The investigation of the work quality for wheat harvesting process

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Summary

Unacceptable network of agricultural production and harvest technology results in extra-cost for farmers, losses at preservation and storage and unsafe production delivered to final consumers. The objective of this study was the investigation of the work quality for wheat harvesting based on the grain quality and cutterbar losses. To assess the grain quality, with respect to grain damage and dockage, the material other than grain (MOG) including broken grain, straw pieces, parts of chaff, foreign materials and weed kernels in grain tanks of combine harvesters were calculated. By collecting the dropped unthreshed grain on the ground and measuring their weight, the cutterbar losses were determined. It was estimated as 7% of the yield. In a bulk (sample) the pure grain was 82-87% while the MOG was 13-18%. The broken grain was 5-8%, straw and chaff was 2-5% and weed kernel was 2-5%.

Key word: combine harvester, losses, material other than grain (MOG), grain quality

Introduction

Due to small farms scale and size, the mostly Iranian farmers prefer to rent combine harvester instead of purchasing it to harvest their crops. The lack of adequate combine harvesters reduces grain and work quality. The work quality is a performance factor for grain harvesting machinery (Hanna and Quick, 2007) and losses are the essential criteria for the quality of the work (Kutzbach and Quick, 1999). Grain harvested by combine harvesters generally mixed with material other than grain (MOG). Sometimes the MOG mixed with the grain are so high that the silos reject it to the farmer. They forced to separate the MOG from the grain or sell it for fewer prices to dealers. For the farmer the MOG mixed with grain and cutterbar losses on ground are real cost. The later is a true loss while the other is a hidden loss. Thus the objective of this study involves determination of the grain quality of harvested wheat and
cutterbar losses on the ground to determine the work quality of the combine harvesters.

**Material and methods**

The experiments were done on the farms of the Laylakh region, with 150,000 ha farmland mostly planted with wheat varieties, at Dehgolan, Sanandaj, Kurdistan, Iran. With no notice to planting methods they are harvested by combine harvesters except those planted in steep hills. As the area is large, the whole region was divided into three parts followed by the study of the grain quality and cutterbar losses at harvesting process.

To determine the work quality of a grain bulk, grain damage and dockage were studied. A grain bulk can be divided into the Grain and MOG which decrease the grain quality. The MOG counting the grain damage and dockage, weed kernels, dirt and etc. The Grain dockage is trash in the grain tanks included: straw pieces, parts of chaff, foreign materials and weed kernels. Kernels appear broken to the naked eye was determined as visible grain damage (broken grain). As invisible grain damage do not affect on price of the bulk grains delivered to silos, it dose not studied here.

The weight of unthreshed that has been dropped by the header is the cutterbar losses. To determine it, all the unthreshed grain in a harvested area with 1 m$^2$ was collected followed by measuring their weight.

The experiment was conducted (3 combine harvester models $\times$ 3 divisions) based on a completely randomized design with three replications. Three common models of conventional combine harvesters including: JD 955 (I.C.M. Co.), TC 56 (New Holland) and Medion 310 (Claas) were studied. Three samples were taken from each combine harvester while different unloading processes. The machine forward speed was 4-5 km/h. The manufactured year of the combine harvesters were not respected, and it was assumed that all of the combine harvesters were adjusted properly by the operators. To get a real data, the combine operators did not know about the experiment.

Data (samples) were achieved by moving in main road between farms in the divisions, finding combine harvesters (each three models) and obtaining samples from their grain tanks whilst unloading. The grain and visible broken grain separated from each sample and weighted. The remained materials were grain dockage. They were expressed as the percentage by weights of grain, damaged kernels and dockage grain respectively.

The experimental data were analyzed using a variance analysis to determine the MOG in the grain tanks of the combines after harvest. The
means of the treatments (MOG and cutterbar losses) were compared with Duncan’s multiple range tests at a 5 percent level of significance.

Results and Discussion

The results are different from those were written in the machine catalogues or said to the illiterate farmers. The grain quality of harvesting material was indicated that there were not significantly differences between the cutterbar losses and MOG in the grain tanks for all of the combine harvesters. Though some models were sold to combine-owners with high prices than the others but their performance are not accepted despite the companies advertisements.

In a bulk (sample) the pure grain was 82-87%, MOG was 13-18%, broken grain was 5-8%, straw and chaff was 2-5% and weed kernel was 2-5% calculated. Also results confirm that the cutterbar losses were determined as 7% of yield. As a consequence, replacing the existing combine harvesters by better ones with respect to desired work quality is required. Meanwhile reducing cost and losses would be acquired by modifying and optimizing them.

References
