

N.I. Volodarsky, USSR

REPORT ON THE ACTIVITIES OF
SECTION III

Scientists from 10 countries took part in the activities of the Section. The participants have heard and discussed 38 reports.

Thirteen reports dealt with physiology, anatomy and immunity, 13 reports with plant and seed biochemistry, and 12 reports presented the problems of oil industry technology and seed and plant processing.

From 85 to 120 persons were present at the sessions.

A number of reports caused a lively discussion.

The common positive trait of all reports was their high theoretical level and at the same time a close connection with practical breeding, plant production and seed processing.

Most reports on physiology were devoted to the problems of water regime, draught resistance and photosynthesis in relation to the productivity of the sunflower plant. A high interest paid in many countries to these problems is ultimately caused by an urgent need to increase sunflower productivity.

These reports have shown a practical possibility and expediency to choose experimentally an optimal structure of the assimilating surface in the crops so that soil moisture is utilized in the best way. It was noted that the sunflower photosynthetic system is highly responsive to the lack of moisture. Draught resistance can be increased by using micro-elements and Chlormekwat. It was shown that insufficient water supply highly influences the protein exchange not only in the above-ground part of the plant but in the roots as well.

It was found that different photosynthesis in different sunflower genotypes is largely responsible for different productivity of inbreds and heterosis hybrids.

Very interesting and new are the studies establishing that under conditions of dry land cultivation the competition between the plants for water influences the photosynthetic productivity and the yield to a much greater extent than competition for light. An intensive competition for available nitrogen was also found under these conditions, a competition that cannot be eliminated by fertilization as this leads to premature water expenditure.

Some differences were found in the character of the broomrape penetration into the roots of susceptible and resistant sunflower genotypes, the causes of resistance were explained and a method of early diagnosis of the immunity to the broomrape was presented, with its importance for breeding and improving seed production being explained.

The studies of the ontogenesis of broomrape and the anatomical pattern of its penetration into sunflower roots were very interesting.

Anatomical studies of developing sunflower seeds have shown the possibility of reducing husk percentage to 15 and even to 13% without losing the phytomelane layer which is necessary to protect the seed against sunflower moth.

Special experiments have shown that sunflower is responsive to the day length not only before the differentiation of the apex but after the appearance of the inflorescence, the reaction to the photoperiod being different in different genotypes. These data are undoubtedly interesting for breeding. Results of studies to determine the optimal regimes of growing the breeding samples of sunflower in the greenhouse and in phytotron were discussed.

Several reports dealt with biochemical properties of sunflower seeds depending on the variety and the conditions of growing, with the quality of the products of processing - protein concentrates and isolates, with the biological value of the high oleic mutant and the influence of the storing conditions on the quality of sunflower seeds.

Special attention was paid to the results of studies of the protein complex of sunflower seed. Possibilities of obtaining vegetable protein were also discussed. Studies of the influence of seed origin and of the character of processing on the quality of protein isolates have considerable practical value and open new prospects in obtaining high quality protein concentrates and isolates from sunflower meal. This question was dealt with in several reports.

Theoretically and practically valuable studies of peculiarities of the fractional and amino acid composition of the protein complex of sunflower seed of high oil varieties have shown in particular that the increase in the share of the water soluble fraction in the protein complex leads to an enrichment of seed protein by a very scarce essential amino acid - lysine. It was shown that sunflower seeds are the source of oil and of high quality protein.

Detailed studies were reported concerning the influence of temperature on the biosynthesis of oil and its fatty acid composition.

Studies of the sunflower collections from different countries have shown a highly variable level of accumulation of oleic and linoleic acids in the oil. The VIR collection may serve as a source of interesting material to develop high oleic or high linoleic varieties of sunflower.

High variability in the oleic and linoleic acids content was found in the oil of wild sunflower species. The ratio between these acids changes greatly under the impact of temperature. But the wild species of *Helianthus* show large differences in the oleic and linoleic acids content even under equal temperature conditions of growing, which goes to show that these differences are due to the genetic factor.

