0	8 072,0	8 419,0
Including Europe	5 874,2	5 951,8	6 060,8	6 153,3
Asia	216,5	295,0	342,6	378,3
Africa	249,8	248,9	253,7	274,0
America	1 203,7	1 272,2	1 401,2	1 581,0
Australia and Oceania	2,8	6,1	13,7	30,3

(Foreign Agriculture Circular, U.S. Department of Agriculture, Foreign Agricultural Service, Washington D.C.)

It is seen a marked tendency of growth in the world sunflower production. In 1965 world sunflower acreage was 7,5 mln. hectares and in 1970 it increased by 0,9 mln. hectares or 11,5 %. Gross yield of sunflower seeds has increased by 1,5 mln. tons or 19,2 % and sunflower oil production by 30 % and reached 3,7 mln. tons.

The share of sunflower oil in the world production of vegetable oils is more than 24 %. In volume of production it yields only to soybean oil.

The history of sunflower as a field crop in Russia dates over 100 years back since in the beginning of the 19 century it was found a method of obtaining oil from seeds. Sharp development of oil mills raised the demand for the raw material and sunflower plantings were extended. Sunflower oil overstepped the limits of using in peasants houses and became an object of trade in home and foreign markets.

The great demand for oil favoured rise in prices on sunflower seeds, thus, providing high economical advantages of sunflower cultivation.

As a result, sunflower spread in Russia, and there were formed large specialised regions of seed production.

However, extended plantings and frequent sunflower recurrence to the same field in the rotation caused a serious rust, broomrape and sunflower moth problem. Sunflower in Russia found itself under the threat of death what entailed sharp decrease in acreage.

In order to preserve this important crop, Russian scientists began to work on breeding varieties resistant to these dangerous diseases. The breeding conducted on resistance to broomrape races of all the climatic zones in the country, where sunflower was cultivated. Owing to this method it became possible to grow varieties bred in one zone on a vast area of the country without any losses of the immunity. Thus, broomrape problem was successfully solved through breeding method. The most valuable contribution to the solving of this problem was made by the soviet scientists, Academicians V.S. Pustovoit and L.A. Zhdanov, breeders V.I. Shcherbina and K.I. Prokhorov. The fact, that in the years of zoning broomrape resistant varieties on the total area of 100 mln. hectares, not a rouble was spent for protection from the parasite, indicates the important economical significances of these varieties.

As far as new varieties were bred, the planting area was extended. In 1913 in Russia, sunflower was grown on the area of 980 000 hectares, in 1970 in the USSR on that of over 4,8 mln. hectares ; with about a five-fold increase. The Soviet Union takes the first place in the world in sunflower production. To the share of our country it falls about 57,1 % of planted acreage and 66 % of gross seed yield (table 2).

Table 2 - Specific share of the USSR in the world sunflower seed and oil production.

Values	Years			
	1965	1968	1969	1970
World sunflower seeded area (mln. hectares)	7,5	7,8	8,1	8,4
Including the USSR	4,9	4,9	4,8	4,8
Specific share of the USSR (%)	64,3	62,8	59,2	57,1
Gross yield of sunflower (mln. tons)	7,7	9,4	9,2	9,2
Including the USSR	5,4	6,7	6,4	6,1
Specific share of the USSR (%)	70,1	71,3	69,6	66,3
Sunflower oil (mln. tons)	2,8	3,6	3,6	3,7
Including the USSR	2,1	2,4	2,3	2,1
Specific share of the USSR (%)	75,0	66,7	63,9	56,8
The world sunflower cropping power (centners/ha)	10,2	11,6	10,9	11,0
USSR	11,1	13,7	13,3	12,8
Cropping power in the USSR in % to the World	108,8	118,1	122,0	116,4

Sunflower is the main oil crop in our country and has a great significance in the national economy. In 1970 it occupied 76 % of the total area under oil crops, and the production sunflower oil in the total oil production from all the other oil seeds was about 77 %. Annual sunflower oil production in our

country was 2,2 mln. tons. Recent years a decrease in gross production of sunflower oil took place in the result of unfavourable weather conditions. Besides, to some extent it was influenced by seed export in other countries. Sunflower oil is one of the most palatable vegetable oils in the world. It is widely used in our country in food, canning industry, confectionary, margarine and in other fields of food industry.

The significance of sunflower is not limited only by obtaining of oil. It makes a great contribution in production of vegetable protein. Oil and protein contents in modern sunflower varieties on the absolute dry basis are 50,8 % and 16,2 % (table 3).

