Statistical Control Applied to Mechanical Harvest Process and Evaluation of Soybean Seeds Performance

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Introduction

During the production process, many factors can influence the quality of soybean seeds, since the installation of the production fields to storage, however, the harvest is considered the most critical phase of the whole process.

Reduction in seed quality during harvest is associated with factors inherent to the culture, the moisture content of the seeds during this operation and settings used in the harvester.

Objectives

The objective of this study was to evaluate the performance of soybean seeds (*Glycine max* (L.) Merrill) throughout the harvesting process using tools of statistical process control.

Metodology

Soybean seeds cv. NA7337RR were collected in the registered seed production field of Agrofava company located in Campo Alegre de Goiás, Goiás State, Brazil.

Two harvesters Case model 2388 , power of 209 kW (284 hp) , 2004, with threshing system of axial and platform 7 m (23 feet).

Samples were collected at the exit of the elevator worm in 10 minute intervals , totaling 20 samples, which were immediately subjected to determination of water content in the field.

In the laboratory, seeds were evaluated by means of physical and physiological parameters: **water content**, **purity**, **mechanical damage**, **germination**, **accelerated aging**, **electrical conductivity**, and **Seedling emergence in the field**.

The statistical methods used were the control charts, drawn from the inferior limit of control (ICL) and superior limit of control (SLC), which have as center line mean overall ($\overline{X}$) . All analyzes and graphs were performed by Minitab® software.

Results

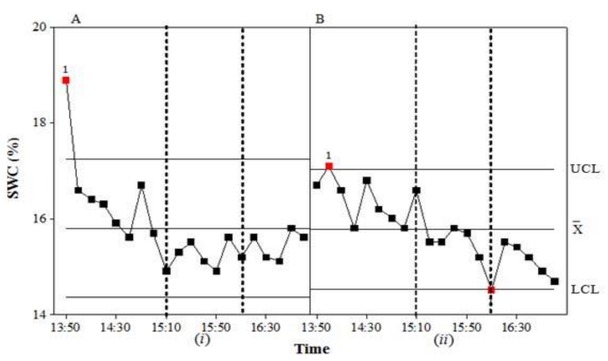

Figure 1 - Control chart for seed water content of soybean seeds (%) during the harvesting process, in function of two harvesters (A and B) and different times of harvest. SLC: superior limit of control, $\overline{X}$: mean, ILC: inferior limit of control. (*i*) and (*ii*): intervals.

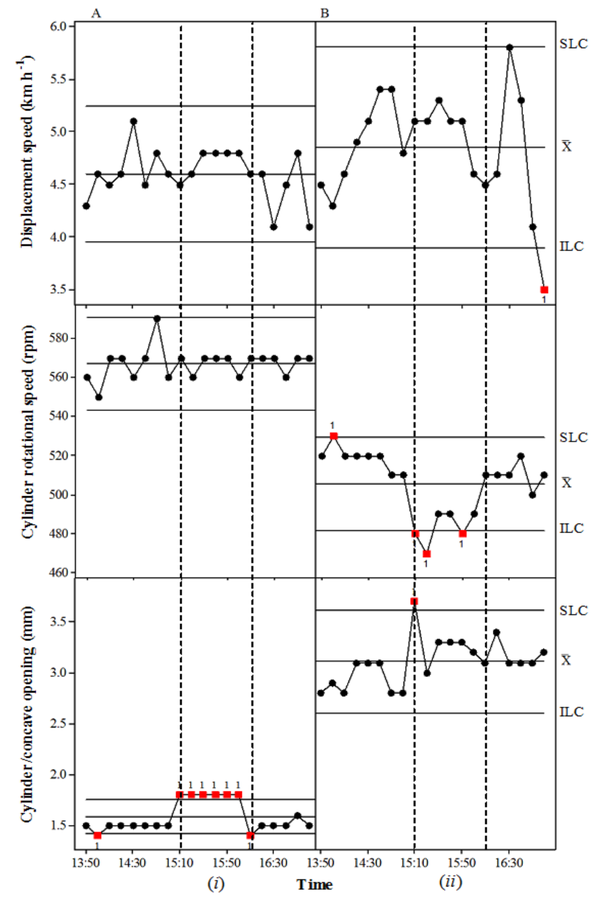

Figure 2 - Control charts for displacement speed (km h^{-1}), cylinder rotational speed (rpm) and cylinder/concave opening (mm), in function of two harvesters of soybean seeds (A and B) and different times of harvest. SLC: superior limit of control, $\overline{X}$: mean, ILC: inferior limit of control. (*i*) and (*ii*): intervals.

