FOREWORD

The members of Penn State's Agricultural Economics faculty are pleased to again present a review of recent trends and current issues affecting Pennsylvania agriculture and of its prospects in coming years. This year's volume, "Pennsylvania's Agricultural Economy: Competing for Resources and Markets in the 1990s," examines a variety of current production and marketing issues.

Included in this volume are papers on pesticide, water and labor issues affecting farmers and food processors. Other papers focus on the impact of BST and the impending North American Trade Agreement on milk producers. The role of agricultural cooperatives in encouraging rural development is examined in another paper. Also included are reports on the outlook for key Pennsylvania commodities including dairy, poultry, livestock and grains, ornamentals and horticultural and fruit crops.

We again are indebted to Jane Mease for preparing the volume. Her expert work on design, layout and compilation were critical in pulling manuscripts, tables and charts together within a brief time span. Tura Eisele and Isabel Hoover again played a key role in developing many of the visuals.

Our thanks to all those who contributed to the success of this effort.

Robert O. Herrmann
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REGULATION OF PESTICIDE USE: IS IT FEDERAL, STATE AND LOCAL REGULATION?

John C. Becker*

INTRODUCTION

A difficult contemporary problem facing landowners and business owners and operators is compliance with various regulations that influence their decisions. Important matters such as use of resources and materials, employment decisions, or the performance of activities at specific sites are common examples. Some who are subject to regulations find them tolerable, while others view them as a serious intrusion into the realm of protected rights of property owners.

When two or more levels of government choose to regulate the same activity, some in the regulated community question the need for additional regulation or even the legal authority supporting it. If one level of regulation is complete and effective for the need to be served, what purpose is served by having a second, or even a third level of regulation imposed? Those who are regulated may not complain about complying with one set of regulations, but a second or third level, which may duplicate the first in some ways, is bound to provoke a negative reaction.

The federal form of government in the United States is built on the premise that each level of government has a specific role to play. In some problem areas, authority of government to intervene in an issue is limited on grounds that the matter under consideration is exclusively within the jurisdiction of only one level of government. The supremacy clause of the United States Constitution, article VI, clause 2, recognizes the potentially serious problem of one level of government interfering in an area of responsibility of another level of government. Although the Constitution recognizes the potential seriousness of this problem, it has not put the problem to rest. In recent years regulations of the U.S. Department of Labor's Occupational Health and Safety Administration and Pennsylvania's Department of Labor and Industry have impacted on employer responsibility to share information with workers facing hazards in their local work environment. Regulation of pesticide use by local government is the most recent example of one activity that could face regulation by federal, state and local governments.

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WISCONSIN PUBLIC INTERVENOR V. RALPH MORTIER, 59 U.S.L.W. 4755 U.S. JUNE 21, 1991, (No. 89-1904)

In 1985, the town of Casey, Wisconsin, a small rural community in Washburn County, adopted ordinance 85-1 to regulate use of pesticides within the town. In adopting the ordinance the town board exercised authority granted to it by Wisconsin law to manage and control activities for the benefit of the public health, safety and welfare of its citizens. In preparing the ordinance, the town board borrowed language from the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA), 7 U.S.C. section 136 et. seq., and state law, Wisconsin Statutes section 61.34(1) and (5). The town's ordinance requires a permit for application of any pesticide to public lands, to private lands subject to public use or for aerial application of any pesticide to private lands. Applicants for a permit must file a form that describes their proposed pesticide use not less than 60 days before the desired use. The town board acts on the application and has authority to deny the permit request, grant the permit, or grant the permit with reasonable conditions that relate to the protection of the health, safety and welfare of the town residents. If a permit is granted the ordinance requires the permit holder to place placards giving notice of the proposed pesticide use and of any label information prescribing a safe reentry time. Violators of this ordinance are subject to fines of up to $5,000 for each violation.

Ralph Mortier applied for a permit for aerial spraying of a portion of his land. The town granted him a permit, but prohibited aerial spraying and limited the permit authority to only a portion of his land. In light of these restrictions, Mortier filed suit against the town charging that the town's regulation was pre-empted by both state and federal law, particularly FIFRA and Wisconsin statutes sections 94.67-974.1. The Wisconsin Public Intervenor, an assistant attorney general of Wisconsin charged with protection of environmental public rights, was admitted to the litigation to defend the town's ordinance and the basis on which it rests. At trial, the court held in favor of Mortier on grounds the town's ordinance was pre-empted by FIFRA and state law. The Supreme Court of Wisconsin affirmed the trial court concluding that FIFRA pre-empted the town's ordinance as its text and legislative history demonstrated a clearly manifest intention to prohibit any regulation of pesticide use by local government. This decision was in agreement with two earlier decisions brought in other states, but in conflict with decisions of two state supreme courts which upheld state laws in the face of similar challenges. In this context, the United States Supreme Court recognizing the importance of the issue and the divergent decisions in other states and chose to accept the case for review under its discretionary review authority.