Table 3 - Oil and protein contents in modern varieties of oil crops  
(in % on the absolute dry basis)

Oil crops	Oil content	Protein content	Summarized oil and protein contents
Sunflower	50,8	16,2	67,0
Flax	46,5	23,4	69,9
Soybean	21,0	42,1	63,1
Castor bean	52,3	17,6	69,9
Mustard	45,7	23,8	69,5
Peanut	54,5	25,8	80,3

Recent years annual yield of oil crops seed protein in the USSR averaged 1,193 thousand tons, 1 mln. tons or 83 % of this quantity being obtained by sunflower production. Owing to high content of main indispensable aminoacids sunflower protein is considered to be a product of high quality (table 4).

Table 4 - The content of indispensable amino acids in protein of some crops  
(in %).

Amino acids	Soybean	Sunflower	Peanut	Wheat	Maize	Pea
Arginine	8,3	9,1	10,7	4,3	4,7	10,7
Histidine	3,3	2,8	2,3	2,1	2,2	2,5
Lysine	6,4	3,5	4,0	2,7	2,3	6,6
Tryptophan	1,5	1,4	1,1	1,2	0,6	0,9
Phenyl alanine	4,8	5,1	5,0	5,0	5,3	4,9
Methionine	1,8	2,2	0,9	1,1	1,4	0,8
Threonine	3,7	3,4	2,9	2,8	3,9	3,9
Leucine	8,1	6,9	6,8	6,5	13,0	7,9
Isoleucine	4,9	4,2	4,0	5,0	4,4	4,9
Valine	5,1	5,8	5,1	4,0	5,3	5,7

In contents of indispensable aminoacids such as arginine, histidine, lysine, tryptophan, etc... sunflower protein does not yield to soybean protein which is considered to be a standard or vegetable protein.

Recent years sunflower production has greatly increased (table 5). This was done owing to the increase of cropping power and seed oil content.

Our breeders - the creators of high oil content varieties have performed great services for increasing sunflower productivity.

Table 5 - Sunflower and sunflower oil production in the USSR

Indices	Years			
	1940	1956-1960	1961-1965	1966-1970
Seeded area (mln. ha)	3,5	4,0	4,5	4,8
Index of growth	1,00	1,14	1,29	1,37
Cropping power (centner/ha)	7,4	9,2	11,3	13,2
Index of growth	1,00	1,24	1,53	1,78
Gross yield (mln. tons)	2,6	3,7	5,1	6,4
Index of growth	1,00	1,42	1,96	2,46
Oil production (mln. tons)	0,8	0,8	1,6	2,2
Index of growth	1,0	1,00	2,00	2,75

Oil content of the initial material the breeding work was begun with was 30-32% on the absolute dry basis. Nowadays we have introduced in production varieties, having 50 - 52 % oil in seeds i.e. half as much in comparison with the initial forms. Combination of good cropping power and high seed oil content provides the highest collections of oil per hectare. According to these values Soviet varieties exceed varieties of other countries.

Attained success is the result of many years breeding work and practical use of a method of improving seed production, developed by Academician V.S. Pustovoi. The method has passed a long experimental trial and is now widely utilized as in the USSR, so in some European Countries. This method allows annual improving of zoned sunflower varieties in main valuable characters-oil content and oil yield per hectare.

Thus successful research work in improvement of sunflower varieties, conducted by our breeders, have resulted in higher sunflower productivity. Table 6 presents a convincing illustration to it.

Table 6 - The results of zoned sunflower varieties improvement in the process of seed production

(according to competitive variety testing data, obtained at the central base - VNIIMK, Krasnodar).

Variety the year of zoning	The year of study	Seed yield centners/ha	Oil content on the absolute dry basis	Yield of oil per ha
VNIIMK 6540 (1950)	1945-1947	22,3	41,2	8,8
	1966-1968	28,7	51,1	12,9
	difference	+ 6,4	+ 9,9	+ 4,1
VNIIMK 8883 (1955)	1949-1952	22,2	42,5	8,6
	1966-1968	26,9	49,5	11,8
	Difference	+ 4,7	+ 7,0	+ 3,2
Peredovik (1960)	1957-1959	24,9	49,1	10,7
	1966-1968	28,5	51,8	13,0
	Difference	+ 3,6	+ 2,7	+ 2,3

Owing to the methods of improving seed production, all the zoned varieties of All-Union Research Institute of Oil Crops (VNIIMK) selection have increased their productivity so that all they could 3-5 times be considered as new ones.

It should be marked that in 1970 under the improved sunflower varieties there was 90 % of all the seeded area of our country. Thus, Peredovik and Armavirskii 3497 varieties occupy more than a half of seeded area, or 2,6 mln. ha, VNIIMK 8931-500 thousand ha, VNIIMK 6540 - more than 400 thousand ha, Smena - more than 150 thousand ha, Zelenka 368 - more than 100 thousand ha, etc... (table 7).

