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Field evaluation of cutter and feeder mechanism of chickpea harvester for lentil harvesting

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Introduction

The main producers of lentil are Canada, India, Nepal and China, respectively and Iran is the ninth producer in the world. The hand pulling is the usual method of lentil harvesting. Use of conventional combine because of short leg varieties, wide combine head in dry land and grain losses by cutter bar vibrations is impossible. So a mechanism should be designed to harvest the lentil plants with minimum damage. This mechanism should be evaluated under different tests of crop and machines such as forward speed (FS), grain moisture content (GMC), different varieties and other parameters. Some researchers studied the effects of GMC (Andrews and *et al.*, 1993; Huitink, 2005; Adisa, 2009; Abdi and Jalali, 2013) and FS on grain losses (Geng *et al.*, 1984; Swapan *et al.*, 2001; Mostafavand and Kamgar, 2014; Hunt, 1995). Field tests were conducted at three levels of FS 1.5, 3 and 4.5 km.h^{-1}; three levels of cutting height (CH) 4, 8 and 13 cm and two levels of GMC, 8 and 14% on two varieties of lentils including Flip and Shiraz with three replications.

Materials and Methods

The feeder and cutter mechanism for chickpea harvesting that was the base design of device which is notched wheel and counter shear, was used. The other components of device were dividers, slat and chain feeders, belt and pulleys, chassis, elevator conveyor and storage. Two split plot design based on a randomized complete design was used to determine the effects of above treatments on lentil losses.

Results and Discussion

The ANOVA results indicated that the all studied factors; FS of feeder and cutter mechanism, CH and GMC had significant effect on losses of Shiraz variety ($P<0.01$). FS and GMC had significant effect at 1% probability level and CH at 5% probability level on lentil losses for Flip variety. The interaction effect of GMC with CH and FS had significant effect at 5% probability on Shiraz variety but none of treatments was significant on grain losses of Flip variety ($P>0.05$). The ranges of losses of Flip variety at 8% GMC were 8.6 to 10% for FS of 1.5 km h^{-1}, 9.1 to 10.4% for FS of 3 km.h^{-1}and 10.4 to 11.4% for FS of 4.5 km h^{-1}. These ranges at 14% GMC were 7.9 to 8.9% for FS of 1.5 km h^{-1}, 8.4 to 9.2% for FS of 3 km h^{-1}and 8.5 to 10% for FS of 4.5 km h^{-1}. The ranges of losses of Shiraz variety at 8% GMC were 8.3 to 10.9% for FS of 1.5 km h^{-1}, 9 to 12.4% for FS of 3 km h^{-1} and 10.7 to 13.6% for FS of 4.5 km h^{-1}. These ranges at 14% GMC were 8.3 to 9.1% for FS of 1.5 km h^{-1}, 8.3 to 9.9% for FS of 3 km h^{-1}and 9.2 to 11.5% for FS of 4.5 km h^{-1}. The comparison between two varieties at different levels of FS, GMC and CH indicated that the lentil losses of Shiraz variety were more than the other variety at 8 cm CH at 8 and 14% GMC. The difference of losses between two varieties was 0.8% at FS of 4.5 km h^{-1} at 14% GMC where this value was 2% at 8% GMC and same FS and at 14% GMC and 8 cm CH from FS of 3 to 4.5 km h^{-1} was 0.3% and 1% for Flip and Shiraz varieties, respectively. Also at 14% GMC and 13 cm CH, the differences within group were 0.8 and 1.4% where at 8% GMC and 13 cm CH were 1 and 1.2% for Flip and Shiraz varieties, respectively. The results of the study of field evaluation of cutter and feeder mechanism of chickpea harvester for lentil harvesting showed that FS, CH and GMC at 1% probability for Shiraz variety and FS and GMC at 1% probability had significant effect on lentil losses but CH at 5% probability for Flip variety had no significant effect. The lentil losses were increased by increase in FS, CH and decreasing of GMC for both varieties. There was no significant difference from 1.5 to 3 km h^{-1} and 4 to 8 cm CH in Flip variety while significant difference was at all levels of FS and CH in Shiraz variety.

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Conclusions

At studied varieties, Flip variety because of more performance and minimum of losses was better than Shiraz variety. Also to achieve the lowest of losses by feeder and cutter mechanism, FS of 3 km h^{-1}, GMC of 14%, CH of 8 cm and variety of Flip was recommended.

Keywords: Chickpea harvester, Cutter and feeder mechanism, Harvest losses, Lentil harvesting