In its decision of June 21, 1991, the court reviewed several issues that surround Mortier's claim that the town's attempt to regulate pesticide use through this ordinance is pre-empted by FIFRA. Pre-emption of a state law by federal law is a matter of determining Congressional intent in passing the federal law. A federal statute can pre-empt state authority to regulate an area by expressly stating so. Intent to pre-empt state authority can also be implied if a scheme of federal regulation is so pervasive that it is reasonable to infer that Congress left no room for the States to supplement federal

regulation. If federal interest in a field is so dominant that the federal system is assumed to preclude enforcement of state laws on the same subject, or if the goals sought and the obligations imposed reveal a purpose to preclude state authority, intent to pre-empt state authority can be implied. In beginning the analysis, a presumption arises that federal law is not intended to pre-empt state law unless there is a clear and manifest purpose to do so.

Pre-emption can also occur in the absence of an express or implied intent to preclude state authority where federal and state laws conflict to such a degree that it is physically impossible to comply with both laws at the same time. For example, if state law permits an act which federal law prohibits, compliance with both laws is impossible. Therefore, federal law pre-empts the inconsistent state law. A similar situation in which federal law pre-empts state law arises when state law stands as an obstacle to the accomplishment and execution of the full purpose and objectives of Congress. When state statutes work against enforcement of federal statutes, state statutes will be pre-empted.

EXPRESS INTENTION TO PRE-EMPT STATE AUTHORITY

In The Wisconsin Supreme Court opinion reviewing the Casey ordinance, the court noted FIFRA's specific reference to the authority of states, 7 U.S.C. section 136v:

> "(a)... A State may regulate the sale or use of any federally registered pesticide or device in the State, but only if and to the extent the regulation does not permit any sale or use prohibited by this subchapter.
>
> "(b)... Such state shall not impose or continue in effect any requirements for labelling or packaging in addition to or different from those required under this subchapter."

The Wisconsin Supreme Court found this provision to be indicative of a pre-emptive Congressional intent. Also significant in the Wisconsin Supreme Court's decision is reference to the term "state" which is used throughout section 136v. FIFRA defines the term "state" as, " a State, the District of Columbia, the Commonwealth of Puerto Rico, the Virgin Islands, Guam, the Trust Territory of the Pacific Islands and American Samoa.", 7 U.S.C. section 136 (aa). Does this definition exclude minor political subdivisions such as the town of Casey?

In its analysis, the United States Supreme Court concluded that neither the language of section 136v nor the definition of "states" justify inferring that Congress expressly intended to pre-empt state authority to regulate in this field. Section 136v plainly authorizes "states" to regulate pesticides and just as plainly is silent with reference to local governments. Mere silence, in this context, cannot establish a clear and manifest purpose needed to pre-empt local authority. Even if FIFRA's grant of authority is read to

apply only to "states", local municipalities could still claim the right to regulate an area, provided their efforts do not violate other pre-emption principles.

Taking a more substantive view than a literal view, the court noted that local government units are created as convenient agencies for exercising governmental power of the State. Exclusion of political subdivisions cannot be inferred from the express authorization to states, because political subdivisions are components of states, the very entity the statute empowers. The court found that a more plausible reading of FIFRA's authorization to the states in section 136v(a) leaves the allocation of regulatory authority to the "absolute discretion" of the states themselves, including the option of leaving local regulation of pesticides in the hands of local authorities.

Before the United States Supreme Court, Mortier argued that the Wisconsin Supreme Court's decision should be affirmed on the basis that the legislative history of FIFRA provides evidence of the congressional intent needed to establish pre-emption. Reviewing the history, the court noted that although Congress was unwilling to grant local political subdivisions authority to regulate pesticide use, it would neither prevent States from delegating their authority to political subdivisions nor prohibit local regulation entirely. Reviewing the legislative history also uncovered interesting conflicts. Although the Senate Agriculture Committee's version of the FIFRA bill did not prohibit local governments from regulating pesticides, the committee's report stated explicitly that local governments could not regulate pesticides in any manner. To counter the language in this report, the Senate Commerce Committee offered an amendment specifically authorizing local regulation, but the amendment was rejected in negotiations between the two committees. On the basis of its own review, the United States Supreme Court concluded that the principal committees responsible for the passage of FIFRA disagreed whether the act pre-empted pesticide regulation by political subdivisions. In its view, the legislative history fell short of establishing pre-emption of local pesticide regulation as the clear and manifest purpose of Congress in enacting section 136v.