Figure 10. Time of harvesting and collecting samples in the field. Harvester A.

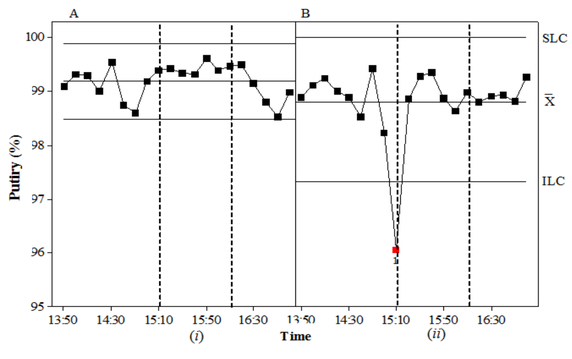

Figure 3 - Control charts of purity of the soybean seeds, in function of two harvesters (A and B) and different times of harvest. SLC: superior limit of control, $\overline{X}$: mean, ILC: inferior limit of control. (*i*) and (*ii*): intervals.

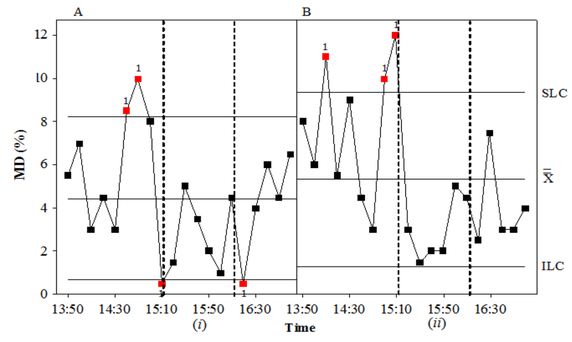

Figure 4 - Control chart for mechanical damage (MD) of soybean seeds in function of two harvesters (A and B) and different times of harvest. SLC: superior limit of control, $\overline{X}$: mean, ILC: inferior limit of control. (*i*) and (*ii*): intervals.

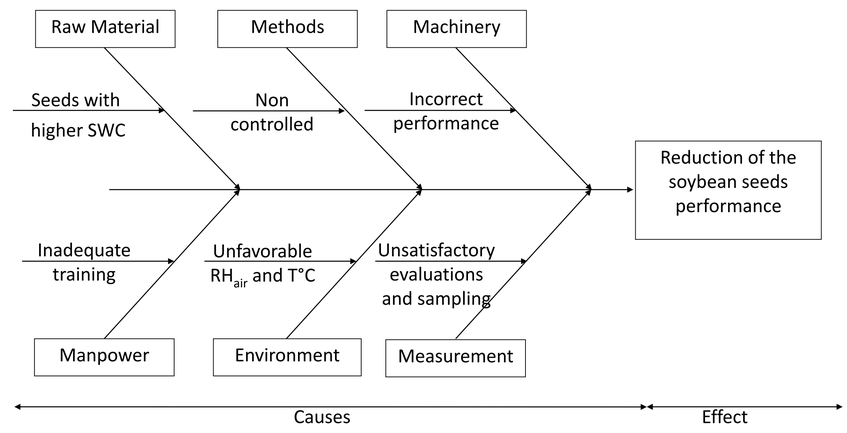

Figure 9. Cause and Effect Diagram applied to the operation of mechanized harvest of soybean seeds. SWC: seed water content; RH_{air}: relative humidity of air; T°C: temperature.

Figure 11. Time of harvesting and collecting samples in the field. Harvester B.

