

father's orchard and farm. His experiments on sweet pea plants led to his discovery of the laws of heredity and gave birth to the modern science of genetics. The value of Mendel's work went unrecognized until 1900 when its rediscovery sparked a tremendous interest in the application of plant genetics to agricultural research.

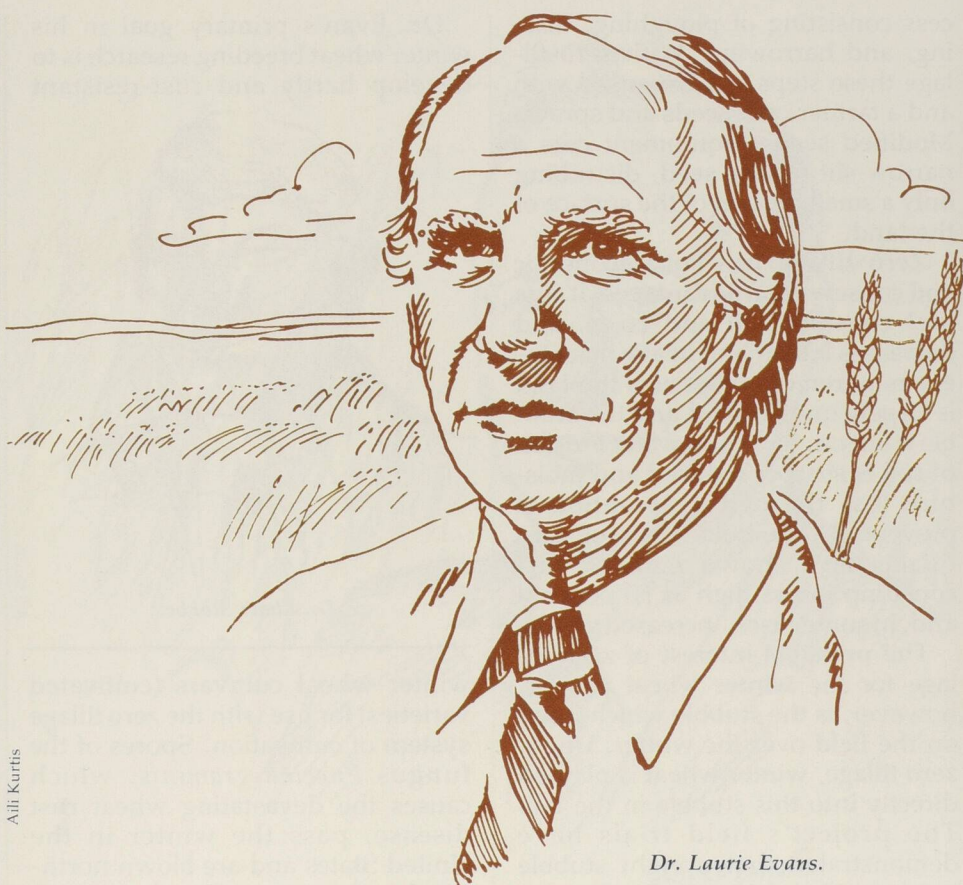
In the past few decades crop yields have increased spectacularly, due largely to the pioneering work of plant breeders in the early part of this century. In the United States, for instance, corn yields climbed from 1.8 tonnes per hectare in 1940 to 6.32 tonnes per hectare in 1980; in the same period, wheat went from 0.96 tonnes per hectare to 2.22 tonnes per hectare. These new plant varieties and agronomic practices produced the widely heralded Green Revolution in the Third World during the 1960's and 1970's. The total wheat production in the countries has more than doubled over the past two decades.

The University of Manitoba's program to improve crop production under Canadian Prairies climate conditions continues the application of this dramatically successful science-based agricultural technology. The program involves a number of projects, of which the winter wheat and corn breeding aspects described here are only the tip of the iceberg.

## Wheat Project

Cereals are literally the staff of life with well over 50 per cent of world food supplied by these crops. In recent years, wheat has replaced rice as the world's largest cereal crop with production exceeding 400 million tonnes (metric tons) annually. As our largest agricultural export crop, wheat is vital to the Canadian economy and we produce about 24 million tonnes annually.

The primary goal of the University of Manitoba's cold crop wheat program is to make the widespread production of winter wheat possible on the Canadian Prairies. Winter wheat is planted in the autumn, gaining a head start in growth before freezing temperatures set in. It matures and is harvested the fol-



*Dr. Laurie Evans.*

lowing summer. Except for a small area in southern Alberta, however, conditions on the Canadian Prairies are too severe for winter wheat and the spring varieties, which are seeded and harvested in the same season, are grown instead.

According to Dr. Laurie Evans, head of Plant Science at the University of Manitoba and the project's wheat breeder, winter wheats have a number of advantages over spring varieties. Spring wheat on the Prairies must be grown in a short, 100-day frost-free season and so early maturing varieties are used. Unfortunately, the earlier a wheat matures, the lower its yield. In fact, for every day of growth beyond 100 days, Dr. Evans estimates that there is about a 1 per cent increase in yield.

The major advantage of winter wheat, then, is that by starting growth in the fall it effectively extends the growing season and increases yields. Dr. Evans projects that winter wheat yields would average as much as 20 to 25 per cent more than current spring wheat yields. So, while prices of winter wheat varieties are 5 to 10 per cent lower than spring wheats, the increased yields would still make it a more profitable crop.

The key problem in growing winter wheat on the Canadian Prairies is winter kill. Temperatures of less than  $-16^{\circ}\text{C}$  for five or six consecutive days will destroy tender shoots and roots just below the surface. Such cold conditions are virtually guaranteed to occur during Prairie winters. It has been discovered, however, that snow cover of approximately 12 cm or more will provide adequate insulation to maintain soil temperatures above  $-16^{\circ}\text{C}$  and permit the survival of winter wheat.

To grow winter wheat on the Canadian Prairies, then, a sufficient continuous snow cover during cold winter months must be assured. While snowfall on the Prairies is adequate overall, drifting and sudden winter thaws leave fields bare long enough for winter kill to occur. The solution to this problem, the University of Manitoba's wheat project has discovered, is the so-called "zero-tillage" system of cultivation.

Zero tillage research, headed by Dr. Elmer Stobbe, has been underway at the University of Manitoba for more than a decade. Conventional cultivation is a three-step pro-