IMPLIED INTENT TO PRE-EMPT STATE AUTHORITY

As mentioned above, the intent to pre-empt state authority can be inferred in certain situations. In the case of FIFRA's impact on state authority, the United States Supreme Court concluded that the intent to pre-empt state authority could not be inferred. Section 136v describing the authority of states undercuts that implication. For example, if Congress intended to occupy the entire field of pesticide regulation, section 136v(b) which prohibits labeling or packaging requirements that are in addition to or different from those found in FIFRA would be mere surplusage in the act. In the court's view, FIFRA's regulatory scheme was not so pervasive as to make reasonable the inference that Congress left no room for the States to supplement its provisions. On the contrary, the statute leaves ample room to supplement federal efforts. For example, FIFRA does not seek to establish a permit scheme, such as that developed by the town of Casey. Likewise, it does not equate compliance with FIFRA registration and labeling requirements

with a general approval to apply pesticides throughout the United States without regard to regional or local factors, such as climate, population, geography, and water supply.

FIFRA's regulatory scheme and that adopted by the town of Casey are not so inconsistent with each other that compliance with both is a physical impossibility. For the reasons stated above, FIFRA section 136v(a) offers states the authority to regulate the sale and use of pesticides, but only if state regulation does not permit any sale or use prohibited by FIFRA. Under 136v(b), states may take other regulatory steps, but may not adopt labeling or packaging requirements that are in addition to or different from those adopted by FIFRA. Clearly, compliance with FIFRA provisions and those envisioned by these sections would be possible.

In its holding the United States Supreme Court stated that FIFRA does not pre-empt the authority of the town of Casey, Wisconsin to regulate the use of pesticides within its borders through the adoption of a permit system, such as that described in ordinance 85-1. The Court remanded the case to the Wisconsin Supreme Court for proceedings on the question of whether Wisconsin law has withheld from local governments the authority which FIFRA plainly gives to states.

LEGISLATIVE RESPONSE TO WISCONSIN V. MORTIER

As United States Supreme Court cases are often high profile issues that generate significant interest and publicity, the specter of wide ranging regulation of pesticide use by local communities across the country prompted a coalition of state, regional and trade associations to move the adoption of a legislative response to the Wisconsin decision. On November 21, 1991, HR 3850 was introduced in the House by Representative Hatcher of Georgia. This bill, would amend FIFRA by expressly pre-empting local government authority to regulate the sale and use of pesticides in their communities. In the Congressional Record of November 22, Representative Hatch stated, "The federal and state governments are best equipped to develop and administer a sensible, uniform regulatory program that will ensure the public continues to enjoy the benefits of access to tested and proven pesticide products" (p. E3983).

On November 26, 1991, a companion bill, S2085, was introduced in the Senate and sponsored by Sens. Mitchell of Mississippi, Bond of Missouri, Shelby of Alabama, Pryor of Arkansas, Dole of Kansas, Cochran of Mississippi and Boren of Oklahoma. Sen. Pryor, in remarks in the Congressional Record noted, "Almost 100 cities and towns and counties are considering adopting or have already adopted their own regulations. To date, no two are alike. Worse yet, many local jurisdictions have left technical, scientific and regulatory decisions in the hands of town engineers and parks department employees since they do not have EPA scientists at their disposal" (S18401). These bills have been titled, "The Federal-State Pesticide Partnership Act of 1991" and referred to committee.

IMPACTS OF THE WISCONSIN V. MORTIER DECISION IN PENNSYLVANIA

The most important impact of the Wisconsin decision for the several states is its reading that the FIFRA grant of authority to the states means that states have "absolute discretion" to decide if local political subdivisions should be given the authority to regulate pesticide use in their communities. If a state has this authority, it can choose to extend the authority or withhold it at the state level. Under Pennsylvania's Pesticide Control Act, 3 P.S. Section 111. 57(b), the General Assembly approached this issue with the following provision:

> "(b)...This act and its provisions are of Statewide concern and occupy the whole field of regulation regarding the registration, sale, transportation, distribution, notification of use, and use of pesticides to the exclusion of all local regulations. Except as otherwise specifically provided in this act, no ordinance or regulation of any political subdivision or home rule municipality may prohibit or in any way attempt to regulate any matter relating to the registration, sale, transportation, handling, or use of pesticides, if any of these ordinances, laws or regulations are in conflict with this act."

The only appellate level decision interpreting this provision is the Commonwealth Court decision in Borough of McAdoo v. Lawn Specialties, 547 A.2d. 1297 (Pa. Cmwlth. 1988). In Borough of McAdoo, the Borough enacted an ordinance that required Lawn Specialties to obtain a license before performing any professional lawn care work in the Borough. At the time, Lawn Specialties was licensed by the Department of Agriculture as a commercial applicator of herbicides, pesticides and insecticides to residential and commercial customers. Lawn Specialties argued that the Borough's attempt to regulate its activities by requiring a license to perform work which the Department of Agriculture already authorized it to perform was pre-empted by section 111.57(b).