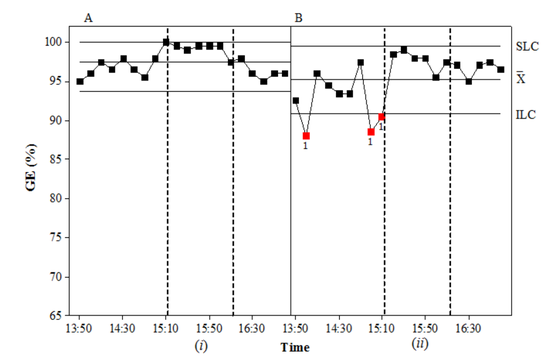

Figure 5 - Control chart for germination (GE) of soybean seeds in function of two harvesters (A and B) and different times of harvest. SLC: superior limit of control, $\overline{X}$: mean, ILC: inferior limit of control. (*i*) and (*ii*): intervals.

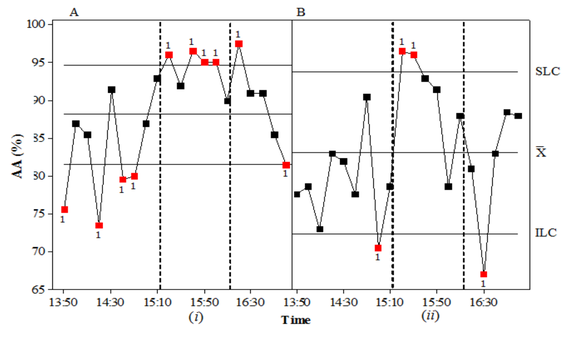

Figure 6 - Control chart for accelerated aging (AA) of the soybean seeds in function of two harvesters (A and B) and different times of harvest. SLC: superior limit of control, $\overline{X}$: mean, ILC: inferior limit of control. (*i*) and (*ii*): intervals.

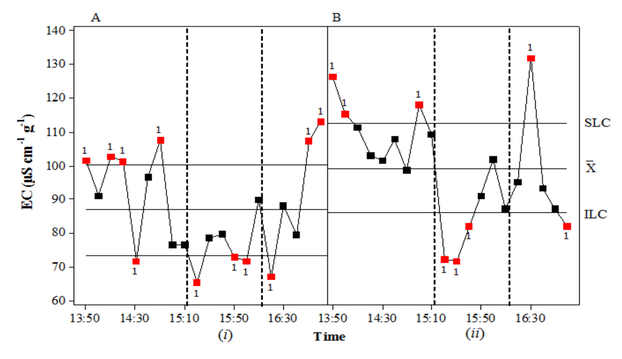

Figure 7 - Control chart for electrical conductivity (EC) of soybean seeds in function of two harvesters (A and B) and different times of harvest. SLC: superior limit of control, $\overline{X}$: mean, ILC: inferior limit of control. (*i*) and (*ii*): intervals.

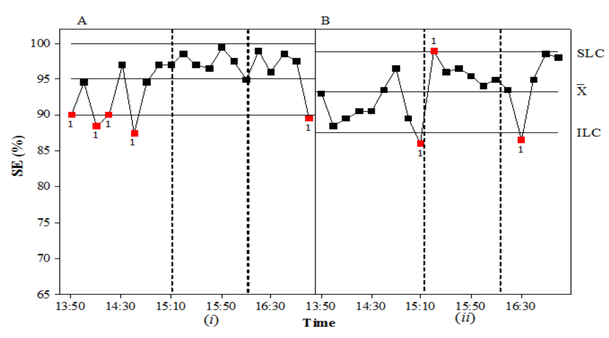

Figure 8 - Control chart for seedling emergence (SE) in the field of soybean seeds in function of two harvesters (A and B) and different times of harvest. SLC: superior limit of control, $\overline{X}$: mean, ILC: inferior limit of control. (*i*) and (*ii*): intervals.

Conclusion

Environmental changes and water content of soybean seeds require changes settings for the operation of mechanized harvesting seed will be efficient.

The harvester, when set correctly, causes no damage to seeds and can still maintain high performance potential of seeds.

The control charts identifying differences between the harvesters and their potential consequences on performance of soybean seeds, monitor the harvesting process and enhance the effects continuously.

Acknowledgements

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