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Improving the Chile Industry of New Mexico Through Industry, Agriculture Experiment Station, and Cooperative Extension Service Collaboration: A Case Study

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Abstract: Chile growers and the Agricultural Research and Cooperative Extension Services at New Mexico State University have a long history of collaboration to sustain the chile industry. This case study identifies and documents the methodology of creating collaboration among the Agriculture Experimental Station, Cooperative Extension, and growers to solving local, regional, and global challenges in a specialty crop. A new paradigm has been created with the formation of a research-team approach with long-term funding guaranteed and the New Mexico Chile Growers Association's direct involvement to determine the allocation of research funds to the team and other funding requests.

Introduction

The Morrill Act of 1862 and Hatch Act of 1887 provided the establishment of agriculture research and teaching universities in every state and territory. Later, the Smith Lever Act of 1914 provided for the establishment of the Cooperative Extension Service with an aim of transferring research results directly to farmers. In the state of New Mexico, Extension functions with a county Extension agent as the first contact with the public, and statewide or region-wide Extension specialists support him or her. County Extension agents also act as an important link between university researchers and farmers. In spite of some difficulties reported in literature (Amanor & Farrington, 1991; Kaimovitz, 1991), county Extension agents are effective in bringing the research results to a farm and making researchers aware of the local and regional problems faced by farmers.

Some of Extension-research activities are funded by commodity commissions that assess fees on a commodity to support research and Extension activities. The leaders of the commission also interact directly with researchers to identify critical problems. One such example is the California Specialty Crops Council (CSCC, 2007), a coalition of over 18 commodity organizations that was formed to serve as a resource to growers and researchers working in the agriculture sector. A similar commission also exists in the state of New Mexico that serves as a liaison between chile researchers and chile growers.

New Mexico is the largest chile pepper producer in the U.S., and this commodity annually contributes $50 million to the economy of the state (Gore, 2005). Over the past several years, the New Mexico chile industry has faced several production problems, including a sharp decline in production in certain parts of the state (according to chile processors data) mainly due to diseases. New Mexico chile industry is also facing serious competition for U.S. markets from other countries, notably China, India, and Mexico, which have a large pool of cost-effective labor (Diemer, Philips, & Hillon, 2004).

Objectives

This case study reported was undertaken to document the methodology for a new paradigm of creating collaboration among the New Mexico State University (NMSU) Agriculture Experimental Station, Cooperative Extension Service, and growers to solve local, regional, and global challenges associated with a specialty crop with the ultimate goal to prevent the demise of the specialty crop industry of New Mexico from global competition.