Citing section 111.57(b), the Commonwealth Court stated the language in the section is explicit in its intent to pre-empt registration of companies using pesticides and the use of pesticides. Therefore, the Commonwealth Court concluded that the state intends to occupy the whole field of regulation of pesticides and pesticide use, thereby excluding attempts, such as that by the Borough of McAdoo, to regulate this area.

Although the Borough of McAdoo decision is fairly clear and direct, the United States Supreme Court's decision in Wisconsin raises several important questions concerning its meaning and significance.

First, Commonwealth Court reads section 111.57(b) in a broad and sweeping fashion. The Supreme Court read FIFRA more narrowly and was willing to recognize that while FIFRA did regulate use, the town of Casey's permit ordinance was not a regulation concerning use. Therefore, it could exist as a regulatory area not denied to states and their political subdivisions.

Second, Wisconsin clarified that states have the "absolute discretion" to decide if local political subdivisions have the authority to regulate local use. Pennsylvania has exercised that authority. Its ability to do so is confirmed by Wisconsin.

Third, how should the scope of section 111.57(b) be interpreted? On one hand it plainly states it intends to exclude all local regulations. In the last sentence, however, the statement is made that no local ordinance may prohibit or regulate the use of pesticides if the ordinance is in conflict with the act. If the ordinance chooses to regulate an area that the Pesticide Control Act does not regulate, the local ordinance will not be in conflict with state law. Therefore, it should be able to exist independent of state law. Since the Borough of McAdoo's regulation covered a wide range of services provided to residents of the Borough, and not only applying restricted-use pesticides, the argument can be made that the Borough's ordinance does not conflict with the Pesticide Control Act provisions. While the borough is asking Lawn Specialties to obtain a separate license to do business in McAdoo, it is a different type of license than the commercial applicator license obtained from the Department of Agriculture.

CONCLUSION

The United States Supreme Court's decision in Wisconsin Public Intervenor v. Mortier clarified the important question of the extent to which FIFRA intended to withhold authority of local governments to regulate pesticide use within their municipalities. In essence, its holding is that there is nothing express or implied in the act that reaches that result. If, however, state law withholds such authority from local municipalities, state legislatures are within the bounds of their authority to make that decision. As the provisions of section 111.57(b) and the Borough of McAdoo case illustrate, the question of how to interpret state legislative action is often difficult to answer. Would the Commonwealth Court have reached the same result in the Borough of McAdoo decision if it had the Wisconsin decision before it? I would argue that the narrowness with which the Supreme Court read the FIFRA language would enable the Commonwealth Court to find enough differences in state law and the ordinance to allow both to exist. Until Congress or the General Assembly act to modify federal or state law, the question remains an open one. To licensed users of pesticides that are approved for use in Pennsylvania, the question of whether there can be a local level regulation of their activities, in addition to federal and state regulation, is still an open question.

REFERENCES

Borough of McAdoo v. Lawn Specialties, 547 A 2d. 197 (Pa. Cmwlth 1988).

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NITROGEN FERTILIZER USE ON PENNSYLVANIA DAIRY FARMS

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Ground and surface water quality has become a serious policy concern in the United States and around the world. Industry, municipalities, and agriculture all have been identified as sources of pollution that adversely affects the environment. Much of the past policy attention has focused on the former two sources, largely because they can be identified readily and specific treatment facilities developed. Agricultural pollution sources are much more difficult to identify and control. In part, the pollution discharge from a farm normally is not concentrated at one site. Surface water and especially ground water pollution could occur from all the fields and can not be attributed to a particular source. In addition, the pollution can be quite variable depending on weather conditions. For example, soil erosion for a bare, tilled field increases with rainfall. If rainfall is minimal until the crop has emerged, erosion is greatly reduced. Despite these control problems, policy attention to agricultural pollution has been increasing as public awareness of its magnitude and effects has been increasing.

Nitrogen pollution from residual fertilizer and manure sources is currently perhaps the most prominent issue in agricultural pollution. In Pennsylvania, nitrogen fertilizer is largely used in producting corn used in feeding dairy cattle. Understanding and controlling nitrogen pollution therefore requires consideration of its use on dairy farms. Compared to cash grain farms, issues in nitrogen use are quite complex on mixed dairy/crop farms. Along with fertilizer, both manure and alfalfa production provide nitrogen. The quantity of this nitrogen available for crops, varies depending on manure management practices and the effects of weather on conversion of organic nitrates to forms usable by crops. Most of the corn produced is used as feed on the farm. Inadequate nitrogen for corn production can therefore affect feed availability. On the surface, fluctuations in feed availability seem little different than fluctuations in output for a cash grain producer--feed purchases fluctuate like crop sales. However, a dairy producer has to consider ration reformulations, changes in milk production per cow, herd size, replacements numbers and other management issues in addition to changes in corn output. This situation is exacerbated by the use of corn as a major forage source for dairy. Forage markets do not perform as well as grain markets, and silage markets are especially limited.

