

Special Report

Improved Automated Device for Rapid Planting of Differential Sets

E. F. IKONEN, 47 Tamworth Bay, Winnipeg, Manitoba, Canada R3T 2X4, and J. W. MARTENS, D. E. HARDER, and D. J. SAMBORSKI, Research Station, Agriculture Canada, 195 Dafoe Road, Winnipeg, Manitoba, Canada R3T 2M9

The study of physiologic specialization in plant pathogens often requires the planting of large numbers of sets of differential host lines. At the Winnipeg Research Station, several thousand differential sets, each comprising 15–30 differential cultivars or backcross lines (2,3), are planted annually to study physiologic specialization in the cereal rust fungi. Planting these sets manually is labor-intensive, subject to error, and often a physical constraint in planning physiologic race surveys or in studying inheritance of virulence (4).

H. C. Young, Jr., at Oklahoma State University first automated the laborious process of set planting (1). His early designs were later modified by L. E. Browder at Kansas State University (1). Since machines of the latter design are no longer available, however, a new machine was designed and constructed for use in Winnipeg.

Design

The Winnipeg automated set planter consists of four major component systems: main support frame, hydraulic platform,

The publication costs of this article were defrayed in part by page charge payment. This article must therefore be hereby marked "advertisement" in accordance with 18 U.S.C. § 1734 solely to indicate this fact.

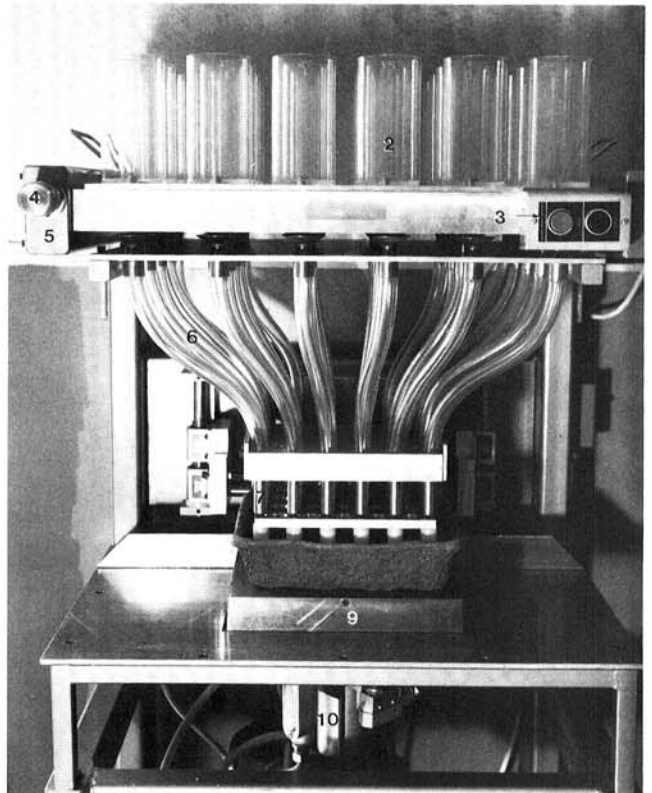
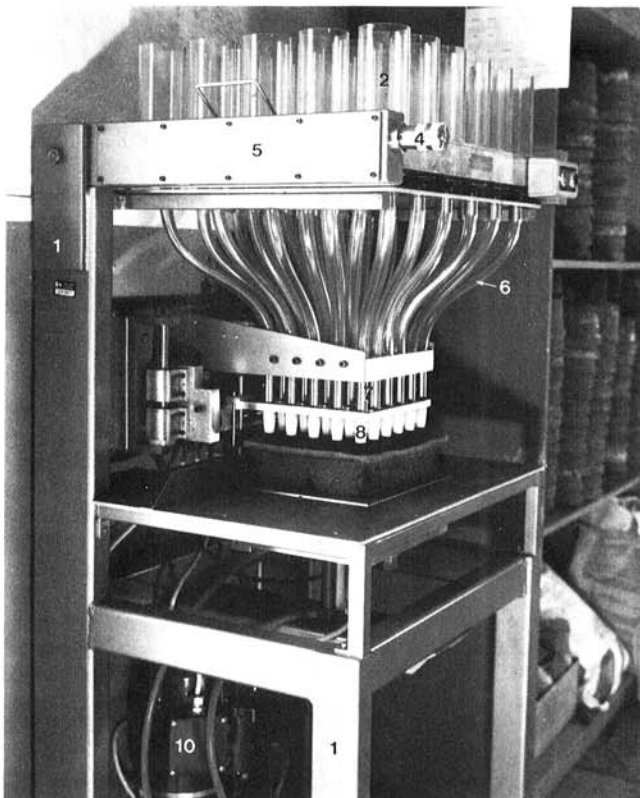
©1984 Department of Agriculture, Government of Canada

seed dispenser, and mechanical and electrical control system.