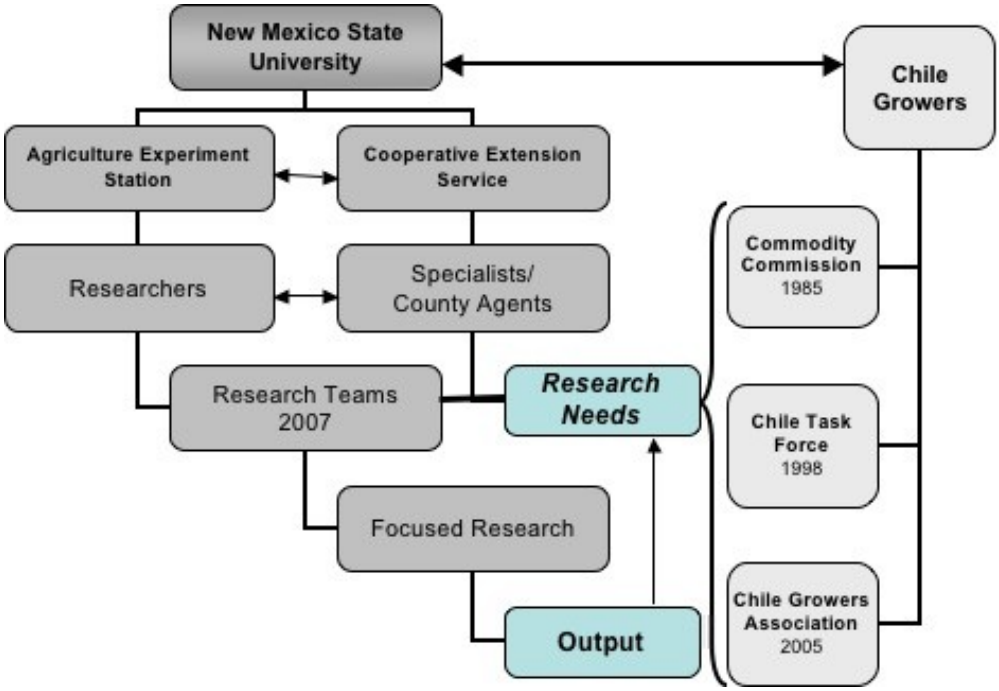
History of Chile Program at NMSU

NMSU has the longest continuous program of chile pepper improvement in the world. The chile pepper breeding program started in 1888 when Fabian Garcia began to hybridize chile peppers. In 1913, a new smooth pod type variety of chile, 'New Mexico No. 9,' was released. During 1960s, another variety of chile, 'New Mexico 6-4,' was released, which was the impetus for the start of the Mexican food industry in the United States. Other releases by chile breeders at NMSU occurred as the chile industry expanded in the state of New Mexico (Bosland, Iglesias, & Gonzalez, 1990; Bosland, 1992; Bosland, Iglesias, & Gonzalez,, 1993; Bosland, Iglesias, & Gonzalez, 1994; Bosland & Votava, 1998).

An organization called "Connoisseurs of red and green chile" was formed by the New Mexico Department of Agriculture in early 1970s. However, they did not have money to support research. Consequently, chile growers established the New Mexico Chile Commodity Commission in 1985 through enabling legislation in 1983 (Figure 1). The Chile Commodity Commission uses check off money ($0.50/ton of chile on wet weight

basis sold by a farmer) to support marketing, research (especially breeding programs), and interacts with NMSU to solve production problems (Lucero, personal communication, 2008). In 2008, the check off money contributions were raised to $0.625/ton on wet basis (Lucero, 2008).

Figure 1.
Flow Chart of Chile Growers and University Interaction



At the request of the chile industry, a Chile Task Force (CTF) was established in 1998 (Figure 1), comprised of NMSU researchers, Extension personnel, growers, and processors, with about 90 members (Diemer, Philips, & Hillon, 2004). The mission of CTF was to conduct additional research on developing best management practices (BMPs), mechanical harvester, and mechanical cleaning of machine-picked chile. The New Mexico Chile Commodity Commission also helped establish the CTF by appropriating seed money. The CTF worked with the university to secure funds from the U.S. Department of Agriculture, Agricultural Research Service and the state legislature to fund the task force.

In 2005, the CTF was reorganized as the chile industry started to concentrate on non-production problems such as marketing and worker compensation, and the New Mexico Chile Growers Association was established to take over the activities of the CTF (New Mexico Chile Growers Association, 2007). These groups were formed to provide a platform for effective interaction with the New Mexico Agricultural Experiment Station (AES), Cooperative Extension Service (CES), and chile growers. Research teams were formed in 2007, and focused research activities started in the same year with the direct involvement of AES, CES, and Chile Growers Association (Figure 1).

Within NMSU, CES conducts the outreach program with the chile growers. During this communication, research problems are identified, and research is conducted by the New Mexico AES researchers. The research results and recommendations are then conveyed to the growers by CES. AES as well as CES are directly involved in research, Extension, publications, distribution of research funds, and coordination among different agencies, commissions, and Extension and research personnel.

Industry University Coordination

Setting Up Research Development Priorities

Since the inception of the interaction between the chile growers and the university, the chile industry has supported the chile pepper breeding program. One example is the project initiated at the request of the New Mexico Chile Commodity Commission on improving two older varieties, 'NuMex Big Jim' and 'New Mexico 6-4,' for higher yield, uniform heat levels, and improved fruit qualities for the southern New Mexico production area.

In 1992, *Phytophthora capsici* disease became a major concern of the chile industry. With the help of the chile industry, NMSU obtained $250,000 of recurring research funds from the state legislature for the AES to conduct research on *Phytophthora* control, development of resistant varieties, and improved BMPs. The number of projects funded ranged between eight and 14 per year and were small in nature, with funds sufficient to support one graduate student per funded project. The allocation of funds was made in such a way that the breeding program received about 23% of the research funds. The remaining 77% supported other research areas, including entomology (23%), specialty breeding programs involving development of *Phytophthora* resistant varieties (8%), genetic engineering for developing Roundup-Ready chile (8%), mechanical harvesting (6%), chemical composition of peppers (8%), and BMP research (23%). The chile breeding program received funds every year, while other projects changed year to year based on the response of the researchers to the call for proposals.