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* Professor of Agricultural Economics. This paper is a summary of a longer report currently being prepared. Brian Roach, James S. Shortle, Richard H. Fox and Douglas Beegle are coauthors on this report. Although the research described in the article has been funded in part by the United States Environmental Protection Agency under Grant Agreement No. CR-817470-02-0, it has not been subject to the Agency's peer and administrative review and therefore may not necessarily reflect the views of the Agency and no official endorsement should be inferred.

Dairy/crop farms therefore face numerous uncertainties in nitrogen management. Like cash grain farmers, needs of the crop vary from year to year due to variations in losses between application and crop use and also to variations in crop response to nitrogen. In addition, the dairy farmer must consider the variations in nitrogen availabe from organic sources. They must consider the impacts of feed variability on dairy herd management. Thus, it is plausible that dairy farmers have different strategies to manage nitrogen than crop farmers.

This presentation reports on an initial phase of research on optimal nitrogen fertilizer use on Pennsylvania dairy farms. The focus of the presentation is a report of results from a recent survey of dairy farmers on nitrogen management practices. The first section of the paper summarizes the survey methods. Results are then presented on issues important to nitrogen management: (1) feed production and purchases, (2) manure management, (3) nitrogen fertilizer use, and (4) nitrogen use from all sources. The paper concludes with a discussion of future research.

SURVEY PROCEDURE

The sample frame including over 30,000 Pennsylvania farmers was obtained from state records of required brucellosis testing of cows. About 80 percent of all farms in Pennsylvania raise some cows for beef or dairy (PA Agricultural Statistics Service, 1991). Thus, this population includes most Pennsylvania farmers that produce corn so both manure management and fertilizer practices could be investigated. A sample size of 1300 was chosen to obtain representative results and still consider the budget limits of the project. The sample was stratified to be representative of the distribution of farmers across Pennsylvania. Number of farmers in each county estimated by the Pennsylvania Agricultural Statistics Service (1991) was used for stratification.

The Total Design Survey Methodology was used (Dillman, 1978). The mail questionnaire included five general topics: general farm information, general corn field management, use of nitrogen fertilizers, manure management practices, and socio-economic characteristics of farmers. The initial mailing in mid-December of 1990 included a copy of the survey and a cover letter explaining the purpose of the study. A reminder/appreciation postcard was sent to the entire sample one week later. In mid-January of 1991, a third mailing was sent to all who had not yet responded to the survey. This mailing included another copy of the survey and another cover letter. A summary of returns is given in Table 1. Since the sample was taken from records which were a few years old, 248 individuals were no longer farming, and 133 could not be contacted. These individuals were not included in the response rate calculation. The effective response rate was 40 percent.

FEED PRODUCTION AND PURCHASES

The average size of farms among the survey respondents was 234.7 acres. Mean acres of land owned was 146.4 acres, and the mean acres of land rented was 88.3 acres. A total of 321 respondents (87.3%) owned land and 246 respondents (68.1%) rented land. Also, 199 respondents (53.6%) both owned and rented farm land. Respondents were asked to list the number of acres grown of 11 crops. The results of this question are given in Table 2. Nearly all respondents (90%) had corn for silage or grain. Over 80 percent of the farmers grew alfalfa hay. Average acreages were 66.6 for corn grain, 39.4 for corn silage and 54.6 for alfalfa. A large number of the respondents also had pasture. In addition, 74 farmers (19.9%) listed other crops not shown in Table 3. The most common ones listed were grass hay mixes (25 respondents) and tobacco (23 respondents).

Information was also obtained on animal numbers; these are included in Table 3. Only 82.7 percent reported dairy cows with an average number of 59.9. Some of the respondents may have included their dairy cows in the heifers (86.3%) or cattle and calves (31.8%). Other than cattle, the horses and mules were the most common animal category (30.7%). Many farms also had poultry (23.7%) and swine (13.7%).

Farmers were also asked about feed used for dairy animals. One question concerned use of eight different feed sources. The responses to this question are given in Table 4. Over 90 percent of the farms used alfalfa or other hay. Corn silage was also used on 87.1 percent and haylage on 62.44 percent of the farms. More farmers used ear corn than shelled corn. Quite a significant number (41.3%) used small grains. In addition to those sources listed, 57 respondents (17.4%) indicated that they used other dairy feed sources not listed in Table 4. The most common were roasted soybeans, complete dairy rations and distiller grains.

