MECHANICAL PROPERTIES OF PEANUT VARIETIES

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INTRODUCTION

On the efforts for rationalizing the production of peanuts in Spain, one of the objectives was to obtain a well adapted variety, suitable for mechanization. We tried to get information on the characteristics that would condition the suitability of a variety to mechanized production, principally mechanical harvesting. All the characters studied would then be taken into account in a breeding program.

MATERIALS AND METHODS

The eight following varieties were tested, which represent a wide range of types: Argentine, Palma (Spanish); Cacahua (Valencia); Bunch G-2, NC-2, GA-119-20, V. Jumbo, Moruno (Virginia). As can be seen, some of these varieties are from American origin, and some are local varieties from Spain. For the measurements of detachment force, manual dynamometers of 500, 1000 and 2000 g were used: the maximum force at the detachment of the pod from — its union with the peduncle or peg was determined in the tests. The plants were smoothly dug, left on the ground for drying 24 h and tested in the field. Four pods of each plant were always measured, in whole maturity and without any damage. Compression testing of the pods was made with a universal testing machine * with a disc of 5 cm in diameter; operating velocity was 1 mm/s for compression of the pods in two positions: carpelar suture parallel to the compression planes, and suture perpendicular to them. Maximum force at rupture or failure was determined.

A laboratory picking device was constructed (Fig. 1). It consisted basically of three cylinders with elastic fingers and its corresponding concaves, in line, that can be made independent by adjustable metal plates, so that it is possible to work with one, two or three cylinders,

* LTCM Chatillon Universal Stand.

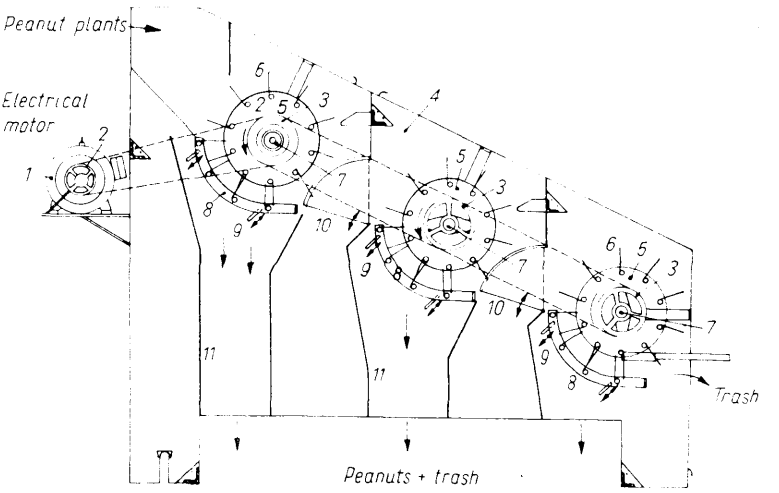

Fig. 1. Stationary mechanical picker, for laboratory tests

and also recover separately the three fractions of the product. The tests with this machine consisted basically in the picking (or "threshing") of a number of plants (around 20, that represent 1.5—2 kg each time), the resevering and the cleaning of the pods, and the classification for damage in three groups: 1) "without damage", 2) "small punctures" or "scrapings" and 3) "holes", "broken pods", etc., which were weighed, and expressed in percentage of total weight. Four rotaing velocities of the cylinders: 350, 450, 550 and 650 r/min (equivalent to: 7.5, 9.6, 11.8 and 13.6 m/s of peripheral velocity respectively), with four replications, were used in each test. In all cases analysis of variance of the data was performed.

RESULTS AND DISCUSSION

1. Detachment force (f.d.) of the pods for different varieties. Table 1 gives the mean values of the f.d. for the eight varieties determined in one year (randomized blocks and 80 determinations per variety were used). It can be stated that the differences of mean f.d. between the varieties in the time of harvest are very important, and not correlated with the mean pod-size of the variety.

The system used for the detrmination of the f.d. proved to be satisfactory, with the following considerations;

— The state of health of the plants, especially with respect to crown and stem rot (*Sclerotium, Botrytis, Aspergillus*) is essential for the value of f.d.

Table 1

Detachment force of the pods (g) and max. length of the pods (cm) of the eight varieties tested

Variety	f.d.(g)	Size of pads (long. nax. cm)
Argentina	1,087	24.24±.31
Bunch G-2	813	35.09±.70
NC-2	772	35.25±.58
Palme	787	28.01±.52
Virginia Jumbo	728	35.71±.62
Moruno	671	37.62±.69
Cacahua	591	37.75±.40
(s.e.:30	595	46.02+.81

— For increasing precision in the measurements, plants should be as uniform as possible with respect to: digging date, moisture content (seeds at 30%) and ambient conditions during determination (not too high temperatures or too dry air).

