IMPLEMENTATION OF A SYSTEM FOR DETERMINING TRACTOR FUEL CONSUMPTION AND VELOCITY

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SUMMARY - An instrument to measure tractor fuel consumption and velocity was attached to a laboratory automation environment that was developed in April of 1990. The fuel consumption meter is a rotational flow meter. The number of rotations are counted and accumulated in the flow volume meter. The speed meter is based on an application of the Doppler effect using radio waves in the 26Ghz range. Instruments are connected to the data logging system and results are processed by a personal computer as part of the laboratory automation system.

Purpose

The performance of tractors in the field vary depending on soil characteristics. Soil characteristics in the Cerrado area change in response to rainfall. Rainfall affects farm work in two ways. First, it determines when the works can be done and secondly, it affects the performance of tractors and farm implements. The first aspect is very important in the optimization process in the management of agriculture. In this paper, tractor performance is our main concern. This performance is important in the selection of farm machinery and crops. The performance data are supplied by the farm machinery manufactures. However, these data are usually obtained on uniform terrain (under optimum conditions).

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Performance consists of many components such as velocity, traction resistance, fuel consumption, and Power Take Off (PTO) torque loads. These components are sometimes related to each other. Therefore, an automated sampling system to take these data simultaneously was necessary for this study. In order to acquire large amounts of data in the field under different conditions, it was necessary to use this kind of date acquisition and processing system because the volume of transient data increases enormounsly in proportion to the duration time of each performance test. The system to minimize the time required and to obtain as much data for each soil condition as possible, described was developed.

Configuration

The system configuration is as follows (Figura 1). Fuel consumption rate is measured by inserting the metering gear in the engine fuel supply pipe. Diesel engines differ from gasoline engines in that there is a return fuel pipe from the injection pump of the diesel engine. This is used to control the pressure of the injection pump. The net fuel consumed in the diesel engine is the difference between the fuel in the supply side pipe and the return side pipe. The return side fuel contains a certain amount of air which must be removed before the net fuel consumption is measured. This is a special problem in measuring the fuel consumption of diesel engines. The data signal in the transducer of the fuel consumption meter is generated by a small magnet which is imprinted into the gear excentrically, thus producing a signal in the form of pulses, each pulse corresponding to 10 c.c. of fuel flow.

The speed detecting device is a Doppler radar unit. It is used to detect the velocity of vehicles. The Doppler frequency from the transducer is proportional to the velocity of the transducer, also produced in the form of pulse data.

The detecting theory is quite simple and easy to be processed. The data are first stored on a 4-track data logger using a Phillips standard cassette magnetic tape. After the test is finished, the data are transfered to the oscilloscope with storage function (Figura 2). The data are now time variant, so, using the cursor, the frequency of each wave is measured. Pulse frequencies are converted to fuel consumption and velocity values.

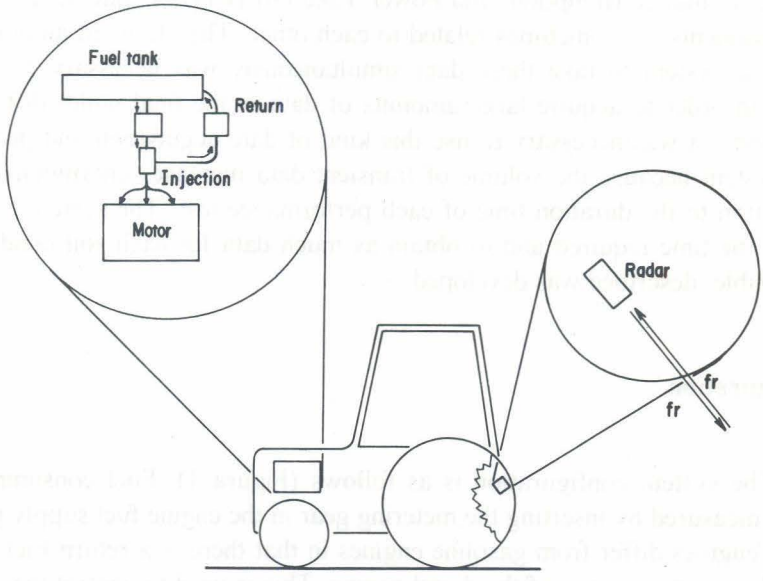

FIG. 1 - The instruments used for fuel consumption and ground speed determination.

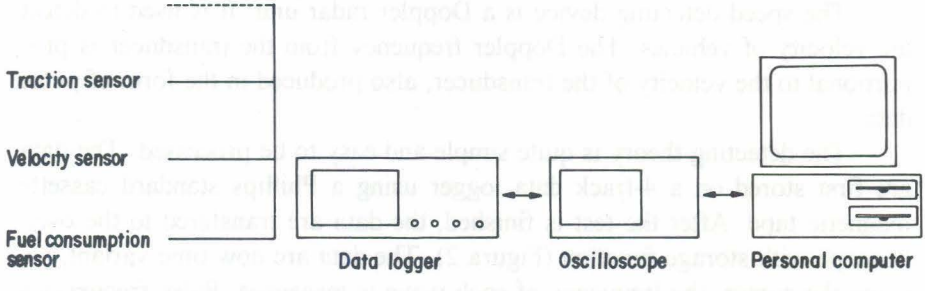

FIG. 2 - Configuration of instruments for tractor performance testing.

Conclusion

Agricultural management is the process of optimization to obtain the highest profit with lowest risk considering the entire production process. The same principle is valid for all types of investment. To obtain the highest profit from agricultural production, each cost should be estimated and considered at every stage of production. Machinery management sometimes affects the total cost by more than 30 percent.

The instruments developed are quite simple, and the system is easy to use. A large volume of data can be produced with this process and should lead to usefull information regarding optimization of farm machinery use. The data should enable the use of farm machinery more efficiently and thus optimize agricultural production systems. Another stage of research will cover the human decision support system. It is hoped that in the future, new technology in computer science such as artificial intelligence or artificial life will be available for this advanced phase of agricultural management systems in the Brazilian Cerrados.