For each feed source, respondents were also asked to indicate how much was purchased and how much they produced themselves. The results of this question are given in Table 5. These data indicate that markets for forages are virtually nonexistent: 98 percent produce all their corn silage, 95 percent all their haylage, and 70 percent all their hay. In contrast, 86 percent buy all their soybean meal and a sizeable number buy corn grain. However, the most common response for all grains was that all was produced. Thus, crop production is crucial for these dairy farmers.

MANURE MANAGEMENT

Considerable research and extension attention has been given to manure management. As an example, McSweeny discussed this issue at an earlier conference (1990). Manure management is concerned with preventing nutrient losses so that its contribution to crops is maximized and contributions to water pollution are minimized.

The survey provided information on several aspects of current manure managerial practices.

Manure was applied by 319 respondents (95.5%) to an average of 55.6 acres of corn. Table 6 indicates the types of manure applied and the application rates. Not surprisingly, cow manure in solid form was the most common response. In addition to those listed in Table 6, 28 respondents (8.8%) indicated that they used some other type of manure, with horse manure being the most common.

Farmers were also asked how often they applied manure to their corn fields. A total of 29 respondents (9.1%) covered their fields less than every year, 42 (13.2%) every other year, 228 (71.5%) every year, and 20 (6.2%) more than once per year. A question was also asked about when manure was applied. The results of this question are given in Table 7. The largest number, 125 (38.2%), applied manure daily, and 70 (21.4%) respondents applied manure in the fall, winter and spring.

The form that farmers applied manure was also determined. Manure was applied only in solid form by 226 farmers (70.2%), 35 (10.9%) applied liquid manure which was not injected or incorporated into the soil, and 23 (7.1%) applied liquid manure which was injected or incorporated into the soil. Additionally, 38 respondents (11.8%) applied manure in both solid and liquid form. Farmers also indicated how soon they incorporated manure into the soil with the results given in Table 8. Over 60 percent of the respondents either waited more than six days to incorporate manure or did not incorporate it at all. This response is consistent with the timing of application.

A question about analyzing manure revealed that only 11.3 percent of farmers had their manure analyzed, normally by a private testing lab. Respondents were asked what they did with manure which they did not apply to their corn fields. The results of this question are given in Table 9. Most respondents (69%) applied manure to other crops while 21.5 percent applied manure only to corn. Lastly, responses to manure storage are given in Table 10. The large number of farmers without manure storage (33.1%) is consistent with the daily application method described above.

NITROGEN APPLICATION RATES

Total available nitrogen was calculated for three possible sources: fertilizer nitrogen, manure, and previous legume crops. Available nitrogen could be estimated for each of the rotations listed in the survey: continuous corn, corn the first year after alfalfa or clover, corn the second year after alfalfa or clover, corn after soybeans, and corn after small grains. Manure application rates were not obtained by rotation. Thus, available nitrogen from manure was assumed to be constant for each rotation. Since about 60 percent of farmers did not apply manure to all their corn fields, application rates across rotations are likely to differ for most farmers. As these differences are not documented in the survey data, this limitation of the analysis should be kept in mind.

The nitrogen fertilizers were given by respondents in terms of pounds of nitrogen per acre for anhydrous ammonia, urea, ammonium nitrate, ammonium sulfate, and liquid nitrogen and are reported in Table 11. One of these forms was used by 212 farmers (63 percent of those who responded to the question). Of these, about 82 percent used only one of the fertilizers, 16 percent used two of the fertilizers, and only 1 percent used three or more. Liquid nitrogen was the most common (33%), and urea second (30.7%). The fertilizer nitrogen for each rotation for those who used only one fertilizer type was directly taken from the survey. If more than one fertilizer was listed as being used, inspection revealed that most of these cases involved farmers who applied different nitrogen rates to different corn fields even for the same rotation. The alternative sources may have been in response to differences among fields. With multiple sources, the highest application rate listed was used to estimate available nitrogen. The average available fertilizer nitrogen to corn in each of the rotations is given in Table 12. As expected, fertilizer nitrogen applied to corn after alfalfa/clover and soybeans is lower than the continuous corn and corn after small grains rates. However, the rate for corn the second year after alfalfa or clover is nearly as high as the rate for continuous corn.

Nitrogen available from manure took into account several factors. Respondents listed the amount of manure applied to corn fields in terms of tons/acre (for solid manure) or gallons/acre (for liquid manure). They also listed the type of manure they used, how often they covered their fields with manure, and how soon they incorporated the manure into the soil. Information from the **Penn State Agronomy Guide** (1989) was used to determine normal nitrogen content of the various manures as:

	Solid form	Liquid form
Cow manure	10 lbs./ton	0.028 lbs./gal.
Hog manure	14 lbs./ton	0.035 lbs./gal.
Poultry manure	50 lbs./ton	0.140 lbs./gal.

