HARVESTING TIME AND STRENGTH FEATURES OF RAPESEED

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ABSTRACT

The investigations were made in order to check strength features of rape in various maturity stages. Maturity range was chosen according to optimal harvest time, from early a few days before optimal harvest date till late a few days after optimal date. Investigations were made within eleven succeeded days. Simple compression test of single seeds were performed between parallel plates. Rupture force, deformation and work were measured. Apparent modulus of elasticity was calculated from linear part of compression curve according to Hertz theory.

INTRODUCTION

Maturity of rape plays very important part in harvesting as well as in oil production. Green seed contains less oil and it moisture content is too high and must be removed by more intensive or longer drying, however keeping plants too long in the field can lead to big quantity losses. Ripe and green rapeseed can have also different strength features, what would be very important in arising damage during harvesting and during postharvest operation. The goal of the present study was to check mechanical strength of rapeseed harvested day after day, beginning with very early harvesting time, through early, optimal, late and very late.

MATERIAL AND METHOD

Investigations were made in 1994. Seed of Bolko variety came from the field experiment of the Institute of Agrophysics. Seed were harvested everyday beginning from July 17th. till July 27th (eleven days). This range was chosen according to optimal harvest time, which was determined from moisture content of seeds and pods as well as from general state of field. Optimal harvest date was July 22th., so felt in the middle of the investigation period. Seeds were harvested, threshed and cleaned by hands in order to avoid preliminary cracks. Wet seeds were exposed at the open air till they achieve air-dry moisture. The samples prepared in the way mentioned above were tested on Instron testing machine in order to check their mechanical resistance to the external loads.

Quasi-static compression test was performed on single seeds. Compression curve was recorded on computer. Specially elaborated programm determined rupture point (force and deformation), calculated rupture work and apparent modulus of elasticity from the initial, straight part of the curve. Calculation was made according to the formula:

$$E=\frac{1.061(1-\mu^2)}{\pi}\sqrt{\frac{K^3}{R}}\sqrt{\frac{(\Delta F)^2}{(\Delta d)^3}} \qquad (1)$$

where:
μ - Poisson's ratio
K - constant
R - radius of seed curvature
ΔF - force in the linear part of compression curve
$a\Delta d$ - deformation of the seed
Poisson's ratio was assumed as 0.4 and constant K as equal 1.3514.

Every combination (harvest day) consisted of 30 replications (seeds), so as 330 seeds were compressed. Analysis of variance was made in order to evaluate confidence intervals and significance of differences between investigated strength parameters.

RESULTS

The rapture deformation and force were correlated (Fig.1 a, b). The decrease of both parameters was noticed on sixth day of investigation and the differences were statistically significant. Similarly on ninth day both parameters increased and on eleventh once more decreased.

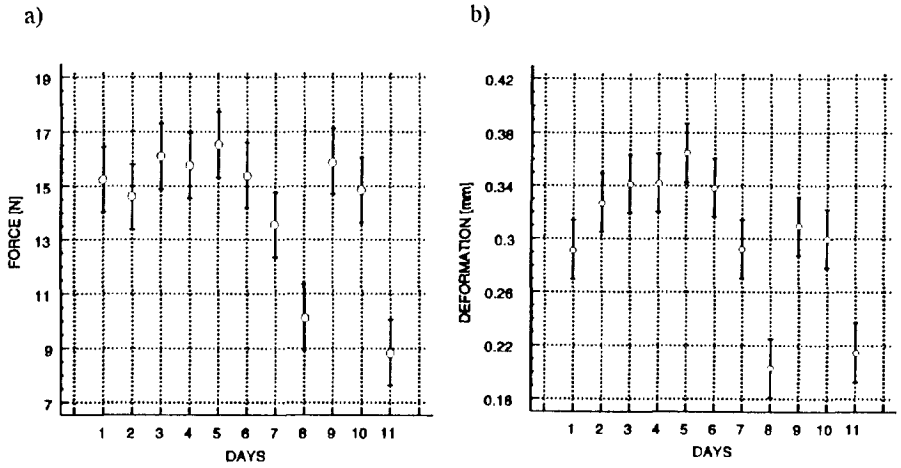

Fig.1. Mean values with confidence intervals of rupture force (a) and deformation (b) of rapeseed harvested in succeeded days of investigations

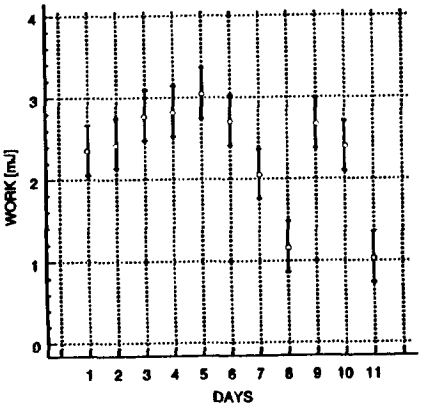

Fig.2. Means with confidence intervals of work till rupture of rapeseed harvested in succeeded days

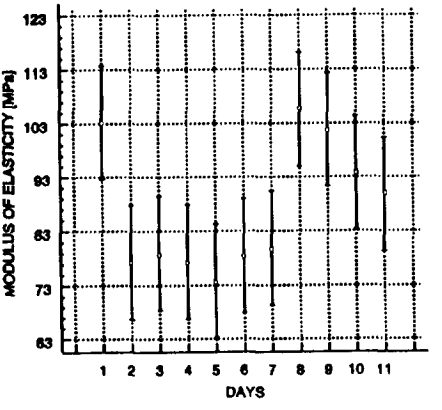

Fig.3. Means with confidence intervals of apparent modulus of elasticity of rapeseed harvested in succeeded days

The rupture work behaved similarly, what can be seen on Fig. 2. At the beginning the differences were insignificant till seventh day, when the decrease was noticed and on ninth day rupture work increased. On eleven day this parameter once more decreased.

Fig 3. shows values of apparent modulus of elasticity for each succeeded day. Higher value of this parameter was observed at the first day of investigation and then modulus of elasticity significantly decreased and stayed at the same level till the eighth day. That day apparent modulus of elasticity significantly increased and then had been slightly decreasing (insignificant changes).

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REFERENCES

Davidson E., Middendorf F.J., Bilanski W.K.: Mechanical properties of rapeseed. *Can. Agric. Eng.*, 17, 50-54, 1975.

Kustermann M.F., Kutzbach H.-D.: Young's modulus dependent on deformation velocity. ASAE Paper No. 82-3055, 1982.