Main support frame. The machine is entirely self-contained and free-standing with all components supported by a frame fabricated from hollow structural steel. The overall dimensions are approximately 165 cm high × 75 cm wide × 70 cm deep.

Hydraulic platform. A platform (30 × 25 cm) constructed of sheet aluminum is raised and lowered by an oil-driven hydraulic system. A soil-filled tray is raised against an overhead template on which are mounted nylon punches, thereby creating depressions in the appropriate place in the soil to accept the seed. After the depressions have been made, the platform drops a short distance to clear the nylon punches, the template moves sideways to line up the seed-dispensing holes with the depressions in the soil, the seed is dispensed, and the platform drops to its resting position.

Seed dispenser. The seed-dispensing apparatus is the most complex part of the set planter. At the upper end of the dispenser is an interchangeable "head" on which are mounted 30 acrylic seed-containing canisters. The seed canisters feed into the seed-regulating mechanism, consisting of an adjustable opening associated with a rotating cam-operated rod. With each rotation of the rod, the requisite number of seeds that have fallen into the opening are fed into flexible polypropylene tubes



(Left) A general view of the Winnipeg automated set planter and (right) the planter in mode to punch depressions in soil. 1 = Main support frame; 2 = interchangeable head with seed canisters; 3 = start and stop switches; 4 = knob to regulate quantity of seed dispensed; 5 = sealed, lubricated housing containing cam-operated gears; 6 = polypropylene tubing to guide seed to dispensing orifices; 7 = stainless-steel seed-dispensing orifices; 8 = nylon punches to create depressions in soil; 9 = hydraulic platform; 10 = hydraulic pump.

leading to the seed-dispensing orifices. Nylon brushes in each of the 30 dispensers keep the regulating mechanism from clogging with seed. The size of each of the 30 openings is regulated by a single knob to control the amount of seed dispensed or to adjust for different types and sizes of seed.

Mechanical and electrical control system. A single electric motor operates the cam and shifts the seed dispenser from the hole-punching mode to the seed-dropping mode. A time-delay relay keeps the unit in seed-dropping mode for a few seconds to ensure that all of the dispensed seed has had time to fall into the soil.

A system of five relays and four limiting switches controls all hydraulic and mechanical movements in sequence and at the proper time from when the unit is set into operation. The entire operation of hole punching to seed dispensing is carried out automatically in about 8 seconds after the start switch is depressed. For safety reasons, the pressure exerted by the hydraulic table is limited to 50 psi, and depressing the prominently displayed stop button releases the pressure.

Except for the support frame, all metal parts of the unit are constructed of hardened aluminum plate or stainless steel. All remaining parts, such as the gears for the rotating cams, are contained in sealed, lubricated housings and require no maintenance.

Operation

The operation of the set planter is extremely simple. A fiber tray approximately 23 cm wide \times 28 cm long \times 6 cm deep is filled with sieved, slightly moist soil and positioned on the hydraulic platform. The planting operation is set in motion by depressing the start switch. The seeded tray is removed manually and the seed covered with soil. The machine is then ready for the next planting.

When differential sets of varying materials, for example, the various wheat or oat rust differentials, are to be planted alternately, a separate seed canister head is used for each differential set. These heads are fully interchangeable, and only the seed-dispensing mechanism needs to be cleared of remnant seed to prepare the machine to plant a new differential set.

LITERATURE CITED

1. Browder, L. E. 1971. Pathogenic specialization in cereal rust fungi, especially *Puccinia recondita* f. sp. *tritici*: Concepts, methods of study and application. U.S. Dep. Agric. Tech. Bull. 1432. 51 pp.
2. Green, G. J., and Martens, J. W. 1982. Incidence and virulence of *Puccinia graminis* on wheat, barley and rye in Canada in 1981. Can. J. Plant Pathol. 4:285-290.
3. Samborski, D. J. 1982. Occurrence and virulence of *Puccinia recondita* in Canada in 1981. Can. J. Plant Pathol. 4:291-294.
4. Samborski, D. J., and Dyck, P. L. 1976. Inheritance of virulence in *Puccinia recondita* on six backcross lines of wheat with single genes for resistance to leaf rust. Can. J. Bot. 54:1666-1671.