A.D. Gumenyuk,
M. S. Sytnik, USSR

BREEDING SUNFLOWER FOR HIGH YIELD AND OIL CONTENT

The breeding work conducted at the V.Y. V.Y. Yuriev Ukrainian Institute of Plant-Growing, Breeding and Genetics (Kharkov) is based on Academician V.S. Pustovoit's method of selection of initial plants from the best varieties-populations with individual evaluation of progeny and the subsequent directed cross-pollination of the best families under conditions of free pollination of plants on isolated plots.

The employment of this method allowed the breeders at the institute to develop a number of high yielding early and middle season varieties-populations containing at least 52-57% of oil in absolutely dry seeds.

Recent five years were particularly fruitful for the breeders. In the forest-steppe zone of the Kharkov region a new high oil sunflower variety Kharkovsky 100 was commercialized; it overyields the check variety VNIIMK 6540 Improved in fat content in seeds by 1.5-2.5% and in oil yield per hectare by 60-80 kg.

In 1975 a new high oil and high yielding variety Kharkovsky 101 was screened from a group of middle season varieties. Under dry conditions of 1975 in central and South-East localities of the Ukraina this variety overyielded commercial varieties by 1-2 c/ha of seeds, by 70-180 kg/ha of oil and by 1-4% of oil content of seeds. According to some variety trials in the Poltava, Donetsk, Nikolayev, Crimea and other regions the Kharkovsky 101 variety has up to 57-59% of oil.

Along with the development of middle season varieties, the institute has recently stepped up breeding early sunflower varieties combining high yield and oil content. In our opinion, in the northern and central zones of the Ukraine,

early sunflower varieties should be cultivated along with middle season varieties, the former maturing 5-7 days earlier than the latter. This would allow sunflower harvesting in more favourable periods of time, would reduce seed losses and improve their quality.

To meet the needs of the economy we have developed an early variety Kharkovsky 50 maturing 4-6 days earlier than commercial sunflower varieties grown in the Ukraine. This variety has the oil content of 51-56%.

In 1973 Kharkovsky 50 was submitted for State Variety Trials; on variety trial plots in Dniepropetrovsk, Nikolayev, Donetsk and other regions of the Ukraine it showed 56-58% of oil content. The Ukrainian State Variety Inspection judged the Kharkovsky 50 variety to be suitable for certain regions of the Ukrainian Republic. Some new prospective early and middle season sunflower varieties have been developed at the Institute. Their main agronomic features are better than those of the check VNIIMK 6540 Improved, which can be seen from the results of competitive varietal trials (Table 1).

Early stages of breeding work showed high yielding sunflower entries with high oil content (Tables 2 and 3).

At present a number of elite plants have been screened having the oil content of 60-61% in the seeds (kernels) and 72-73% in the whole seeds. Such oil content level, as Academician V.S. Pustovoit stated, is close to the biological limit; it is possible that further breeding for this trait will be gradually reduced.

At the Institute we conduct research on interspecific hybridization between different perennial and annual Helianthus species and cultivated sunflower. In the progenies of F_{4-12} of interspecific hybrids certain plants of cultivated type have been been showing resistance to broomrape (Orobanche cumana Wallr.) and

Table 1

Results of Competitive Varietal Trials of the Best Sunflower Varieties at the Institute

(Kharkov, 1975)

Variety	Seed yield, c/ha	Oil yield, kg/ha	Oil content, %	Vegetation period, days
Kharkovsky 226	30.2	1470	55.3	93
Kharkovsky 224	28.9	1404	55.2	94
Kharkovsky 229	28.4	1392	55.7	93
Kharkovsky 231	28.7	1384	55.4	91
Kharkovsky 230	28.6	1399	55.0	91
VNIIMK 6540 Improved (check)	28.2	1271	51.2	94

Table 2

The Best Entries of the Nursery of the Second Year of Evaluation (Mean for 1974-1975)

Varieties, entries	Seed yield, c/ha	Seed oil content, %		Length of vegetation period, days
		kernel	seed	
VNIIMK 6540, check	29.8	63.8	51.7	101
≠ 580	35.1	66.0	55.0	99
VNIIMK 6540, check	26.2	63.6	51.1	101
≠ 7448	33.8	66.8	55.1	101
VNIIMK 6540, check	26.5	63.1	50.8	102
≠ 7487	32.5	66.2	54.4	102
VNIIMK, check	27.1	63.7	51.2	101
≠ 7655	30.5	67.0	55.4	97

Table 3

The Best Entries of the Nursery of the First Year of Evaluation (1975)

Varities, entries	Seed yield, c/ha	Seed oil content, %		Length of vegetation period, days
		kernel	seed	
Kharkovsky 100, check	27.5	65.3	52.7	93
≠ 7716	32.8	68.7	58.2	93
Kharkovsky 100, check	28.8	65.1	53.0	93
≠ 7720	31.7	67.9	57.0	93
Kharkovsky 100, check	28.4	66.4	54.2	94
≠ 7783	31.2	68.6	58.0	91
Kharkovsky 100, check	27.5	65.3	53.2	93
≠ 7769	29.7	68.4	57.3	93
Kharkovsky 100, check	28.4	67.3	54.0	94
≠ 7788	29.4	69.1	58.1	93

sclerotinia (Sclerotinia libertiana Fuck.) under artificial and natural infestation. Of particular interest are combinations 561 and 563 of interspecific hybrids (Peredovik x H. scaberimus) which overyield the check variety VNIIMK 6540 Improved by 2-3 c/ha of seed yield and show 100% resistance to broomrape and sclerotinia. But the oil content of these hybrids is 3-4% lower than that of the check.

At present research is conducted to ameliorate qualitative traits of these hybrids.