

DEVELOPMENT OF THE PHENOTYPING SYSTEM OF SUNFLOWER SEEDS FOR SELECTION

Phenotyping is a digital determination of an object phenotype. The object of our research was sunflower seeds. Phenotyping includes obtaining reliable information on the size and color of seeds. The development is intended for selective breeding of individual samples or plants. Special techniques have been developed to describe the phenotype of seeds. The state method of Ukraine is called "Methodology for determining homogeneity and stability (VOS)". The European method is called: "INTERNATIONAL UNION FOR THE PROTECTION OF NEW VARIETIES OF PLANTS (UPOV)". The European method has one gradation more. The physical dimensions of the seeds hesitate from 5 to 25 mm in length and from 3 to 7 mm in width.

The thickness of the seed is less than the width. In the description documents, there are four gradations of seed shape. The color of sunflower seeds is described using 4 or five signs with gradations. In cultivated sunflower, which is used for breeding, the general color of the seeds is quite dark, even with stripes.

The inheritance of coloration of different layers of seed fertilization was studied at the Institute of Oil Crops of the National Academy of Sciences of Ukraine. As a result, a collection was created, which is divided into 12 groups by color. Breeders need to evaluate individual seeds and individual plants by size and color and make these analyzes more accurate. Our task is to create a fully automated algorithm and program for collecting a seed database with a description of its size and color.

As a research material, a part of the automatic phenotyping device of seeds developed at the IOC of the National Academy of Sciences of the Russian Academy of Sciences by Aliev E. B. was used, namely a device for photographing seeds. The device is connected to a laptop and transmits information directly. Sunflower seeds from the collection of the Institute of Oil Crops also served as research material.

As a result of the work, a program was developed for the analysis of the seed image, which will be able to create a database of sizes based on the color of the seed. A photographic image of the seed from a stationary device is used. Information is transferred in the form of a table that can be pro-

cessed in the Excel program. Measurement of sizes and configuration is performed using software developed in the Python environment.

Program algorithm. We load a seed photo file into the program input using the directory = 'images' function. We turn the photo into a matrix of ones and zeros. According to the program code, we make the matrix square so that the number of rows is equal to the number of columns. We create an array in which we will store the sum of units of diagonals parallel to the main one. Similarly for the auxiliary diagonal. We carry out a consistent comparison of the amount received from the assembly of the mattress with the subsequent one. As a result, we are going to get the maximum value of the diagonal. The obtained maximum among diagonals is the parameters of the length and width of the seed. The thickness is measured by the second photo, in which the seed is on the rib. This is how data is processed for one seed or for counting the number of pixels of the pattern. We can use it to convert dimensions from the number of pixels to metric dimensions, such as millimeters.

The next step of work was to determine the color of the seeds. To do this, we add the function of to determine colors and output their general table in Excel format to the program. The result of the work is a table that can be opened in the Excel program.