Manure loses nitrogen content when it is not immediately incorporated into the soil. **The Agronomy Guide** indicates that only a certain percentage of nitrogen will remain in the manure depending on the length of time until incorporation. The following adjustments were made to nitrogen amounts according to the length of time until incorporation:

Days until incorporation	Hog & cow manure	Poultry manure
Less than two	0.50	0.75
Two to six	0.35	0.40
More than six	0.25	0.20
No incorporation	0.20	0.15

Finally, an adjustment was made according to how often the respondent covered corn fields with manure. According to **The Agronomy Guide**, if the respondents applied manure every other year, available nitrogen from manure was adjusted upwards by 15 percent. If the respondent applied manure every year, then manure nitrogen was

increased by 25 percent. The average available nitrogen from manure sources was 68.2 pounds per acre. Figure 1 presents the sample distribution of available manure nitrogen. Over half of the farmers applied less than 50 pounds of nitrogen from manure sources. Nearly 15 percent applied manure in excess of 100 pounds of nitrogen.

The third source of available nitrogen was residuals from previous legume crops. Using values from **The Agronomy Guide**, if alfalfa or clover was grown on the field in the previous year then 100 pounds of nitrogen per acre is available. If alfalfa or clover were grown on the field two years ago, 50 pounds of nitrogen is available. If soybeans were grown on the field the previous year, 35 pounds of nitrogen was available.

Nitrogen from these three sources were added together to calculate estimates of total nitrogen available to corn in each of the five rotations. The average values are given in Table 13. If farmers consider all sources, the total values should be similar in all rotations. The higher average for the legume rotations suggest that all farmers do not consider the nitrogen carryover from the legume crops in their nutrient management programs. The distribution of fertilizer nitrogen compared with the distribution of total available nitrogen is illustrated for continuous corn in Figure 2. The largest category of farmers (nearly 40%) apply 51-100 pounds of nitrogen in fertilizer. Over 20 percent have 101-150 and 151-200 pounds of total nitrogen available. Some of the extreme values are probably response errors. It is clear that most of the high values are from manure applications--only a small percentage applied more than 150 pounds of nitrogen. Distributions for the other corn rotations have a similar pattern.

CONCLUSIONS

The survey confirms several common viewpoints concerning nitrogen management among Pennsylvania dairy farms. Most Pennsylvania dairy farms produce almost all of their forage, especially corn silage and haylage and to a lesser extent hay. The legumes do provide residual nitrogen for corn and other crops. However, having sufficient nitrogen for corn silage is an important management issue. Manure management is not at the levels recommended by many experts. Many in the sample did not have storage facilities, few tested their manure, and even more did not incorporate the manure quickly after application. As Figure 2 illustrates the levels of nitrogen available from fertilizer, manure and legumes were quite high for many farmers. However, fertilizer rates did not have as large a magnitude. Thus, farmers seem to be discounting the nitrogen available from manure and legumes. The nitrogen from these farm sources is not completely ignored--fertilizer rates were lower for corn immediately after alfalfa and nearly 50 percent of the farmers applied less than 100 pounds of fertilizer nitrogen to continuous corn. Given the manure management methods, discounting the nitrogen from the source seems reasonable. In addition, mineralization of organic nitrogen is a uncertain process.

Overall, survey results suggest that Pennsylvania dairy farmers are relying heavily on fertilizer to ensure availability of nitrogen for corn. Nitrogen from farm produced

sources--manure and legume crops--appears to be discounted or ignored by many farmers. The component of the sample with manure recommended manure management practices including storage, testing, and rapid incorporation in the soil, may not follow this generalization. If the sample is large enough, we plan to further investigate this component with improved practices and its differences in fertilizer use with the general sample. In addition, investigation of the economic rationale for the general patterns of results is currently the focus of our research program. Given the importance of silage as a feed and the non-existence of silage markets, the research is considering the total farm system. Nitrogen requirements for optimal grain and silage yields vary among years as do nitrogen available from organic sources. Given the relatively low cost of fertilizer and the greater certainty of its availability for crop use, it is plausible that investing financial capital and management time in manure management may not be profitable. Another plausible hypothesis is that farmers apply nitrogen for the worst case scenario--the highest amount which would be normally needed for optimal crop response in years with largest nitrogen response and the least available from organic sources. Understanding this behavior is crucial for designing profitable fertilizer and nutrient management programs and in considering policies to influence nitrogen use and pollution.