Research Extension Outputs

On farm research in NMSU often involves active collaboration between researchers and Extension personnel (see Figure 1). The results of the research and Extension carried out by CTF on various aspects of chile production are summarized in Table 1 (Abernathy, Hughs, & Eaton, 2007). One of foci of the CTF was to highlight chile research by encouraging research and Extension publications. New Mexico CES published articles on several aspects, ranging from chile food preparation to commercial and home garden chile production. Of the 196 Extension guides related to chile, 45 are horticulture guides for the growth of chile (<http://cahe.nmsu.edu/pubs/taskforce/> retrieved April 28, 2008), 16 deal with the economics of chile production, 18 are about food processing, and the rest cover all aspects of knowledge of chile. Consequently, interaction among New Mexico Agriculture Experiment Station, Cooperative Extension Service, chile growers, and New Mexico Chile Commodity Commission has resulted in quality research and publication of reports and Extension guides on several aspects of chile production. Several of the reports were subsequently published in peer-reviewed journals as well (Bosland & Votava, 1998; Wall, Walker, Hughs, & Philips, 2003; Diemer, Philips, & Hillon, 2004).

Table 1.
List of Reports Generated as Extension Publications from the Chile Task Force (2002-2008)

Area of Research and Extension	Number of Reports
Farm labor issues	2
Global competition	1
Integrated pest management.	2

Seed quality and germination	2
Guidelines for chile production	3
Economics of chile production	8
Machine-harvesting, processing and cleaning	11

Without the financial support and guidance from the chile growers, the university likely would not have been able to undertake this challenge at the same level of activity. As an important part of the interaction and support by the chile growers, the Extension Service organizes the annual New Mexico Chile Conference. This conference was started in 1986 in response to the chile growers' need for current information about chile production. The conference showcases the research and Extension outputs including new varieties developed over the past one year.

Agricultural Experiment Station Response to a New Industry Request

In 2006, almost a year after the reorganization of the CTF, the industry again approached the university with the observed problem of yield decline (reportedly from 5,300 kg/ha to 3,125 kg/ha), especially on farms that were under chile production for several years. As a result of the growers' request, the Director of the Agriculture Experiment Station organized a meeting of research and Extension personal and support staff involved or interested in research on chile-pepper production. A second meeting was organized involving the chile industry representatives as well. One of the main outcomes of the two meetings was the recognition of the need for a multidisciplinary research effort (Figure 1). As a result, a team of eight researchers and Extension specialists was formed, and initial funding was given to collect and analyze soil samples from some farmers' field where yield decline was reported.

This team approach required a change in research funding procedures from a year-to-year basis to 5-year funding for the research team. Consequently, the method of selecting projects to be funded was also changed in response to the growers' concern. In the past, chile proposals had been evaluated by the department heads and the Agricultural Experiment Station director, and projects receiving higher priorities were funded. The selection method was changed to have the Agricultural Experiment Station director interact with the chile growers to prioritize and decide the level of funding allocated to the team and individual projects. In the past, chile growers were not involved in the decision-making process that allocates funds, and this new paradigm created a different dynamic between the growers and the university.

For the first year of the team's existence, 69% of the total research dollars were allocated to the interdisciplinary team, while the rest of the funds went to the chile breeding program. Consequently, with the new allocation approach no funds were made available to conduct research on some areas typically funded on an annual basis, such as beet curly top virus epidemiology, development of a glyphosate resistance gene, impact of soil temperature on chile planting date, and *Phytophthora* propagation. The new paradigm will test the hypothesis that allocating research dollars to interdisciplinary teams with direct involvement of the Chile Growers Association is key to setting up long-term research goals and to saving the chile industry in the state of New Mexico.

Summary

New Mexico State University started research on chile in 1888 that continues to this day. The university has been instrumental in the formation of a New Mexico Chile Commodity Commission, Chile Growers Association, Chile Task Force, and chile Extension activities. The research and Extension personal at New Mexico State University have secured, in conjunction with the chile industry, long-term research funds and short-term Extension funds. Funds allocated for both research and Extension by the New Mexico Chile Commission and the Agricultural Experiment Station have encouraged cooperation between the entities and resulted in a more productive institution.

The close collaborations among researchers, Extension personnel, growers, and industry personnel have played a key role in the overall growth of the chile research and production in the state. A new paradigm has been created with the formation of a research-team approach, with long-term funding guaranteed and the New Mexico Chile Growers Association playing an active role in determining the allocation of research funds to the team and other individual funding requests while simultaneously continuing funding for chile breeding program at the New Mexico State University.

Acknowledgement

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