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ECOLOGICAL EFFECTS ON SUNFLOWER SEED QUALITY

Sunflower seed production in our country is unvariably based on the system of annual varietal renovation developed by Academician V.S. Pustovoit. At the same time, in some regions of the Central Chernozem zone, Middle Volga Basin, the Urals, Altai and northern parts of the Ukraine seed with high sowing qualities is not always obtained even in the case of strictly following the recommendations of V.S. Pustovoit of producing seed for sowing purposes.

During the periods of seed filling and especially seed maturing weather is a rule unfavourable in these zones: frequent precipitations, high relative air humidity, lack of sufficient number of sunny days, low temperatures, early frosts, and in some seasons early snowing. Moreover, seeds are affected by grey rot and Sclerotinium sp. which drastically reduce their sowing qualities. The farms having no sowing material of their own are therefore obliged to obtain seed from other zones of sunflower cultivation.

It is known that different growing conditions considerably change the character of physiological processes and hence the processes of metabolism, considerably affecting the biological properties of plants and seed quality. It is quite appropriate to remind Ch. Darwin's remark that Organic substances undergoing any environmental changes during several generations are inclined to change and have a direct and powerful influence on the traits of a descendant. In 1876 Nebbe stated that the most suitable wheat seeds to be sown in the northern regions of Germany were those imported from southern regions of Russia or Hungary. Prominent ecologist G. Azzhi reports that farmers in England often obtain wheat seed from sout-

hern regions of the country where relatively dry and hot weather favourably influences the formation and development of the embryo, thus conforming Timiryazev's statement that the earlier in occurrence is the influence of the environmental factors the more it is pronounced.

The earliest period in the development of a particular plant generation is its embryonic development in the seed.

P.N. Konstantinov says that the difference in yield of winter wheat of one and the same variety may even exceed varietal differences, that depending on the origin of the sown seeds. P.I. Lisitsyn, G.F. Nikitenko and others also point to a positive effect of seed reproduction region on yielding properties. Although this problem is very important, no research has been conducted, either in this country or abroad, on the effect of ecological factors on the formation of sowing qualities of sunflower seeds. The existing system of seed production did not consider the influence of the day length, the intensity of solar radiation during developement and especially ripening of the seeds on the formation of sowing properties.

In 1967-1973 experimental studies were conducted in different soil and climatic zones of the Kuibyshev and Voronezh regions and the Krasnodar Territory to ascertain the influence of ecological factors on the formation of sowing qualities and yielding ability of sunflower seed. The seeds of the following sunflower varieties commercialized in the above-mentioned regions were included into experiments: VNIIMK 8883, Peredovik and Voronezhsky 154. Experiments were conducted on two aspects: 1. Growing first-reproduction seeds in the above-mentioned zones strictly following the managerial practices of seed production; and 2. Testing the yielding abilities of the harvested seed according to methods of State Variety Trials in the Kuibyshev and Voronezh regions and the Krasnodar Territory. Seeds grown in the Rostov, Odessa and Volgograd regions and in Moldavia, representing

the same varieties, were also tested. Methods of sunflower management recommended for these zones of cultivation were utilized in all cases. Agricultural and climatic conditions for each zone are given in Table 1.

It was found that the quantity of solar energy available in daily terms is uneven in different phases of growth and development of sunflower plants.

For example, during the period from emergence to flowering under Voronezh region conditions the quantity of solar radiation is always larger than in the Krasnodar Territory. The main role here is played by the day length.

Comparing the Voronezh region and the Krasnodar Territory by this factor we can see that by May 1 the day length in Voronezh grows by 30 minutes.

Since the soil warming in the Voronezh region is delayed for two weeks the day length increases by 1.1 hour. This results in a greater duration of solar radiation and in larger availability of solar energy (by 77 Kkal per sq.cm).

An increased inflow of solar energy during the period from emergence to flowering promotes a more energetic growth of organic matter and the formation of a more powerful system of leaves. High correlation - 0.940 was found between the day length, solar radiation and total leaf area. The available solar energy after flowering per day is always less in the Voronezh and Kuibyshev regions than in Krasnodar. The total vegetation period of sunflower in the Voronezh region is 17 days longer than in Krasnodar.

Owing to a reduction of solar radiation intensity and of mean daily temperatures, and to a greater relative air humidity, the increase of the vegetation period was mainly observed in the phases of flowering and full maturity when the seed quality is being formed.

Table 1

Agricultural and Climatic Conditions (mean perennial figures)

Indicator	Krasnodar	Kuibyshev	Voronezh
Total precipitation during vegetation, mm	225	150	234
Average air temperature during vegetation, °C	19.7	16.6	17.6
Average air temperature at maturity, °C	22.8	14.0	16.9
Relative air humidity at maturing stage, %	48	67	53
Length of period with positive temperatures, days	180-230	125-140	145-165
Sum of positive temperatures during vegetation, °C	2600-3000	2200-2700	2500-2800

Different conditions in the period of seed formation resulted in differences in the seeds biochemical content, as can be seen from the differences in accumulated phosphorus and nitrogen compounds (Table 2).

Table 2

Phosphorus and Nitrogen in Sunflower Seed in Relation to the Zone of Reproduction (1971-1973)

Zone	P_2O_5, %	N, %
Krasnodar Territory	0.984	2.883
Voronezh Region	0.634	2.409

Phosphorus and nitrogen compounds are important elements influencing yielding abilities of the seed. In our experiments we have found that sunflower seeds reproduced in the Krasnodar Territory possessed better yielding abilities as compared with seeds grown in the Kuibyshev and Voronezh regions (Table 3).

As can be seen from the Table, the yield gain of sunflower seed of Krasnodar reproduction amounted to 1.9 - 2.5 c/ha. Moreover, the progeny of the seed of Krasnodar reproduction was 0.96 - 2.26 % higher in oil content. Seeds grown in the Rostov and Odessa regions and in Moldavia appeared to be close to the seed of Krasnodar reproduction in this respect.

Our experiments proved the expediency of distributing the seed production fields of sunflower in favourable zones of the country, viz. the Krasnodar Territory and southern parts of the Rostov region, the Ukraine and Moldavia.

Table 3

Yielding Abilities of Sunflower Seeds in Relation to the Zone of Reproduction (1968-1970; 1971-1973)

Zone of seed reproduction	Variety	Yield q/ha seed	Seed oil content	Oil yield q/ha
Krasnodar Territory	8883	13.6	43.94	5.4
Kuibyshev Region	8883	11.7	41.68	4.2
Krasnodar Region	Peredovik	20.1	48.73	8.6
Voronezh Region	Peredovik	17.6	47.77	7.5