Agriculture
Canada

Publication 5285/B

Instrumented tractor

In 1987, an Agriculture Canada Research Branch project was begun to equip a standard farm tractor with on-board, precision electronic and electro-mechanical devices. Their purpose is to monitor and record forces and energy involved in tillage and other similar agricultural field operations.

Tractor

A state-of-the-art design, 97-kW (135-hp), front-wheel drive assist, diesel tractor was selected as meeting research needs and as representing farm usage. The instrumented tractor can

- carry out plot- or farm-scale research using full-size implements while doing typical farm operations
- measure forces imposed on the tractor by implements either trailed or mounted on a three-point hitch
- measure forces transmitted through each rear axle, such as torque, weight, and draft
- measure wheel speeds and actual ground speeds
- measure fuel consumption
- measure reaction forces exerted by a tillage tool and implement frame
- measure, record, and display data using high-speed sampling and in-depth analysis.

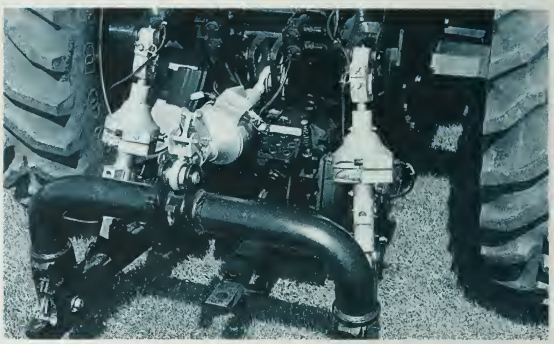
Sensors

To measure forces imposed both on specific components of the tractor, and by the tractor on implements and the soil, electro-mechanical transducers were installed

- in the front-axle pivot pin
- on the front driveshaft
- on both rear-axle shafts
- in the three-point hitch linkage
- in both three-point hitch lower-arm pivots.

Transducers on rear-axle shaft.

True ground speed is measured by a Doppler radar system. Fuel consumption is calculated by a sophisticated system that compensates for fuel temperature and recirculation.



Transducers mounted in the three-point hitch arms.

Computer

Electrical signals from the transducers are fed through conditioners where they are filtered and amplified. They then are fed into an on-board computer where they are monitored in real time and stored on disc and tape.

A monitor and keyboard allow the computer operator to control the experiment and to view the measurements being made.

A 4-kW diesel generator mounted on the right side of the tractor provides AC power for the computer.

To house both the computer and its operator, the tractor cab was modified by removing the left side of the original cab and clamping a mating cab extension to the original frame.

Generator mounted on right side of tractor.

Computer mounted in cab extension.

Application

The instrumented tractor has been used in tillage experiments on the Central

Instrumented tractor on transport calibration trailer.

Experimental Farm, Ottawa, at local agricultural colleges, and at the Agriculture Canada Research Station in Charlottetown, Prince Edward Island. Typical experiments involve treatments using conventional moldboard plows, ridge tillage equipment,

Tillage experiment.

chisel plows, subsoilers, conventional seeders, and no-till seeders. As the tractor and implement operate in the field, data are collected on fuel consumption, implement draft and power requirement, wheel slip, and dynamic axle loading.

The instrumented tractor is available for collaborative research with industry, universities, colleges, provincial governments, and other federal departments.

For more information contact

Research Branch, Agriculture Canada
Land Resource Research Centre
K.W. Neatby Building, Room 1141
Ottawa, Ontario
Canada K1A 0C6
Tel. (613) 995-5011
Fax (613) 995-7283

Copies available from
Communications Branch, Agriculture Canada
Ottawa, Ont. K1A 0C7

Cat. No. A15-5285/1991 ISBN 0-662-58210-1
Printed 1991

Produced by Research Program Service

Canada