World Geography
The Green Revolution in Mexico

Name:
Section:
Score: _____/5

Directions: Read the following article about the Mexican Agricultural Program (MAP) and answer the thought questions at the end.

The Mexican Agricultural Program


Dr. Norman Borlaug (standing) with students in Mexico, 1964. [Rockefeller Foundation]

In 1940, Henry A. Wallace had just been elected Vice President after serving as Pres. Franklin D. Roosevelt's Secretary of Agriculture. There was also a new president of Mexico, Ávila Comacho, and FDR sent Wallace as "Ambassador Extraordinary and Plenipotentiary" to attend the Mexican inauguration.

Wallace was an old plant breeder, and he had a little time before taking over his new job in Washington. So, Wallace drove his own Plymouth around the Mexico so that he could "get out and look at some corn if I feel like it." The Mexican people loved it. Wallace was the first official U.S. representative to attend a Mexican inauguration, yet he insisted on traveling among the ordinary people. Soon, thousands of people were waiting in villages to see him. He visited both subsistence and industrial farms, agricultural experiment stations and government officials. He was relentless in his questions. He found that it took a typical Mexican farmer at least 200 hours of backbreaking labor to produce each bushel of corn; in his home state of Iowa, it took the typical farmer 10 hours for every bushel of corn. Wallace came back convinced that modern agricultural technology could help Mexico out of poverty and hunger. But there were no U.S. government programs, yet.

There was the Rockefeller Foundation. Through the 1930s, the foundation had been supporting scientific research – particularly agricultural research – in China and Europe. When World War II began, those programs were dead for the duration of the war, however long that might be. So, the foundation began looking for new ways to further its philanthropic aims.

Wallace knew Nelson Rockefeller and many of the program officers at the foundation. In a series of discussions after his return from Mexico, Wallace convinced the foundation that they could make a big difference by supporting research to improve the productivity of corn (maize) and beans, traditional staples of Mexican agriculture and diet.

The new Mexican government, on the other hand, was interested in a program that would help move the economy into the Industrial Age. That meant that agriculture would have to move beyond subsistence farming – where farm families grew little more than they could consume on their own – to large scale, commercial enterprises using the latest machines, plant breeds and technology. The Comacho government was also interested in producing crops that could be exported to the rest of the world, supplying much-needed foreign currency. That meant that they should find ways to grow more wheat where there was a well-established export market in place. Fewer farmers growing more wheat would also mean that people would move from rural areas to the cities to become workers in the new factories.

In 1943, the Rockefeller Foundation worked out an agreement with the Mexican government and the Mexican Agricultural Program (MAP) was established. U.S. scientists would come down to Mexico, set up a plant breeding program, distribute new hybrid varieties of maize and wheat, train farmers how to use them, and train new plant scientists from Mexico and (eventually) around the world.

MAP actually began work in 1943 at a site just outside of Mexico City. The program was headed by J. George Harrar. His corn breeder was Edwin Wellhausen, and Dr. Norman Borlaug joined the program to develop

varieties of wheat that would resist the deadly disease of wheat rust. Rust is a fungus whose spores can travel thousands of miles in the wind and devastate crops wherever they land.

Borlaug approached the task of developing rust-resistant wheat varieties by importing seeds for various rice varieties from friends and colleagues from around the world. As with other plant breeders, Borlaug would then carefully cross various varieties that seemed to offer the best potentials. There were at least four things that were different about Borlaug's approach –

Borlaug quickly moved beyond the problems of wheat rust to tackle the basic problem of increasing yields under modern growing conditions and technologies.

He realized that there were two growing regions in Mexico that could be used successively to cut the time needed to breed new varieties in half. This approach became known as "shuttle breeding."

He recognized that an unintended benefit of the shuttle breeding was that the resulting varieties resisted many different varieties of pests and diseases and they didn't care how long the days were during their growing season. A wheat plant that is insensitive to "photoperiod" can adapt well to a wide range of conditions.

He was determined to get the word out – to diffuse the innovations – to Mexican farmers and to student plant scientists around the world.

Yields

First, Borlaug tackled the problems of the wheat rust that was cutting down yields. Between 1943 and 1958, Mexico went from a nation that had to import wheat to feed its people to a nation that exported wheat to other nations. Then, Borlaug turned to more basic problems of wheat yield.

Wheat is perhaps the major staple of diets around the world. It has more protein than rice, maize or sorghum and can be grown in a variety of climates. But as farmers began using more and more fertilizer they discovered that traditional tall varieties of wheat started to "lodge" or fall over before they could be harvested. The fertilizer encouraged taller plants with heavier heads, but the stems were too thin to support the extra weight.

