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PECULIARITIES OF PHOSPHOROUS METABOLISM IN HIGHLY OIL-BEARING SUNFLOWER SEEDS IN THE PROCESS OF DEVELOPMENT

The phosphorus metabolism in sunflower seeds was studied by the method of spotted atoms (32p) on two varieties: highly oil-bearing, productive Peredovik and low oil-bearing, low productive Kruglik A-41. Phosphorus metabolism was studied in the ovaries in the first two days after pollination, in seeds and seed shells in the process of their growth and development. The regularities governing fat and protein accumulation in the seeds of these varieties were also studied.

The investigations have shown (Table 1) that radioactive phosphorus begins to penetrate sunflower seeds in the early stages of ovary formation. In the first two days it most intensively penetrates the acid-soluble fraction, nucleic acids and the phospholipides. The level of accumulation of nucleic acids and phospholipides at the end of the period is higher in the ovaries of the high-yielding variety than in those of the low-yielding one. Conversely, the Peredovik variety has a smaller fraction of acid-soluble compounds, probably because more mineral phosphorus of this fraction was used to synthesise nucleic acids and phospholipides.

The data obtained suggest that phosphorus metabolism is more intensive in the ovaries of high-yielding varieties.

Fat and protein accumulation also begins at an early period of the seeds' development. At all stages of development Peredovik has more fat and protein than Kruglik A-41, the weight of 1.000 seeds being also higher. Consequently,

Table 1

Radioactivity of Fractions of Phosphorus Compounds in Sunflower Seeds During Their Initial Development (imp/min per 100 ovaries)

Variety	Fraction			
	acid-soluble	lipide	nucleic acids	protein
	6 hours after pollination			
Peredovik	1.750±30	1.640±20	2.210±60	290±20
Kruglik A-41	2.450±50	1.100±20	1.840±30	270±8
NSP 0.90	650.0	250.0	510.0	
	24 hour after pollination			
Peredovik	1.990±40	2.630±30	3.590±10	420±60
Kruglik A-41	2.290±50	2.110±20	3.130± 0	370±20
NSP 0.90	490.0	340.0	270.0	
	48 hours after pollination			
Peredovik	2.460±5	3.130±10	3.350±20	310±5
Kruglik A-41	2.940±20	2.500±30	2.940±10	260±10
NSP 0.90	127.0	107.0	216.0	

a higher level of accumulation of nucleic acids and phospholipides and a high content of other phosphoric compounds in the ovaries of highly oil-yielding varieties during the early period of their development go hand in hand with a higher level of fat and protein in the seeds during their maturation.

It was found that in the first five days of achenes' development phosphorus metabolism is more intensive in the seed hull. Phosphorus actively penetrated the acid-soluble fraction and lipide and nucleic acids.

The total radioactivity of phosphoric compounds in that period is twice as much in the seed hull as in seeds or nuclei themselves. In addition, the accumulation level of nucleic acids and phospholipides is 50% more in the hull of the high-yielding variety than in that of the low-yielding one. The radioactivity of these fractions is 5.000 imp/min each in the former variety and 3.000 imp/min in the latter.

The content of phosphoric compounds begins to decrease after five days of development and continues decreasing up to the stage of full maturity. These compounds accumulate and then decrease quicker in Peredovik than in Kruglik A-41.

Phosphorus metabolism is more intensive in the seed hull of the highly oil-yielding variety, thus promoting its rapid formation.

In five-day seeds (Table 2) phosphorus must actively penetrates the acid-soluble fraction. Hence it follows that in the early period phosphorus metabolism is to a greater extent connected with the synthesis of microorganic phosphoric compounds.

Between five and 14 days nucleic acids and phospholipides intensively accumulate, reaching the maximum by the end of that period. This maximum coincides with the start of the intensive accumulation of fat and protein, which points to an important role played by the

Table 2

Radioactivity of Separate Fractions of Phosphoric Compounds in Sunflower Seeds in the Process of Their Development (imp/min per 100 units)

Variety	Fraction			
	acid-soluble	lipide	nucleic acids	protein
Peredovik	3.840±120	670±30	2.030±40	170±6
Kruglik A-41	3.770±70	760±10	1.780±40	120±20
	14 days after fertilisation			
Peredovik	51.080±450	6.000±130	10,730±110	1. 480±110
Kruglik A-41	38.080±490	4.110±250	8,160±150	860±20
	21 days after fertilisation			
Peredovik	116.460±210	4.060±330	6.260±440	240±20
Kruglik A-41	81.380±210	4.230±360	8.850±390	428±20
	30 days after fertilisation			
Peredovik	121.400±330	6.590±720	6.650±0	830±20
Kruglik A-41	114.260±240	4.380±30	4.960±610	830±20

fractions in fat and protein build-up. The all-out increase in the nucleic acids' fractions coincides with the period of the intensive division of the cells of the seeds' fetus in the first two weeks of its growth and development.

In the high oil-yielding variety the level of accumulation of the phosphoric compounds' fractions at the age of 14 days is almost 50% higher than in the low-yielding one. In the subsequent period (from 14 to 21 days) the quantity of nucleic acids and phospholipides in the high-yielding variety diminishes and that in the low-yielding variety remains at the same level, decreasing only after the 21st day of development. By the end of the maturation period the content of these fractions becomes constant.

The acid-soluble fraction increases to the end of maturation through an intensive accumulation of phytin, the reserve form of phosphoric compounds. Already on the 14th day the accumulation level of this fraction is higher in Peredovik than in Kruglik A-41.

It follows from the data adduced that phosphorus metabolism in the seeds of highly oil-yielding sunflower is more intensive from the early stages to the end of the maturation period. Differences existing between high- and low-yielding varieties in the intensity of phosphorus metabolism in their seeds, especially those in the scale and scope of accumulating nucleic acids and phospholipides, coupled with a high level of other phosphorus compounds, to some extent predetermine the hereditary differences in fat and protein accumulation in their seeds and in their productivity.