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MECHANICAL DAMAGE TO CHICKPEA SEEDS AS AFFECTED BY NPK FERTILIZATION

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ABSTRACT. The aim of research was to determine the effect of nitrogen (N), phosphorus (P) and potassium (K) fertilizers onthe some physical properties and mechanical damage to chickpea seeds under impact. The martial for tests was from a field experiment with varied levels fertilization with nitrogen (0 and 50 kg/ha, N), phosphorus (0 and 100 kg/ha, P_2O_5) and potassium (0 and 100 kg/ha, K_2O). The variation of the mechanical damage was analyzed depending on the mode of varied fertilization, seed moisture content and impact energy. It was found that the chickpea seeds were bigger with NPK supply. The effects of phosphorus and potassium fertilizers rates on the mechanical damage to chickpea seeds was significant at 1% probability level (P<0.01) and increased its hardness and resilience therefore caused the better resistance to impact damage. Potassium fertilization ratehad the most influence and phosphorus fertilization rate had the least. The effect of the nitrogen fertilizer rate was not significant (P>0.05). Harvesting chickpea seeds at higher moisture content and lower impact energy should give lower breakage when NPK is supplied, as well as when no NPK is supplied.

Key words: Chickpea; Mechanical damage; Harvesting; Handling; Fertilization.

INTRODUCTION

Many of today's seed production environments are managed at very high levels of chemical fertilizers to return plant nutrient to agricultural lands and ensure maximum yield potential. Consequently, it is important to understand the seed properties and resistance to impact changes in response to chemical fertilizers such as nitrogen, phosphorus and potassium. Chickpea (*Cicer arietinum* L.) seeds are subjected to a series of static and dynamic loads during harvesting, handling, processing, and storage. Such loads cause external and internal damage of seeds, which lead to decreases in quality and can eliminate both viability and vigor (Shahbazi, 2011). The harvesting and the postharvest operations negatively influence the quality of seeds. The

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machinery and equipment for harvesting, transportation, storage and processing caused significant mechanical damage to seeds i.e. skin rupture, seed fracture etc. The damage resulted from mechanical interaction between the biological material (seeds) and the materials in the machineries (steel, rubber etc.). Most authors admit that the seeds damage mainly occurs in the course of harvest and transport, when the seeds are damaged by impact forces.

The mechanical resistance to impact damage of seeds, among other mechanical and physical properties, plays a very important role in the design and selection of the operating parameters of the respective equipments – for harvesting, threshing, handling and other processing of the seeds (Baryeh, 2002). It is very important to use crops resistant to injury during harvesting techniques and to further introduce varieties and agro technical methods that ensure the maximum resistance to injury (Niewczas, 1994). Resistance to impacts can be advantageous (storage, biological form); on the other hand, high impact resistance is an unfavorable trait in processing because of higher energy costs and less efficiency in size reduction (Szwed and Tys, 2002).

Among biological, physical and thermal factors, an important role in the resistance to damage is played by the hardness and resilience of seeds. The higher resilience, the better resistance to damage and therefore higher sowing value/potential. Particularly important here are the seed cover, its structure, position and chemical composition (Gorzelany, 1999). These factors are affected by the mineral fertilization level (Szwed and Tys, 2002). Therefore, it is useful to determine the effects of various modes of fertilization of chickpea seed plantation on the mechanical damage of seeds. Another highly important factor that has a significant effect on the resistance to damage of seeds is their water (moisture) content. Water content in seeds affects their anatomical-morphological structure only to a slight degree (Dziki and Laskowski, 2007), but plays a significant role in affecting their elastic properties. Dry biological material is not too elastic and relatively brittle, and stress caused by external forces is more likely to disturb its inner structure. A higher moisture content increases the elasticity and deformability of seeds. Some researches prove the significant influence of moisture content upon the seed damage and state that the damage increases significantly as the moisture content decreases (Baryeh, 2002; Parde *et al.*, 2002; Szwed and Lukaszuk, 2007; Shahbazi, 2011). According to numerous studies, a seed is less vulnerable to injuries from outer mechanical loads for an optimum value of water content (Niewczas, 1994). This feature may be important for selecting the time of harvest and postharvest process, aiming to minimize yield losses due to the share of damaged seeds.