Table 7 - Seeding of sunflower varieties in the USSR  
(basic varieties) 1970

Name of variety	Seeded area (thousand ha)	% to the total variety seeded areas	% to the total sunflower seeded area
Peredovik	1 388,1	29,8	29,1
Armavirskii 3497	1 256,4	27,0	26,3
VNIIMK 8931	504,9	10,8	10,5
VNIIMK 6540	423,5	9,1	8,9
VNIIMK 1646	231,8	5,0	4,8
Majak	179,1	3,8	3,7
Smena	158,5	3,4	3,3
Zelenka 368	112,7	2,4	2,3
Yenisei	93,3	2,0	1,9
Armavirets	72,0	1,5	1,5
Yugo-vostochnii	60,1	1,3	1,2
Chakinskii 269	41,0	0,9	0,8
Chernyanka 66	39,6	0,8	0,8
VNIIMK 8931	31,3	0,7	0,6
Total variety seeded area in the USSR (thousand ha)	4 652,6	-	-
Total sunflower seeded area in the USSR (thousand ha)	4 776,9	-	-

Improving seed production is the basis of the annual sunflower renovation scheme developed by Academician V.S. Pustovoi.

The scheme implies the following : improved elite seeds of zoned varieties are annually delivered from research institutions to collective and state-farms : the first reproduction from the material grown on their seed plots is obtained and sown on the whole sunflower area ; the second reproduction is produced on commercial seeded areas and sold to oil extraction plants.

Introduction of high oil content sunflower varieties and improvement of zoned varieties in the process of seed production allowed to increase commercial seed oil content to the considerable extent. For the 30 years sunflower oil content has increased by 16,6 % and the yield of oil - by 18,6 %.

Owing to the annual variety renovation it became possible to obtain additional 800 thousand tons of sunflower oil to a total value of 1,2 milliard roubles.

The following example may serve as a convincing fact indicating high economic significance of our scientists achievements in the field of breeding and seed production.

If at present we grew sunflower varieties with 28,5 % oil (1940 level), then to produce as much oil as we do now, we should have seeded extra 3 mln. hectares i.e. total about 8 mln. hectares.

It should have required, also, extra state capital investments in order to provide collective and state farms with a considerable amount of agricultural technique and building of more oil extraction plants.

Soviet high oil content sunflower varieties occupy area of about a million hectares in Rumania, Bulgaria, Hungary, Yugoslavia, Czechoslovakia.

France, Argentina, Brasil, Kanada and other countries in the world show interest for these varieties.

Sumultaneously with introduction of new varieties cultivation technology was improving. Extensive mechanisation and effective agrotechnique devices in sunflower production have made it possible to increase labour productivity. Earlier sunflower was a manual labour crop, nowadays, the processes of cultivation and harvesting are almost fully mechanized. Labour expenditure for sunflower production is equal to that for cereal crops production. Recent 5 years for growing 1 hectare of sunflower 4,59 men-days were required and for obtaining 1 centner of sunflower seeds -0,33 man-day, i.e. 30 % reduction as compared with former 5 years.

On the account for cropping power increase, further increase of sunflower production in our country will be put into life. It requires breeding of sunflower varieties with higher productivity and wide use of chemization and mechanization devices. Next five years sunflower varieties with oil content 53-54 % will be introduced into production. Nowadays there have been bred varieties with complex immunity to bromrape, sunflower woth, downey midew, Brachicandus helichrise, verticilliose, rust, which do not yield in productivity of the best zoned varieties.

Proceeding from production requirements, there will be introduced varieties, maturing 8-12 days earlier than middle-ripening ones, and their cultivation rise sunflower productivity especially in unfavourable regions.

High economic effect follows the application of fertilizers. They allow annual obtaining of extra 8-9 mln. centners of seeds. The application of herbicides treflan and prometrin types is considered to be rather perspective.

For dry regions there are developed some methods of sunflower cultivation in irrigable conditions. Irrigation of sunflower in combination with mineral fertilizers allows to get in these regions stable high yields -25-30 centners per hectare. Moreover, irrigation promotes the increase of sunflower oil content by 2-4 %.

Great importance is attached to application of desiccants, especially in the nothern regions of sunflower cultivation. Thus magnesium chlorate impeds seed maturation and gives possibility to begin harvesting by 8-12 days earlier than usual, to raise agregate efficiency, to improve the quality of production and reduce seed losses by 1-1,5 centners per hectare.

The problem of sunflower harvesting according to a complete technological cycle is solved now. New attachment PSP-1,5 to the harvesters SK-4 and "Niva" allows simultaneous harvesting of seeds and sunflower heads for livestock feed and stalks crushing with subsequent leaving them in the field. The method allows to make soil preparing for winter crops and earlier fall-ploughing. Introduction of the attachment in the main districts of sunflower cultivation increase gross seed yield by 250-260 thousand tons and summarized effect is estimated at 123 mln. roubles.

Practical utilization of achievements of science and use of reserves available gives opportunity to show the qualities of sunflower high oil content varieties with the greatest efficiency and increase high quality sunflower oil production.