INTERRELATIONSHIP BETWEEN CROP AND MACHINE PARAMETERS RESPONSIBLE FOR WHEAT HARVESTING LOSSES

Qamar-uz-Zaman, A.D. Chaudhry & M. Asghar Rana
Department of Farm Machinery & Power,
University of Agriculture, Faisalabad

To establish machine crop factors interrelationships and to evaluate the comparative performance of John Deere and Claas combines, the present study involved experiments with three speeds of the combines, two wheat varieties (Pak-81, Punjab-85) and three grain moisture levels (26, 20 and 13%). The data collected were analysed to study the variations due to interactions of parameters. Significant interactions occurred for variety-moisture content, variety-machine, moisture content-machine as well as variety-speed. The machine-speed and moisture content-speed interactions appeared to be non-significant. It is suggested that John Deere is beneficial for moisture level of 26% and 20%. The Claas combine can only be employed at 26% grain moisture for minimum losses. John Deere is recommended at second and third speeds while Claas can only be used at first speed taking into account minimum separation losses. Punjab-85 shows less quality losses compared with its counterpart.

INTRODUCTION

Of the agricultural commodities consumed as food, wheat contributes the bulk of the world's need. The evolution of high yielding varieties and use of the latest farm equipment have changed the local farming practices. Large areas have been brought under cultivation. Grain crops need early harvesting and immediate threshing in order to reduce grain losses. About 10% of the cereals harvested in developing countries are lost annually.

Early harvesting produces immature grains whereas delayed harvesting causes shattering and quality losses. The only way to escape from the hazards is to mechanise the harvesting operations. The combine harvesters are helpful in this regard which not only minimize the losses from delayed harvesting, but also help in timely sowing of the subsequent crop. Tandon *et al.* (1988) investigated the interaction of different machine and crop parameters on threshing efficiency of a pulse thresher. This study was carried out to see the effects of machine/crop parameters on wheat grain losses and to establish the interrelationships.

MATERIALS AND METHODS

Two combine harvesters, John Deere and Claas, were used to harvest Pak-81 and Punjab-85 wheat varieties. Three levels of grain moisture content (26, 20 and 13%) were varied by harvesting on different days of season. Three levels of speed were tested for the two machines and two wheat varieties. Three sample areas of one sq. meter size each were randomly selected from the experimental field and the average yield of wheat crop was obtained. The data collected were analysed and the variations due to the interactions of parameters were studied.

RESULTS AND DISCUSSION

Significant interactions occurred for variety-moisture content, variety-machine, moisture content-machine, as well as variety-speed. The machine-speed and moisture content-speed interactions appeared to be non-significant.

Shattering losses: The variety-moisture interaction was significant since Punjab-85 was more susceptible to shattering than Pak-81 due to its characteristics. Lesser losses in Pak-81 were noticed even with delayed harvesting at 13% moisture level (231.2 kg/ha) compared with Punjab-85 at 26% (239.1 kg/ha). The variety-machine interaction is marginally significant at 5% level. Claas caused higher losses (324.8 kg/ha) for Punjab-85 compared with John Deere as 236.5 kg/ha. But for Pak-81, losses were not so high for both the machines. Regarding machine speed, Pak-81 had lesser losses at all three speeds, whereas shattering losses for Punjab-85 were even higher (256.2 kg/ha) as compared with 224.7 kg/ha for Pak-81 at third speed. The moisture content-machine interaction suggested that John Deere was beneficial at 20% and 26%, whereas Claas can only be recommended at 26% moisture level.

Separation losses: The variety-moisture content interrelationship depicts that for all three grain moisture levels, Punjab-85 undergoes more separation losses i.e., 41.8, 26.9, 17.3 kg/ha compared with those of Pak-81 which were 30.9, 17.7 and 14.0 kg/ha respectively. This is due to the reason that Punjab-85 has more volume of intake and higher moisture level needs more impact force for complete threshing. The variety-machine interaction is significant and shows that losses were high for Punjab-85 with Claas combine. This is so because Punjab-85 is a high yielding variety, it has more number of tillers, more volume of intake and Claas combine had more forward speed than John Deere at the same gear. The moisture content-speed interaction was highly significant. At 26% moisture with second and third speed, the losses were higher than those with first speed. This is attributed to the fact that at 26% moisture, the unthreshed grain percentage increased with increase in forward speed due to inadequate impact force on the kernels, the cylinder speed being constant.

Quality losses: The data revealed higher quality losses in Pak-81 (4.2%) than those of Punjab-85 (3.1%). This was due to the genetic and ecological variations of Pak-81. Also, the grain size of Pak-81 was small; the grains became readily brittle and were more susceptible to damage. It was noticed that grain damage was higher at 13% compared with that at 26% moisture level. This occurred due to the reason that dry kernels had higher tendency to breakage. The forward speed had significant effect on decreasing the quality losses as speed increased. Because high speed favoured increasing the feed rate which created cushioning effect in the threshing cylinder resulting in less impact force on the individual kernels. Regarding the machine, Claas did not perform well in any case under prevailing conditions.

CONCLUSIONS

1. Punjab-85 has been noticed as more susceptible to shattering. However, in terms of machine forward speed, Pak-81 shows better results reducing the shattering losses.
2. Punjab-85 undergoes more losses if harvested by Claas. Therefore, John Deere is more suitable to avoid the undesirable separation loss.
3. The grains of Pak-81 become more brittle at lower grain moisture level and

more grain damage results in high quality loss. Therefore, Punjab-85 is a better choice in combination with John Deere combine to obtain good quality grains.

4. The advantage of increased field capacity in terms of higher speed of the machine has to be weighed against the expected loss.

REFERENCES

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