In our conditions, the determination of 20 to 30 plants (4 pods per plant) for each line or variety, would be sufficient for detecting significant differences of 65 g at 5% level. In (1) the values given for this character in three different Asiatic peanut varieties were very coincident with our results (1,100—1,300 g, 800 g and 700 g). The f.d. value decreased not more than 200 g in the last four weeks of maturation of the plants in the soil. On the other hand, the correlation of the f.d. with moisture is given in Figure 2.

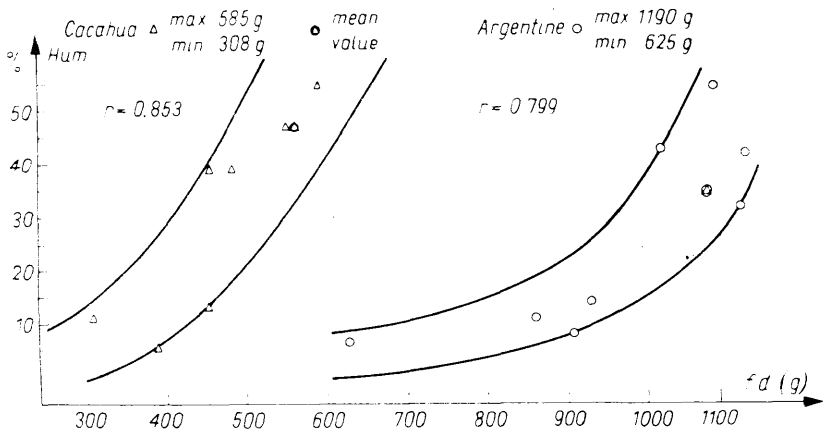

Fig. 2. Decrease of the f.d. during the dessication period, for two varieties

2. Length of the pegs or peduncles (l.p.). Having measured the first year the depth and width of the clod of pods and soil for each variety (Table 2), we could state the grouping of the varieties in the Spanish (plants always erect) and Virginia (with bigger clod). All the varieties were cultivated in single rows, (62.5 cm between rows) and with ground irrigation.

Table 2

Width and depth of the clod of pods and earth and length of the peduncles, in the eight varieties (in cm)

Variety	Width of clod (cm)	Depth of clod (cm)	l.p.(cm)
Moruno	17.4	15.10	7.64±.31
Bunch G-2	17.3	13.15	8.70±.30
NC-2	17.1	14.35	7.12±.23
Virg. Jumbo	16.8	13.00	7.61±.31
GA-119-20	16.8	14.20	6.46±.23
Palma	15.9	12.70	7.09±.23
Argentine	15 3	11.00	4.15±.19
Cacahua	15.8	12.55	6.35±.26
(s.e.:.54)		(s.e.:.44)	

The values for the second year were smaller (low production was general this year) but the grouping of the varieties turned out the same. The third year, the length of 50 pegs from different random plants of each variety were measured. The correlation between mean width of the clod and l.p. for the eight varieties is highly significant (Table 2).

3. Resistance of the pods to compression. The measures were always taken in the two positions described: there are varieties with high compression resistance in parallel position (Palma) and others with a very similar resistance in both positions (Cacahua) (Table 3). There appears a significant influence of locality (temperatures and type of soil) on the resistance characteristics of the pods. In the tests of compression in vertical position, it is measured mainly the resistance of the suture to "opening". This resistance increases (highly in Palma and Bunch G-2, and less in the rest) with drying.

In the tests in horizontal position, the characteristics resistance of the shell, as well as the resistance of the suture, the position of the seeds inside and the form of the pod are contributing factors, so that this measures becomes the most varieble. The differences between varieties appear, though, highly significant.

4. Mechanical picking. With the laboratory picker, and

Table 3

Resistance of the pods to compression, in kg, for two positions and two moisture contents: high moisture (h.m.) and low moisture (l.m.)

Variety	Suture paralell (h.m.)	Suture paralell (l.m.)	Suture perpend. (h.m.)	Suture perpend. (l.m.)
GA-119-20	11.04	10.02	7.32	8.01
Palma	8.30	10.18	4.08	7.62
Cacahua	8.47	9.96	7.01	7.67
Maruno	8.65	8.61	6.52	6.35
Virg. Jumbo	8.17	8.65	5.12	6.53
NC-2	7.60	8.44	5.08	6.17
Bunch G-2	7.96	7.53	4.37	6.21
Argentine	5.52	4.96	4.42	4.51
(s.e.: 0.46)	.....		(s.e. 0.34)	.....

the described method the eight varieties were tested for their adaption to actual mechanical harvesting, related with the mechanical properties studied. Figure 3 shows the results of a) four earlier varieties in good dessication condition, low moisture; b) four later varieties — high moisture.