Borlaug knew that there were Japanese "dwarf" varieties of wheat whose short stalks were able to hold up high-yielding heads. In 1953, MAP got a small amount of a dwarf hybrid from Washington State University and Borlaug began breeding that variety with local varieties. There were a lot of failures – crosses that were sterile or whose heads shattered. But by 1960, MAP released two semi-dwarf varieties that were adapted to growing conditions and diseases in Mexico.

Over the next 20 years, many new varieties were released. Because of these new varieties, Mexico was able to grow enough for its own needs between 1956 and 1971. Then, the population monster caught up again. Between 1940 and 1980, the population ballooned more than three times over. Average yields and overall wheat production in Mexico have continued to grow. But there is no new land appropriate for planting wheat, and so the increases in population have outpaced the increases in yields. Though it is importing wheat again, Mexico does not face massive hunger.

Research methods

Borlaug and his colleagues were able to quickly improve the wheat harvests in Mexico because they found two shortcuts. Conventional breeding programs in the 1940s and 50s required 10 to 12 years to produce a new variety. It took seven years – or seven breeding cycles – to find better hybrids, and then three to five years to test the variety and grow enough to distribute to farmers. Borlaug knew that they had to produce results quickly, so he made an educated guess that two varieties from Kenya and two from the U.S. were the best candidates for yields and disease resistance in Mexico. Within four years, MAP held their first "field day" where farmers were invited to see the results of the new varieties. These first hybrids were a little better than the traditional wheat varieties, and later ones got a lot better.

The second shortcut started when Borlaug realized that he could get two breeding cycles out of every year. MAP had inherited two research stations in different parts of the country. The first was in the Sonora region in the northwest part of Mexico (south of Arizona). This region was at sea level and was warm enough to allow for a good winter growing season. The second experiment station was in the Chapingo region in the mountains north

of Mexico City. Because of the elevation, it was cool enough in the summer to allow for a second growing season.

Borlaug's team would make one set of hybrid crosses in Sonora and grow the seed there. Those seeds would be harvested and then shuttled back down to Chapingo where the next set of crosses would be made. Using this "shuttle breeding" approach, the team produced new varieties in as little as three years instead of the 10 needed in other places.

Diffusion

The best seed varieties in the world do little good unless they are adopted and planted by local farmers who then follow the best growing practices. This is the process of diffusion of innovation. So, when they were ready to introduce their first new hybrid variety of wheat in 1948, Borlaug went to the local newspaper and announced a "field day" with free barbeque and beer. "We only got about 25 people," he says, "and 22 of them were bureaucrats… And maybe only three farmers, and they were probably the three poorest farmers in the valley. They came for the free barbeque and beer."

But the farmers around the experiment station saw the results, and the next year there were a lot of farmers and good farmers. Then the task became convincing them that fertilizers were worth the cost. Gradually, that message got through as well.

As Mexican farmers began to produce more, they were faced with the problem of storing the extra grain. Don Freeman of York, Nebraska, was one of the Americans who became involved in building grain storage bins in Mexico. His company built storage bins in areas that still needed roads, but the bins enabled farmers to join the world market. "I think they were jumping over all the development that we [American farmers] did, right into modern farming."

Then Borlaug and his colleagues turned their attention to the world. They were aware of President Truman's warning about famine threatening half of the world. The MAP had been able to produce good results. So, with the approval of the Mexican government, and with interest from other governments, MAP began training plant scientists from around the world. Each year, up to 50 students from every continent on the globe gathered in Mexico to work along side of the U.S. scientists and learn the most modern methods of plant breeding.

Modern agriculture had now been successfully exported from the U.S. to Mexico. The stage was set to export it again to India, Pakistan and the rest of the world.

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Thought Questions:

1. What was the influence of the United States Vice President Henry Wallace and the Rockefeller Foundation in the development of agriculture in Mexico?

2. What was the goal of agricultural development in Mexico through the actions of President Avila Comacho and programs like MAP?

3. What did MAP actually do to actually begin the process of increasing Mexico's wheat yields? Make sure you talk specifically about the specific breeding techniques and the staff and techniques used.

4. Who was Norman Borlaug and why was he so important to MAP?

5. What were the challenges MAP faced and how were they able to overcome them?

6. What types of shortcuts did Borlaug use and how were they beneficial?

7. Explain the process of diffusion of the farming techniques once MAP had proved successful at their research sites.

8. Using your own ideas and information from the reading fill out the E.S.P.N. Chart below of the impacts of MAP

Economic	Social
Political	Natural