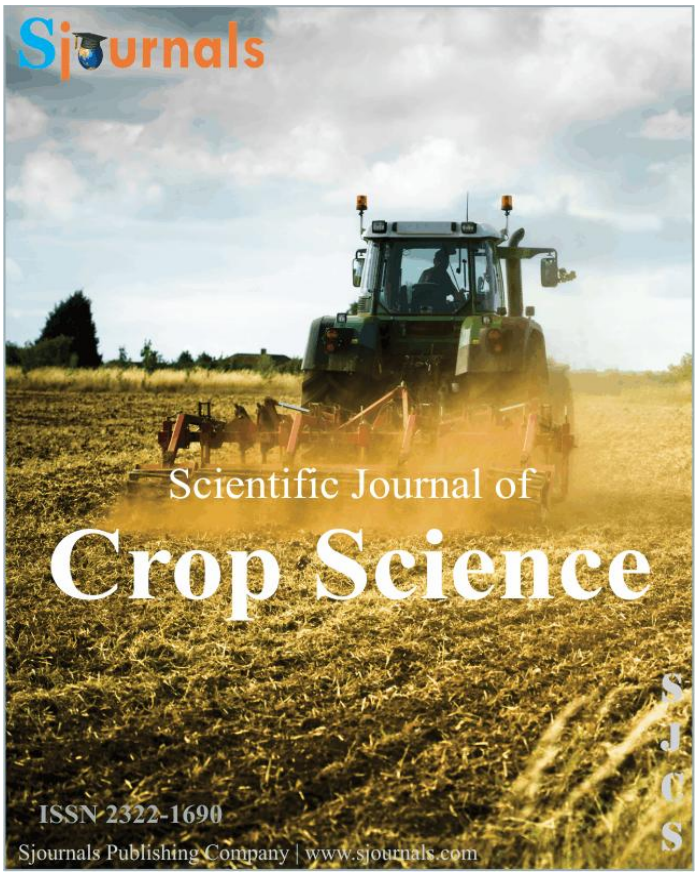
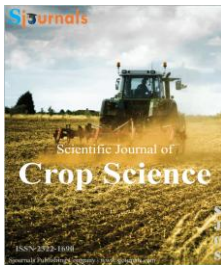


Scientific Journal of Crop Science (2016) 5(7) 121-124
ISSN 2322-1690
doi: 10.14196/sjcs.v5i7.2253



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Scientific Journal of **Crop Science**

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Original article

Peg strength of eight peanut cultivars grown in Mediterranean conditions

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ARTICLE INFO

Article history,
Received 11 June 2016
Accepted 10 July 2016
Available online 17 July 2016
iThenticate screening 14 June 2016
English editing 08 July 2016
Quality control 14 July 2016

Keywords,
Peanuts
Mechanical properties
Peg strength
Detachment force

ABSTRACT

Peg strength is one of the most important agronomic properties in peanut crop to avoid harvest losses and mechanical production and harvesting. The objective of this study was to compare peg strength for selection the best cultivar to avoid harvest losses. Peanut peg strength, which influences the amount of peanut pods harvested, was measured as a function of the force required either to detach the peg from the pod or to break the peg. Peg strength of cultivars has been investigated. Mean peg detachment forces for Halisbey, Arioglu-2003, Wilson, Batem, NC-7, Brantley, Osmaniye-2005, Sultan were 104149, 74896, 69064, 65647, 63112, 69889, 128948 and 134627, respectively. Accordingly, results indicated, Sultan cultivar has more strength peg in our selection.

1. Introduction

Peanut (*Arachishypogaea* L.) is one of the important oilseed crops in the World. The world annual peanut production is around 45 million tonnes from the 25.4 million ha of production (FAO, 2014). It is the fourth important source of edible oil and third most important source of vegetable protein. It is widely distributed in the tropical, subtropical, and temperate regions of the world. It is a rich source of oil (44-56%), protein (22-30%), and carbohydrate (10-25%). Also, it is a very good source of minerals such as calcium, phosphorus, magnesium, zinc, iron and vitamins (E, B and K) Because of the suitable climate and soil conditions, peanut can be grown successfully

as a main and second crop after wheat harvesting in southern part of Turkey (Mediterranean area) (Baloch et al., 2010). Peanut is cultivated mainly in Adana, Osmaniye and Aydın provinces. The second crop of peanut production is approximately comprised of 40% in the total production area.