Studies of the peculiarities of the fatty acid metabolism in the seeds of the high oleic sunflower mutant have shown that as distinct from the VNIIMK 8931 variety there is an intense synthesis of oleic acid in the seed of the high oleic

mutant during the whole period of ripening with a depression of the synthesis of linoleic acid leading to a reduction of iodine number to 96.

Studies of the biological activity of oil with a high oleic acid content have shown that this oil with new properties is a very valuable product, which has clear advantages over sunflower oil as fritted fat in the food industry.

Studies of the lipides accompanying sunflower oil have shown that breeding for high oil content does not lead to any essential changes in the content of lecithine, a most valuable phosphatide. The sterole composition has shown a shift towards an increased synthesis of the biologically valuable compound - β - cytosterole.

Due to the reduction of husk percentage in sunflower seeds and to a considerable change in the composition of the gel and oil parts of high oil sunflower seeds there arises an urgent problem of developing and introducing new methods of storage and seed processing.

There was one common trait in reports on the technology of seed processing - the problem of increasing the quality of all useful products obtained during sunflower seed processing. At present sunflower is not only an oil crop but a protein-oil crop as well. It is only natural therefore that attention was focussed at the section on improving the quality of sunflower oil and of protein products of sunflower seeds.

It may be concluded from the reports that the quality of oil may be improved by eliminating undesirable lipide-type substances from the oil obtained according to the traditional technology, such as products of fatty acid oxidation, waxes and some phospholipides, and polycyclic aromatic carbohydrates.

Some interesting considerations were made on the temperature optimum during the humid-heat processing, which guarantees an oil stable in storage. Wax elimination from sunflower oil is a necessary operation for obtaining transparent oils. It has become especially important as a re-

sult of breeding for high oil content as wax content skyrocketed in the husk. Wax elimination without filtering was of special interest in this respect.

It was shown that by varying the condition of humid-aim-heat treatment of crushed sunflower seeds it is possible to increase the output of phospholipides during the hydration of oil. The problem of obtaining sunflower oil without benz-a-pyrene was also reported in some communication. One of the main ways to reach this goal is to eliminate seeds with products of incomplete combustion when drying the seed, and to utilize gaseous fuels for this purpose. This is also interesting for processing the seeds of other oil-bearing crops. Of special interest is research into rational methods of refining sunflower oil to assure the maximum utilization of its useful components.

New data were reported to the section on the improvement of the edible value of the products of sunflower oil processing - particularly margarine - by modifying and re-etherifying sunflower oil.

The second group of communications dealt with the problem of improving the quality of protein products obtained from sunflower seeds after a full or partial extraction of oil.

In this respect it is of interest to note the communication on the method of extracting chlorogenic acid and oligosaccharides from sunflower meal by means of non-denaturated extracting agents.

Research into the origination and decay of protein-lipide complexes in sunflower seeds at heat drying and subsequent storage has a considerable theoretical and practical importance. The relevant studies enable to develop notions on the phase change in the acid value of oil going through heat drying, and make it possible to explain the so-called delay time of seeds and determine this period depending on the intensity of seed processing.

The successful solution of the problem of utilizing all sunflower components, first of all oil and edible protein, necessitates a radical improvement of traditional technology and a search for new technological approaches. Direct extraction of sunflower oil undoubtedly assures an improvement of oil and protein quality but it also requires the solution of many technological and machinery problems, first of all intensified defatting of the practically structureless high oil material.

The reports to the section demonstrate a high scientific level of R and D in sunflower physiology and biochemistry and in processing technology, and are also a proof of the urgent need for studies aimed at a deeper knowledge of the inner laws of the life of sunflower plant in order to obtain higher seed yields, master the processes of formation of high quality of seeds, improve the methods of processing, and comprehensively utilize the biological yield of sunflower.

The studies reported by scientists from different countries are also interesting for sunflower breeders.

The free discussion at the section enabled scientists working in the field of physiology, biochemistry and technology to exchange constructive ideas and will undoubtedly be an incentive for further fruitful research.