

# Determining cooking time of individual bean seeds by the apparatus AID-1

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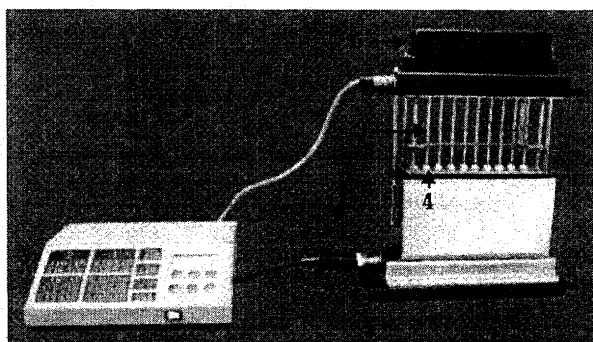
There are two groups of methods for determining the cooking time of bean seeds: methods for cooking of a sample of certain weight and methods for cooking of a sample containing a certain number of seeds. The most suitable method for determining the cooking homogeneity of seeds is cooking a sample with a certain number of seeds by using the apparatus AID-1 (Fig.1), constructed in AID - General Toshevo (Genchev, 1999). AID-1 allows to determine the cooking time of each individual seed, the results being registered and stored electronically. There is an option to store the cooking time of 200 samples, each of 10 seeds. Two mechanical blocks can be attached to a single electronic part. The cooking time is determined on the basis of the consistency corresponding to the cooked seeds. Ten seeds are simultaneously supplied. The cooking time is registered at any desirable temperature within the range from 30 to 98 ° C. The temperature is controlled by a thermoregulation mechanism. The precision of the equipment is 1 minute.

Table 1 presents the cooking time of 50 seeds from the dry bean varieties most common in Bulgaria - Abritus, Dobroudjanski 7 and Dobroudjanka 2. The determination of the cooking time of each seed allows successful selection of new dry bean varieties with more homogeneously cooking seeds. Furthermore, this gives the possibility to carry out statistical analyses that would aid the breeder in making more properly a breeding strategy and characterizing more completely a given variety.

Table 2 gives the P-values at which the zero hypothesis is rejected among the individual variants. In variants I, II, III, IV and V 10 seeds are used, and in variant VI - 50 seeds.

Table 3 shows the number of seeds of which the cooking time is to be determined ( $P=0.99$ ) in order the zero hypothesis not to be rejected in comparing the results in a given pair of variants.

When determining the cooking time of a given variety, it is necessary to initially register the cooking time of two samples, each of 10 seeds. If the zero hypothesis is not rejected at the respective degree of significance, the mean value, the standard error and the mean interval of variation are calculated. In case the zero hypothesis is rejected, the number of seeds, of which the cooking time is to be determined at a desirable degree of significance, is calculated.



**Figure 1.** Apparatus for determining the cooking time of bean seeds AID-1; 1 - mechanical part; 2- electronic part; 3 - needle mechanism; 4 - seed; 5 - sensor mechanism.

**Table 1:** Cooking time of individual seeds of the varieties Abritus, Dobroudjanski 7 and Dobroudjanka 2 at 98 C.

Variety	Cooking time of individual seeds (min)	Mean standart error (min)	Interval from to (min)
Abritus	75,74,90,83,83,81,85,91,109,86,64,81,94,94,82,84,121,69,99,70,80,86,94,78,90,91,87,76,67,90,76,97,66,91,105,92,69,63,64,80,76,87,80,76,90,61,82,87,64,105	83.3±1.8	61-121
Dobroudjanski 7	107,88,76,92,104,100,97,117,94,105,92,169,87,90,121,89,84,87,74,78,122,71,99,132,116,121,112,122,126,131,129,122,122,123,124,135,118,108,123,140,110,119,128,106,127,98,101,102,116	109.7±2.7	71-169
Dobroudjanka 2	96,95,106,105,89,92,92,100,112,118,132,132,95,92,130,97,128,122,167,167,103,120,118,106,104,88,119,108,91,106,110,116,106,101,108,92,113,110,123,130,107,125,113,105,117,101,102,111,99,127	110.0±2.4	89-167

**Table 2:** P-values of rejection/confirmation of the zero hypothesis for cv. Abritus

Variant*	II*	III	IV	V	VI
I	>0.997	0.977	0.711	0.702	0.866
II		>0.997	0.806	0.820	0.976
III			0.871	0.425	>0.997
IV				>0.997	0.941
V					0.923

\*In variants I, II, III, IV and V 10 seeds were used, and in variant VI - 50 seeds.

**Table 3:** Number of seeds from cv. Abritus of which the cooking time is to be determined at standart error 5 min, P = 0.99.

Variant*	II*	III	IV	V	VI
I	77	26	61	43	42
II		77	77	77	77
III			61	43	42
IV				61	42
V					42

\* In variants I, II, III, IV and V 10 seeds were used, and in variant VI - 50 seeds.

## References

Genchev, D. 1999. Cooking time determination of dry bean seeds (*Phaseolus vulgaris* L.). BIC 42:129-130.