

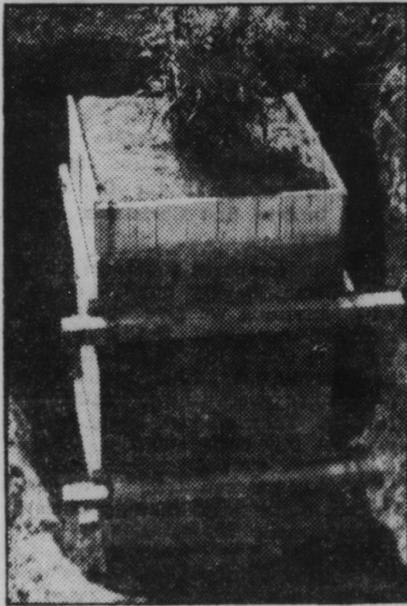
Helping the FARMER by GRASS-ROOTS SCIENCE

By Dr. Frank Thone

ROOTS loom large in our national consciousness nowadays. Floods, soil erosion, and the lowering threat of choking storms swirling out of the West's "dust bowl," have made even city folk apostles of the plant-more-grass movement. We all want to see the myriad cords of roots holding fast the slipping soil that is rich if it stays where it belongs, ruin if it does not.

Yet, paradoxically, we know very little about this subject that has become so important to us. Botanical scientists have for centuries centered their studies on the overground parts of plants, and have left the roots in muddy darkness.

This neglect of roots has been a serious error. Roots do an important and indispensable share of every higher plant's life work: they get the all-necessary water, along with the all-necessary mineral nutrients from the soil, and



The lifting case is bolted around the block of soil containing a root system so that it can be removed for study.

they anchor the plant in place. Sometimes also they store reserve food.

Out on the Canadian prairies, at the University of Saskatchewan, there is a plant scientist who is actively doing something about roots. He knows more about where roots actually go than any man who has ever lived, for he is the first man who has ever taken the trouble to remove all the soil from a whole root system, grain by grain, and chart the roots, inch by inch, as he has come to them. He is a real grass-roots botanist.

His name is T. K. Pavlychenko. He is a native of Ukraine, but he has for several years been a Canadian citizen. He is attached to the faculty of the University of Saskatchewan, at Saskatoon, in the capacity of "weed experimentalist."

The whole thing started because of weeds. Farmers on the fertile plains of Saskatchewan were increasingly troubled with several particularly persistent and pestiferous weed species. The authorities at the experiment station of the province, located at Saskatoon, decided to attack the advancing enemy with all the weapons of science.

AMONG the most troublesome weeds of the Saskatchewan plains were several species of wild mustard, and even worse than these, wild oats.

These weeds, in turn, can be routed by two or three species of range grass, especially one brought in from western Asia, known as crested wheat grass.

To Pavlychenko fell the task of finding out exactly how the roots of each weed and crop plant behaved, both when grown alone with plenty of space both above and under ground and when grown side by side with a competing plant.

He went about the job thoroughly. He planted seeds of each kind, both



Millet, famous French painter, was a "grass roots" artist, painting innumerable great pictures of agricultural subjects. Here is his famous picture, "The Angelus."



With the specially built spray nozzle, the earth is carefully cleared away from the roots.

separately and within competing range of other plants. At four different times during the first growing season, and with perennial plants twice more during the following year, he took out a sample plant of each kind, lifting with each plant a solid block of soil containing its entire root system.

With a "brush" of fine water-jets he removed every particle of soil, charting the position of every root as he did so. Later, in flat tanks in the laboratory, he measured every inch of every root. How laborious this job was may be guessed from the fact that some of the root systems of full-grown plants had main roots and branches summing up to two and three hundred miles!

To get at a root system involves plenty of hard labor.

First, Mr. Pavlychenko digs a trench clear around the plant he is going to study, leaving a block of soil big enough to hold all the roots. If it is a big clump of crested wheat grass, for example, the block is four feet square and seven or eight feet deep.

The next step is to enclose the plant in a sectional case or framework, made of stout two-inch lumber and steel rods. Once securely enclosed, the soil mass is loosened at the bottom and tilted slowly over on its side. Then, with block and tackle, a couple of husky-backed young

assistants haul the whole massive block up to the surface.

Here it is slid onto a platform mounted on trailer wheels, and removable sides are set up around it. Bolted tight, they form an oblong watertight tank. This is filled, and the soil mass is left to soak until it is soft through—perhaps a couple of days.

With this heavy-labor part of the job finished, the real work is ready to begin. All that earth has to be removed

THE only safe working tool is water; in fine, brush-like streams. Mr. Pavlychenko has devised such a water-brush, a flat spray-nozzle with a valve to control the force of its fine streams.

Beginning at the bottom, working slowly toward the top, the water-brush does its work. Inch by inch, as the roots appear, the scientist charts them on a big sheet of graph paper. After about two weeks, he has a complete map of the whole intricate root system.

Once the root system is clear of all foreign matter, it can be rolled up and packed away in a container of preservative, to be taken out for further study when the long Saskatchewan winter comes, and not even the most enthusiastic grass-roots botanist can dig in the frozen soil.

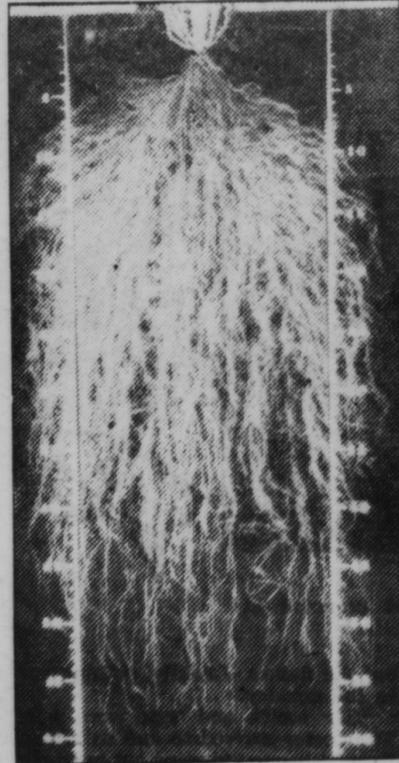
The job of measuring up a big root system may take a month of winter laboratory time. The roots are laid out in natural position in a flat, shallow tank, painted black inside to set off the white of the roots to best advantage and strongly illuminated with a battery of eight 250-watt electric lamps.

To take a big root system traveling, Mr. Pavlychenko has devised an ingenious traveling tank. It is as long as the root system is wide—some 40 inches. It has a tightly fitting lid, which can be sealed on.

The root system is first laid out flat in its tank, with a wide sheet of oiled paper beneath it. The water is slowly drained away, letting the roots settle flat on the paper. Preservative solution is sprayed or sprinkled on. Then the paper is rolled up, roots and all, beginning at the bottom.

The roll is gently lowered into the tank, which has a bulge built into its bottom, to accommodate the thick clump where roots and stems come together—the "crown," botanists call it. Thus Mr. Pavlychenko's favorite crested wheat grass specimen traveled many hundreds of miles.

Mr. Pavlychenko is enthusiastic about crested wheat grass, as a plant for the Canadian West and for the northern Great Plains of the United States. It has practically all weeds licked from the first gong. It grows more roots, deeper roots, and grows them faster, than any grass he has experimented with. And it holds soil with a tenacious grip.



Root system of a single wild oat plant 80 days after sprouting. Total length of all roots and branches—3,456,000 inches.

from around and among those infinite interwebbed roots, and yet not the smallest branch may be broken. No trowel, not even a toothpick, could meet those exacting requirements.