Harvesting of peanuts requires a two-step process. Firstly, the peanuts plant is stick out from the soil and inverted the plant upward to accelerate the field drying and second step is combining. To stick and invers the peanuts requires the use of a peanut digger, which when setup properly will remove the plants from the ground with minimal yield losses. However, the inversion process is where most pod losses are incurred (Bader et al., 2012). The harvesting time of second crop is occurred at the same time with rainy season. During this period, although peanut has come to maturity, the harvesting isn't realized due to rain. So, the decreasing is observed in terms of the peg strength of the peanut in soil while harvest delaying and this situation is lead to losses of harvesting product. With increasing input costs and decreasing return margins, all efforts must be made to harvest the full yield produced. So, peanut cultivars must be good peg strength as well as high yield performance in order to prevent the losses of harvesting product. The knowledge of some important physical properties such as shape, size, and some mechanical properties (rupture force, stiffness, hull strength, tensile strength, peg strength) of grains is necessary for design of various harvesting, separating, handling, and optimum of threshing performance, processes of pneumatic conveying, storing and drying systems (Aydin, 2007). Therefore, this study aims to search the differences the tensile strength of peanuts peg and maximum load of some peanut cultivars mainly cultivated in Turkey to avoid the harvest losses. The harvesting losses affect the sustainability of farming. To reduce the yield losses will help the farmer. Therefore, selection of the best cultivar of the peanuts is important issue. In our knowledge's, no information is known about peg strength of Turkish peanut cultivars. The present study was therefore undertaken to quantify peg strength in commonly grown peanut cultivars in Turkey.

2. Materials and methods

The eight peanut varieties viz. (1) Halisbey, (2) Arioglu-2003, (3) Wilson, (4) Batem, (5) NC-7, (6) Brantley, (7) Osmaniye-2005 and (8) Sultan were used in this study. These are common varieties which are mainly cultivated in Turkey. This study was conducted at the Experimental Farm of the Cukurova University (41°04´ N, 36°71´ E, and 36 m elevation), at Adana, Turkey in 2014. The soil at the experimental area has formed as alluvial carried by the sub-branches of the river Seyhan. It has type A and C horizons, and has a mid-deep to deep structure. The ratio of organic materials decreases with depth. The soil has a loamy structure and its pH levels were in the range of 7.23-7.26. Its salt ratio is in the range of 0.052-0.060% levels. The useable P_2O_5 is approximately 14.32% at the top levels and decreases with depth. In addition, the nitrogen levels are approximately 0.143% at the top levels, whereas it is approximately 0.062% at deeper levels. Lastly, its lime levels are approximately 34.41% at the top level, while it decreases with depth.

The seed bed was prepared by deep plowing, disking and loosening. Before the sowing, 200 kg ha^{-1} of 18-46-0 fertilizer (36 kg ha^{-1} N, 92 kg ha^{-1} P) and 2.0 l ha^{-1} of Traflen (Trifluralin) as herbicide was applied. The seed sowing was done by hand with a depth of approximately 5 to 6 cm in the rows. In order to determine whether or not the peanut pods were ready for harvest, samples were gathered from the plots and mature pod ratios were determined through "Shell-out" method. At the harvest, the middle two rows of each plot was harvested by hand, while the outer two rows of each plot were discarded. The measurements were done after the digging of the peanut plants.

Tensile strength tests were done with a Lloyd Material Testing Machine (model LRX Plus) equipped with a 5000 N load cell and computer. Two loading positions which are parallel to the principal dimensions of the fruit were used in the tensile strength tests. Each sample was placed between two plates and pulled at 20 mm min^{-1} speed until the fruit was initiated. Tensile force was read directly from graphics. Each test was repeated 30 times. To determine the best cultivar for avoiding the harvesting losses it's important to know the tensile strength of the peg. Statistical analysis was performed using SPSS 22 by One-Way ANOVA method. Treatment means were compared using Duncan Multiple Range Test (Duncan, 1955).

3. Results and discussion

The descriptive measurements are shown in Table 1. This study was reflected on peg strength, maximum load, deflection, work to limit of the eight cultivars of the peanuts. The results show us that there is significantly

important differences between the cultivars of peanut on measured and counted mechanical properties such as work to limit, detachment force, peg Strength, peg thickness and deflection (p<0,05). From the data work to limit values varies from 0,0272 (sample 5) to 0,0638 (sample 7) to rupture the peg from the peanuts. The strength force (N) parallel to these findings and varies from 6,312 (sample 5) to 13,462 (sample 8). Some researcher investigated the mechanical and physical properties of peanuts such as some engineering properties of peanut and kernel (Aydin, 2007), physical properties of peanut hull pellets (Fasina, 2008), physical and mechanical properties of peanut protein film (Liuet al., 2004). Also, Thomas et al. (1983) researched the peg strength. On the other hands, Warner et al. (2015) were studied the losses of the harvesting at some wet soil and compared the moisture content effect on harvesting losses.

