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SPECIFIED METHODS TO DEFINE THE GERMINATING POWER OF SUNFLOWER SEEDS

In the Soviet Union the quality of seeds sown in the field is controlled by the state seed inspections. Farms are forbidden to sow non-certified seeds. We upgrade the demands made by state standards on the sowing qualities and methods of defining them, and select the seeds for sowing, which are able to give normal sprouts in the field. State standards are revised every five years so as to improve them.

In the case of oil-bearing crops the All-Union Research Institute of Oil Crops improves the methods of their assessment and drafts relevant standards.

USSR state standards geared to the determination of germinative power, and the international rules of seed testing, give definitions of normally and abnormally germinating seeds, which are uniform for all crops. International rules even consider damaged seedlings as a normal case, unless their conducting tissue is broken. When he conducts massive analysis a researcher is hard put to find his bearings in evaluating seedlings if he takes the existing prescriptions as his guide. A study was therefore made of abnormally germinating seeds that occur in the sowing material, and their morphological description was given (see Fig.).

The normally germinating seeds have a fast growing hypocotyl and its hale juncture with cotyledons which under germination are disengaged from the hull and pericarp. We regard as abnormal the seedlings with a damaged main root and which do not produce well-developed branch roots.

Seeds under thermal effect (self-heating, overdrying) can give seedlings with a hypocotyl that is thickened or divided into segments. The

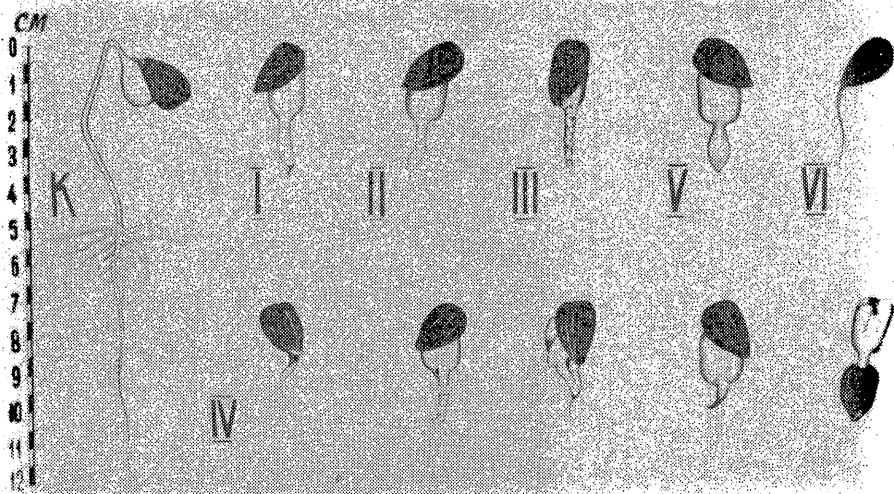


Fig. 1. Categories of five-day shoots of sunflower seeds

degree of deformation depends on the seed's biological viability and the amount of temperature impact. Abnormal germination is also observed in the case of preliminarily germinating and then dried-up seeds or those infected and exposed to the dressers' toxic effect.

Experiments in the field verified economic value of the abnormally germinating seeds of different categories. It has been found that 1.5 to 2.2 times less sprouts appear from seedlings with a rotten or undeveloped root (Categories I and II) than from normal sprouts, while their period of emergence was longer (Table 1).

Seedlings of other categories yielded individual weak sprouts in the field or did not germinate at all. Many of the germinated plants died without even unfolding the first pair of normal leaves.

Plants that grew from the abnormally germinated seeds of the first and second categories developed slowly and lagged behind check plants in their growth during the whole of vegetation. When they grew in one hill with check plants their productivity was less by 35 to 50% (Table 2).

Since the abnormally germinating seeds do not produce full sprouts in the field while the sprouts have lower productivity the methods of laboratory assessment of the seedlings were specified.

The 12038-66 state standard said: fruitful sunflower seeds are seeds that produced one well-developed root on the day when the germinative power was measured (third and fifth days); the size of the root together with the hypocotyl should not be less than the length of the seed.

The seedlings that lag behind in their growth and deviate from the normal development should be included among unfruitful seeds.

The laboratory assessment of germination depends not only on the objective evaluation of the seedlings but also on the time when

the germinated seeds have been registered. The early standard methods of determining germination recommended registering germinated sunflower seeds in seven days. It was found in the course of studies of germination dynamics that the seeds of modern varieties that in addition went through an after-harvest ripening germinate very evenly (Table 3).

Table 1

Appearance of Sprouts and the
Development of Plants from Seedlings
(average for 1968, 1970)

| Category of abnormal seedlings | Germinating plants, % | Germination rate | | Height, cm | |
|--------------------------------|-----------------------|------------------|---------|------------------|------------------|
| | | days | act. t | before flowering | during flowering |
| Check | 86 | 5 | - | 41 | 131 |
| I | 56 | 7 | 2.3-2.8 | 31 | 110 |
| II | 37 | 10 | 4.7-8.2 | 24 | 86 |
| | | t 0.95=2.1 | | | |

Table 2
Productivity of Sunflower Developing
from Abnormally Germinating
Seeds

Average for 1969-70

| Category of abnormal seedlings | Yield, g/plant | % of check | Actual t. |
|--------------------------------|----------------|------------|-----------|
| Check | 56 | - | - |
| I | 36 | 65 | 3.2 |
| II | 28 | 50 | 6.9 |
| | t 0.95=2.1 | | |

Table 3
Dynamics of Seed Germination

| Germination, %, not less than | Number of samples | Average % of germinating seeds in . . . days | | | | Seeds germinating in two days, % of all seedlings |
|-------------------------------|-------------------|--|----|----|----|---|
| | | 2 | 3 | 5 | 7 | |
| 96 | 71 | 89 | 98 | 98 | 98 | 90.8 |
| 94 | 14 | 81 | 94 | 95 | 95 | 85.3 |
| 90 | 33 | 77 | 90 | 91 | 91 | 84.6 |
| Less than 90 | 33 | 63 | 77 | 81 | 82 | 76.8 |

The bulk of fruitful sunflower seeds germinate in two days, while the germination of low-fruitful seeds drastically decreases. In the seed stock with over 90% of germination 85-91% of fruitful seeds germinate in two days,

and when germination is less than 90% only 77% of seeds germinate. The germinative power is determined in three days. The higher is this index and the closer it is to that of germination on the fifth and seventh days the better quality the sowing material has.

Experiments proved that sowing seeds with a high germinating power guarantees full and even sprouts and extra yield of 1 to 3.5 c/ha, as compared to seeds with a low germinating power but almost the same germination.

A shorter period for measuring germination (on the fifth day rather than on the seventh) brings conditions for selecting seed stocks according to this index closer together. When the periods of germination are longer the low viable seedlings which increase the laboratory determination of germination are also taken into account.

It is possible to use shortened periods for defining the germination of seeds that went through the period of after-harvest ripening, which is corroborated by the existence of a strong correlation between germination and the number of seeds that germinated in three days (0.976-0.977) and in five days (0.984-1000).

At the VNIIMK's instance, the USSR state standards have incorporated a shortened period for determining germination and included pictures of abnormal seedlings. This made it possible to establish in the sowing stock the percentage of quality seeds capable of normal germination and of developing into highly productive plants in field conditions, and not merely into sprouts. Plants obtained from such sprouts prove to be low-yielding.

The application of specified methods of determining seeds' germination in the seeds control practices will help further increase sunflower yields in the country.