The results of these tests could be summarized as follows:

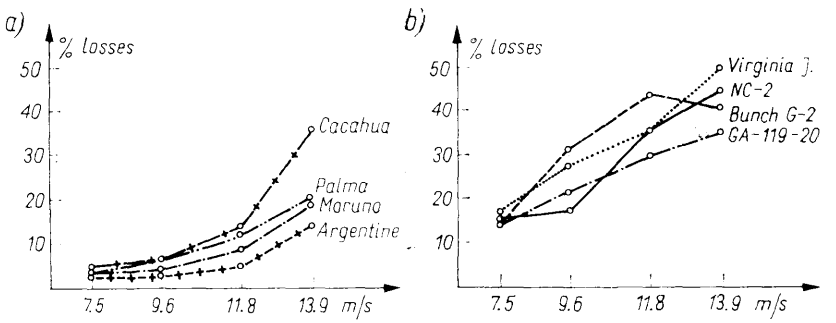

Fig. 3. Losses caused by mechanical picking, in percentage. a) four earlier varieties, low moisture, b) four later varieties, high moisture

— The effect of moisture of pods and plants is most important on the incidence of damage. The losses were bigger with higher moisture content, and were also related to the size of the pods. This was an evidence that the damage is more because of compression of the pods, passing through too narrow clearances, and not so much because of impacts. This indicates the need of adjusting the different parts of the

machine to the pod characteristics of the variety. On the other hand, the compression tests were very indicative of the specific resistance of each variety to mechanical harvesting.

— The efficiency of picking was very high in all cases, also at the minimum peripheral velocity of the cylinders, in which the damages are low, also in the cases when the crop is in conditions of high moisture, as is the case of the Valencia area of Spain.

CONCLUSIONS

Of the varieties studied, and in our conditions, the most suitable, for mechanical harvesting would be GA-119-20 and Palma, as well as NC-2. The established breeding program is based on the crossings of these varieties as the parentals.

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MECHANICZNE WŁAŚCIWOŚCI ODMIAN ORZESZKA ZIEMNEGO

Streszczenie

Niektóre metody badania cech mechanicznych płodów rolnych zastosowano przy ocenie ośmiu odmian orzeszka ziemnego, które reprezentują szeroki zakres uprawianych form. Przeprowadzono serię pomiarów cech charakterystycznych dla tej rośliny: siła odłączenia od strąka, szerokość i głębokość umieszczenia masy strąków, rodzaju gleby, odporność strąków na ściskanie, drgania wibracyjne oraz tarcie i zdolność do zagęszczenia. Skonstruowano urządzenie wirowe i mechaniczne zrywarkę.

Siła odłączenia od strąka jest charakterystyczna dla każdej odmiany. Średnie wartości mieszczą się między 1,0 a 0,4 kG. Siła ta nieznacznie wzrasta w czasie ostatniej fazy dojrzewania roślin w glebie i zmniejsza się do połowy swej wartości w okresie suszenia. Szerokość masy strąków zależy przede wszystkim od rodzaju gleby. Odporność poszczególnych strąków na ściskanie zamyka się w granicach 1—3 kG, zaś dla różnych odmian zmienia się między 5 a 12 kG. Granica szybkości obwodowej cylinderków zrywających wynosi 7 m/sek i jest przyjmowana dla mniej odpornych odmian w badanych warunkach. Straty przy zbiorze mechanicznym rosną szybciej dla wyższych, w porównaniu do niższych, zawartości wilgoci w strąkach.

Я. Ортис-Каньявате, М. Руис Альтисент

МЕХАНИЧЕСКИЕ СВОЙСТВА СОРТОВ АРАХИСА

Резюме

Некоторые методы исследования механических свойств сельскохозяйственных продуктов были применены при оценке восьми сортов земляного ореха, располагающих многими возделываемыми формами. Была проведена серия измерений свойств, характерных для этого растения: силы отделения от стручка, ширины и глубины размещения массы стручков, вида почвы, устойчивости стручков против сжатия, вибрационных колебаний, а также трения и способности к уплотнению.

Сила отделения от стручка характерна для каждого сорта. Средние величины располагаются между 1,0 и 0,4 кГ. Эта сила растет незначительно в последней фазе созревания растений в почве и уменьшается до половины своей величины в период сушки. Ширина массы стручков зависит прежде всего от вида почвы. Устойчивость против сжатия отдельных стручков располэгается в пределах 1-3 кГ, а для различных сортов изменяется от 5 до 12 кГ. Предел периферической скорости срывающих цилиндров составляет 7 м/сек и принимается для менее устойчивых сортов в исследуемых условиях. Потери при механическом сборе растут быстрее при высшем содержании влаги, чем при низшем.

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