Table 1
Descriptive of the given measurement of selected peanuts cultivar.

Name	Number	Sample	Work to limit (J)	Detachment force (N)	Deflection (mm)	Peg strength (N/m)	Peg thick-ness (mm)
Halisbey	1	30	0.0632^{a}	10.4149^{b}	2.270^{a}	3668.8011^{b}	2.27^{a}
Arioglu-2003	2	30	0.0404^{b}	7.4896^{c}	1.231^{d}	3317.5828^{b}	1.231^{d}
Wilson	3	30	0.0316^{b}	6.9064^{c}	1.209^{d}	2850.1548^{b}	1.209^{d}
Batem	4	30	0.0337^{b}	6.5647^{c}	1.332^{d}	3105.0968^{b}	1.332^{d}
NC-7	5	30	0.0272^{b}	6.3112^{c}	1.206^{d}	2904.1987^{b}	1.206^{d}
Brantley	6	30	0.0341^{b}	6.9889^{c}	1.609^{c}	3135.0552^{b}	1.609^{c}
Osmaniye-2005	7	30	0.0638^{a}	12.8948^{ab}	2.081^{ab}	4754.5581^{a}	2.081^{ab}
Sultan	8	30	0.0636^{a}	13.4627^{a}	1.933^{b}	5032.2159^{a}	1.965^{b}
	Total	240	0.0447	8.8792	1.6089	5690.5454	1.612

The parameter was subjected to Duncan multiple comparison method.

The peg strength is very important for the study target which affects the yield losses. The datum indicates that more strength peg material was at Sultan (number 8) and the lesser one is at Wilson (number 3). It means that variety of Sultan has to be scattered for the less yield losses.

The mean peg detachment forces were 104149, 74896, 69064, 65647, 63112, 69889, 18948 and 134627 at Halisbey (1), Arioglu-2003 (2), Wilson (3), Batem (4), NC-7 (5), Brantley (6), Osmaniye-2005 (7), Sultan (8), respectively. As its expected Sultan (sample 8) variety has higher peg detachment forces which differs from the others. On the other hand, Osmaniye-2005 (sample 7) values close to this finding.

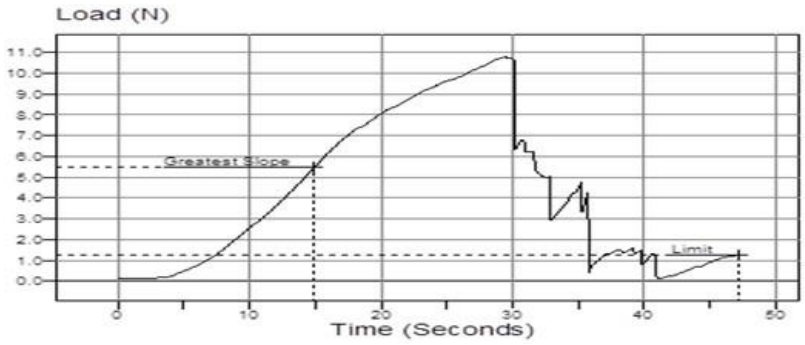

Fig. 1. Peg detachment forces experiment of peanut.

On the other hand, peg thickness is playing important roles to up higher detachment forces except the variety of Halisbey (sample 1). This contradiction needs to evaluate the study for the future in the scope of the peg structure. The peg detachment pattern of this experiment is shown in Figure 1. The earlier researcher which was done Thomas et al. (1983) the mean peg detachment forces for Florunner,Florigiant, Spantex, Tamnut-74 and Toalson varieties were 10.0, 12.7, 13.0, 17.2, and 22.1 Newtons (N), respectively.

4. Conclusion

The mentioned issue as a matter of harvesting losses is very important to sustainability. The results indicated that more strength peg was found at Sultan cultivar, lesser one at Wilson. The results give us important information for the selection of best cultivarby comparing the peg strength to avoid the harvest losses. Moreover, peg strength could be used as selection criteria for peanut varieties suitable for mechanical harvesting.

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How to cite this article: Kurt, C., Erdem, T., Bakal, H., Arioglu, H., El Sabagh, A., 2016. Peg strength of eight peanut cultivars grown in Mediterranean conditions. Scientific Journal of Crop Science, 5(7), 121-124.