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Development of measurement system for grain loss of some chickpea varieties

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ABSTRACT

Grain loss is one of the most significant problems encountered during chickpea harvest. Scientific studies to increase chickpea production are focused on decreasing grain loss and increasing revenues. In Turkey, large quantities of chickpea crop fall to the ground and therefore are lost when harvesting using the combine harvester. In this study, a measurement method was developed to determine the grain loss of some widely produced chickpea types in Turkey, Hisar, Yaşa-5, Azkan and Işık-5, and tested for precision. This study consisted of two stages: the first stage included designing and developing a laboratory type measurement method using sensors and software; in the second stage, the precision of the method was tested for Hisar, Yaşa-05, Azkan and Işık-5 chickpea varieties in three different moisture contents and five different feeding rates (10 g chickpea grain, 30 g stalk mixture; 20 g chickpea grain, 60 g stalk mixture; 30 g chickpea grain, 90 g stalk mixture; 40 g chickpea grain, 120 g stalk mixture; and 50 g chickpea grain, 150 g stalk mixture). According to our results, the increase in the mixture ratio associated with the chickpea grain impact value leads to a decrease in the threshold value. The precision of the method was determined as 90% for all threshold values defined according to the chickpea impact value among all chickpea varieties and mixture ratios. Additionally, it was determined that the change in the moisture content is an accelerant for the threshold value defined according to the chickpea impact value.

1. Introduction

The chickpea (*Cicer arietinum* L.) is a rare plant that has been cultivated for thousands of years, thought to originate in southeastern Turkey about 7000–7500 years ago [1]. Chickpea is an annual legume that is usually grown in the summer and has atmospheric nitrogen-fixing root nodules [1]. While its roots can descend for up to 2 m, it can grow from 0.2 m up to 1 m high [1]. Its fern-like leaves are composed of either 3–10 pairs of leaflets or a single leaf, and the plant can have different colored flowers [1].

The chickpea plant can be short or not completely developed and thus not suitable for automated harvesters. Therefore, chickpeas are harvested by hand and then blended into machines. However, harvesting the chickpea crop using combine harvesters is becoming more widespread. Combine harvesters should be adjusted for harvesting the chickpea to prevent significant grain loss during the harvest.

New technologies should be implemented to minimize the grain lost during the harvest. Moreover, in order to use these technologies, it is important to know changes that occur in sensors based on chickpeas types, moisture contents, and absorption levels.

Nyborg et al. evaluated that the grain loss associated with the product and the combine harvester, the researchers

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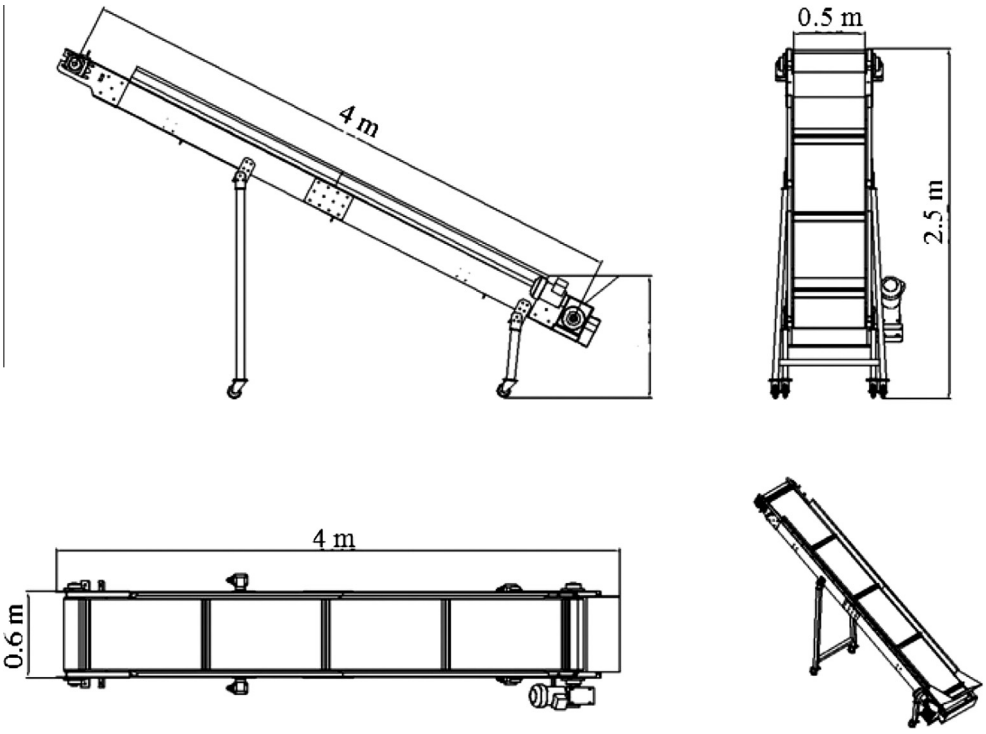

Fig. 1. Design of adjustable feeding unit.

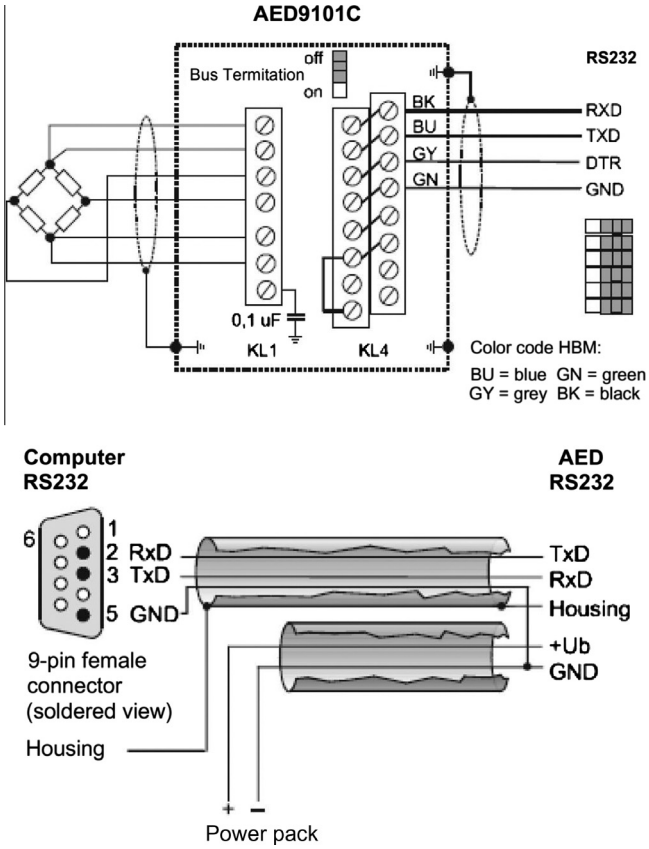

Fig. 2. The connection of measuring instruments data sheets to circuit.