LOSSES AT MECHANIZED HARVESTING OF BULGARIAN PEANUT VARIETIES

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Abstract

An experiment was conducted to determine the share of fruit losses in mechanized harvesting of the established Bulgarian varieties of peanuts called Kalina, Kremena and Tsvetelina. The results show that total fruit losses range from 9.7% for Tsvetelina to 30.6% for Kremena. The fruit losses at digging the plants were 10.8% for Kalina, 6.3% for Kremena, and 12.6% for Tsvetelina. The losses at picking the plants up were 18% and 15.6% for Kalina and Kremena respectively, while for Tsvetelina they decreased to 3.4%. In order to reduce losses from mechanized picking of peanuts, selection of varieties with increased strength of gynophores is recommended.

Key words: peanuts, loss, mechanized harvesting.

INTRODUCTION

Peanuts are not a major culture for Bulgaria, but they have significant economic potential (Bencheva, 2002). Until recently, they were grown mainly in small-scale farms with lack of mechanization and much manual labor mainly for harvesting the crop (Bencheva et al., 1997; Georgiev et al., 2011). Recently, many farmers are moving to growing peanuts over large areas and introducing mechanization to carry out all technological operations (Bencheva et al., 2008). The results show that Bulgarian peanut varieties scatter some of their fruits into the soil or on its surface at mechanized harvesting. These losses are a significant problem because they require subsequent manual harvesting of the scattered fruits (Ince and Guzel, 2003).

Peanuts require two-phase harvesting technology. The first phase involves digging the roots, separating soil from plants and placing them on the surface. The second phase is carried out after drying the plants and consists in picking them and threshing the fruits. During both phases, the fruits and their gynophores are subjected to dynamic tensile or shock loads, therefore some of them are torn off and scattered on the soil (Georgiev et al., 2011).

The purpose of the study is to determine the share of fruit losses of approved by the practice Bulgarian peanut varieties in the two phases of their mechanized harvesting.

MATERIALS AND METHODS

The losses from mechanized harvesting of approved Bulgarian varieties of peanuts Kalina, Kremena and Tsvetelina were analyzed.
They are selected at the Institute of Plant Genetic Resources - Sadovo - Bulgaria (Georgiev, 1992).
The Kalina variety was recognized and entered in the variety list of Bulgaria in 1992, Kremena in 2003, and Tsvetelina in 2008.
A three row digger KSM 4-36-38 was used to root up the plants and lay them on the soil surface. After reaching 12% humidity, the plants were picked and threshed with peanut harvester Lilystone 1518.
Determination of losses was performed using an existing method (Afshin et al., 2014), which is ased on measurements from one square meter and on the following formulas:

$$A = B + C \qquad (1)$$

where:
A is the commercial yield per a square meter, *kg*;
B - the mass of fruits remaining on the plants, *kg*;

C - the mass of the fruit left in the soil and scattered on the surface after two phases of plants harvesting, *kg*.

Losses of fruit in the soil or on the soil surface (Photo 1) after digging were determined as a share of the commercial yield:

$$D = 100\frac{C}{A} \qquad (2)$$

where D are the losses from the plant digging, %;

Fruit losses from their mechanized picking up were calculated by the formula:

$$E = 100\frac{F}{A} \qquad (3)$$

where:
E losses of stem picking,%;
F is the mass of the fruits over the soil surface, kg.
Measurements were made in four replications.

Photo 1. Fruit scattered on the soil surface after the first phase of the peanut harvesting

RESULTS AND DISCUSSIONS

The results obtained (Table 1) show that during the first phase of mechanized harvesting, the most peanut fruit is lost by the Kremena variety - 12.6%, followed by the Kalina variety - 10.8% and the Tsvetelina variety - 6.3%. The first harvesting phase accounts 41.2% of the total losses in the Kremena variety. For Tsvetelina they are 64.9% and for Kalina they are 40.9% (Figure 1). The losses from mechanized selection of the Tsvetelina variety are 3.4% or 35.1% of the total losses. For the Kremena variety the losses were 18.0% or 58.8% of the total and for Kalina they were 15.6% or 59.0% of the total losses. As an absolute value, the total losses of the Kremena variety are the largest and reach 30.6%. For Kalina they are 26.4% and for Tsvetelina - 9.7%.

Table 1. Fruit loss in mechanized harvesting of Bulgarian peanut varieties, %

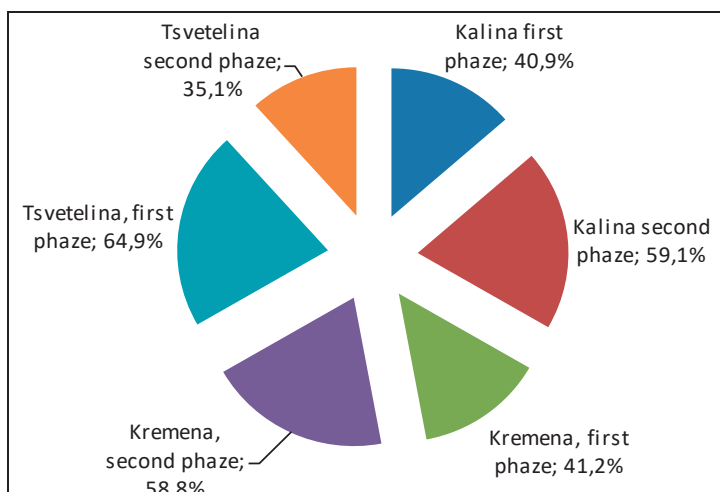| Variety	Loss of fruit at first phase	Loss of fruit at second phase	Total losses
Kalina	10.8	15.6	26.4
Kremena	12.6	18.0	30.6
Tsvetelina	6.3	3.4	9.7

Figure 1. Proportion of fruit losses during the two harvesting phases

The results obtained are similar to studies by other authors from abroad, although they have used other harvesters and there are differences in soil and climatic conditions of investigations.

Losses from 5.3 to 35.2% are reported in the US (Beasley, 1970) and from 3.1 to 47.1% in Brazil (Santos et al., 2013).

The losses in manual and mechanized picking of peanuts are compared (Afshin et al., 2014). Manual harvesting causes losses of 3.5% and mechanized of 20.2%.

It has been determined that large losses in mechanized harvesting increase the price of production due to the re-harvesting of the scattered fruits, which is conducted manually. In all the studies mentioned above is reported that the losses of fruit is mainly due to the low strength of the peanut gynophores.

The need for selection of varieties with gynophores that are more resistant to dynamic impacts is emphasized (Zerbado et al., 2017).

CONCLUSIONS

The losses from the scattering of fruits at mechanized harvesting of peanuts from established Bulgarian varieties range from 9.7% to 30.6%.

The old Kalina and Kremena varieties cause the most losses and are therefore not recommended for mechanized harvesting, but the Tsvetelina variety allows mechanized

harvesting with acceptable losses. The results obtained are close to those of other authors from abroad, despite differences in soil and climatic conditions and harvesters used. Therefore, selection of varieties with increased strength of gynophores is recommended in order to reduce the losses from mechanized harvesting of peanuts.

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