

## SUNFLOWER CROPS AND THEIR PROBLEMS IN BULGARIA

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Concerning sunflower planted area Bulgaria ranks fourth in the world, and ranks first concerning sunflower yield per inhabitant.

Over 90% of Bulgaria's edible and vegetal oil requirement is met by sunflower yield and great exportation availabilities have been moreover created.

Sunflower cropping for industrial processing began in Bulgaria in 1947. From then on its cropping continually extended (Table 1) and has reached highest area in the last five year plan (1966—1970).

Table 1

Areas cropped with sunflower and yields obtained in Bulgaria

Periods according to 5 year plans	Cropped surface in %	Average production kg/ha
1940—1944	100.0	734
1945—1949	105.1	457
1950—1954	140.9	945
1955—1959	127.0	1120
1950—1964	153.8	1359
1965—1970	169.5	1655
1971	173.4	1742
1972	168.4	1810
1973	162.8	1793

Data concerning yield per hectare is also important as this yield continually increases. The great recession in production reported in 1945—1949 was to a great extent due to the *Orobanche cumana* parasite, that brought about not only yield decrease, but even threatened growth and extension of this plant. But by introducing in culture new varieties, resistant to infection, this hazard was rapidly eliminated. The rise registered subsequently was determined by the better cultural practices, by a wide application of fertilizers, by the mechanization of differ-

ent practices. Presently conditions are created so as to currently obtain 2,000 kg/ha in the following years.

An important premise in order to enhance sunflower yield per hectare in Bulgaria resides in the concentration of all the sunflower cropped area in microzones and within great production units.

In this respect, the elaboration of new organization forms — namely of new agro-industrial complexes — is important. These are characterized by a high concentration of the production and a higher training in the respective specialty branch. The high capacity of these complexes will allow the creation of great areas holding the same crop; these should be of the most beneficial size on condition to be cultivated on a wide scale by the newest agrotechnical means.

In Bulgaria, sunflower has been properly zoned and the areas on which it was cropped were quickly concentrated. As a whole the crops were concentrated in three years on 17 territories, as to 27 on which they were formerly grown. Excepted were the southern regions of the country, where climate conditions are not adequate. The concentration was also achieved within the different territories: in 1970, 4031 plots were held by this crop (each of them averaging about 60 ha); in 1972, the same area was concentrated on 3300 plots. Greatest size of the ground strips was registered in the cereal growing region of the country — in the Dobroudja. Here the size of a sunflower fields was, in 1971, of 807.5 ha, a yield of 2200 t amounting approximately to a single farm. It was proved that 500—800 ha constitute an optimum size for a field, so as to efficiently use the technical means and to manage effectively the cultural practices. For optimum pollination by bees the planted strip of ground should not exceed 2500 m.

Thus very favourable conditions are developed and industrial methods may be applied on condition to achieve a complete mechanization of all practices starting from sowing and up to harvesting. Great savings are obtained and last but not the least of all cultural practices can be applied at the most favourable moment for each of them under such conditions.

Data prove that at present nearly all sunflower production is concentrated in the regions with most favourable conditions; this provides relatively high yields at a relatively low expense in production costs, fertilizers, etc. (Table 2).

Table 2

Sunflower zoning in Bulgaria

Pedoclimatic conditions	Number of farms	Yields in kg/ha	Cost price for 100 kg. in leva
Highly favourable	107	2260	8.93
Favourable	51	2180	9.63
Not too favourable	4	1820	14.11
Unfavourable	0	—	—

Besides the application of a correct technology, a great concern is shown in the introduction of new varieties, this constituting a great intensification factor. After 1962, the Sovietic variety Peredovik was released; it was grown on nearly the entire area after 1965 and became the fundamental sunflower variety in Bulgaria.

This variety is characterized by a great productivity — 70-80 g seeds per plant — and a consistent oil content of 47—50% from perfectly dry seeds. From 1970 to 1973 a whole range of varieties and new hybrids — developed in Bulgaria, the USSR, Romania and France — was tried out; for the moment they have not proved consistently superior to the Peredovik variety, concerning oil yield.

An important part is played, in the maintenance of quality in the varieties, by the production of a high quality planting material, obtained in accordance with strictly scientific methods. Special attention is afforded to the stand of crops destined for seeds, as in production are used only seeds with an absolute weight of 80 g or even higher. The results of experiments prove that, under weather conditions prevailing in Bulgaria, about 30.000 pl. per hectare should be grown in order to obtain seeds with high cultural features (Table 3).

Table 3

Effect of crop stand

Number of plants per hectare	Total yield of seeds kg/ha	Production of conditioned seeds		Absolute weight g	Seed oil content %	Seed protein content %
		kg/ha	%			
10,000	1660	1523	91.8	113	41.5	23.3
20,000	2930	2446	83.5	88	44.3	23.3
30,000	3300	2142	64.9	75	45.6	21.9
40,000	3430	1756	51.2	68	46.1	20.8
50,000	3180	1167	36.7	58	46.4	20.3
70,000	2990	921	30.8	52	46.0	19.9

Only seeds of the first increase are used in production.

Breeding practices for sunflower began in Bulgaria right after the crop was introduced; thus the first Bulgarian varieties were employed in 1932. In 1950 a newer variety — the Bulgarian nr. 75 — began to be spread in production; it had a higher oil percentage and was more resistant to *Orobanche*. Presently, a range of new, high yielding varieties, with high oil content, are experimented.

Among the activities aiming at introducing new most adequate varieties in production, an important part is played by the trials with a range of foreign varieties.

Sunflower breeding may be achieved according to two methods of hybridation between lines. In their selection work, the specialists dispose of a great number of lines and a wide scale for estimating their different characteristics (Table 4).

Scale of characteristics of the S<sub>5</sub>-S<sub>12</sub> inbred lines

Characteristics	Minimal value	Maximal value
1. Vegetation period, days	102	147
2. Plant height, cm	41	230
3. Oil content in seeds, %	23.4	52.48
4. Proteine content in seeds, %	13.9	23.65
5. Linoleic acid, %	32.15	70.92
6. Oleic acid, %	19.00	36.42

Concerning combining ability, a series of lines proved most satisfactory. Among the 500 hybrids tried out in 1972 and 1973, about 14% exceed by over 10% the Peredovik variety in oil production; 70% produced the same yield. The other hybrids proved less yielding.

The groups of hybrids with high productivity based on cytoplasmic male sterility, part of which are increased, are investigated in our Institute.

The continuous increase in sunflower yield sets to the scientists a series of new problems they must solve at today's level.

Production programming is the main task of the Scientific Institutes. An intensive activity is developed within them for the study of this plant's physiology.

Investigations for the perfecting of the harvesting technology in sunflower with the combine must be stepped up, so as to lose at most 2% seeds and to collect as far as possible the stems and heads for forage.

The genetic research concerning this crop, in view of developing immunity against the main diseases, becomes extremely important in intensive agriculture. That is why in breeding it becomes imperative to associate the factors of resistance both in the cultivated and in the wild varieties.

In research an important part is played by protein content. Here an intensive breeding activity, aiming at types with high protein content and with a more reduced percentage of hulls, is developed.

An important task held by biochemistry is that of elaborating an optimal chemical composition; this task should be rationally dealt with both from a biologic and from an economic viewpoint.