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Table 1. Responses for Survey of Pennsylvania Dairy Farmers

Questionnaires sent	1300
Not returned	553
Not deliverable, deceased, no forwarding address	133
Returned but not farming or retired	248
Returned and completed	371
Effective Response Rate (371 ÷ 1200 - 133 - 248)	40%

Table 2. Agronomic Crops Grown by Pennsylvania Dairy Farmers

Crop	Respondents with Crop		Average Number of Acres [a]
	Number	(%)	
Corn silage	292	(78.7%)	39.4
Corn for grain	300	(80.9%)	66.6
Soybeans	76	(20.5%)	43.0
Wheat	105	(28.3%)	21.3
Oats	146	(39.4%)	21.7
Barley	91	(24.5%)	16.2
Rye	70	(18.9%)	19.4
Sorghum	24	(6.5%)	12.1
Alfalfa or alfalfa/grass	310	(83.6%)	54.6
Clover or clover/grass	147	(39.6%)	39.7
Pasture	293	(79.0%)	34.7

[a] Average values for each category include only those farmers growing some of the crop in that category.

Table 3. Animals Reported by Sample of Pennsylvania Dairy Farmers

Animal Category	Raising Animal		Average Number of Animals[a]
	Number	(%)	
Dairy cows	307	(82.7%)	59.9
Heifers	320	(86.3%)	46.7
Cattle and calves	118	(31.8%)	31.7
Sows and boars	19	(5.1%)	13.7
Feeder pigs	32	(8.6%)	103.3
Sheep	22	(5.9%)	24.0
Broilers	11	(3.0%)	33,659.2
Laying hens	68	(18.3%)	1,684.2
Turkeys	9	(2.4%)	1,504.8
Horses and mules	114	(30.7%)	5.8

[a] Average values for each category include only those farmers with at least one animal in that category.

Table 4. Dairy Feeds Used by Sample of Pennsylvania Dairy Farmers

Feeds	Using	
	Number	(%)
Corn silage	285	(87.1%)
Haylage	204	(62.4%)
Alfalfa or other hay	302	(92.3%)
Corn grain	159	(48.6%)
Ear corn	182	(55.7%)
Oats, wheat or barley	135	(41.3%)
Soybean meal	176	(53.9%)
Concentrates or additives	233	(75.5%)

Table 5. Purchases and Production of Dairy Feed Sources by Sample of Pennsylvania Dairy Farmers

Feed	Buy All		Buy 75%		Buy 50%		Buy 25%		Produce All	
	Number	(%)	Number	(%)	Number	(%)	Number	(%)	Number	(%)
Corn silage	3	(1%)	0	(0%)	0	(0%)	4	(1%)	270	(98%)
Haylage	4	(2%)	1	(0%)	3	(1%)	2	(1%)	194	(95%)
Alfalfa/other hay	9	(3%)	10	(3%)	13	(4%)	33	(11%)	210	(70%)
Corn grain	38	(21%)	13	(7%)	13	(7%)	33	(18%)	87	(47%)
Ear corn	8	(4%)	6	(3%)	15	(8%)	34	(18%)	124	(66%)
Oats, wheat or barley	14	(10%)	6	(4%)	6	(4%)	14	(10%)	106	(73%)
Soybean meal	183	(86%)	5	(2%)	4	(2%)	5	(2%)	17	(8%)

Table 6. Manure Types and Application Rates for Sample of Pennsylvania Dairy Farmers

Manure	Applying in Solid Form		Application Rate (tons/ac.)	Applying in Liquid Form		Application Rate (gal./ac.)
	Number	(%)		Number	(%)	
Cow	223	(70.0%)	14.2	48	(15.0%)	5,998
Hog	8	(2.5%)	5.6	13	(4.0%)	4,423
Poultry	16	(5.0%)	3.7	2	(0.3%)	7,600

Table 7. Manure Application Timing by Pennsylvania Dairy Farmers

Time of Year	Number	(%)
Apply daily	125	(38.2%)
Fall, winter, spring	70	(21.4%)
Fall and spring	43	(13.1%)
Spring only	38	(11.6%)
Fall and winter	10	(3.1%)
Fall only	7	(2.1%)
All other combinations of fall, winter, and spring	34	(10.4%)

Table 8. Timing of Manure Incorporation into the Soil

Time Between Application and Incorporation	Number	(%)
More than six days	118	(37.9%)
Do not incorporate	79	(25.4%)
Less than two days	41	(13.2%)
Two to six days	27	(8.7%)
Some two to six days and some more than six days	13	(4.2%)
All other combinations of incorporation	33	(10.6%)

Table 9. Manure Uses Other Than Application to Corn

Manure Use	Number	(%)
Apply all manure to corn fields	72	(21.5%)
Apply manure to other crops	231	(69.0%)
Store excess manure on farm	11	(3.3%)
Apply manure to other crops and store excess manure on farm	9	(2.7%)
Sell manure to others	4	(1.2%)
Other uses	8	(2.4%)

Table 10. Type of Manure Storage

Storage Type	Number	(%)
No storage or hauled daily	109	(33.1%)
Liquid storage (tank, pond, etc.)	50	(15.2%)
Open piles	35	(10.6%)
Bedded pack	32	(9.7%)
Bedded pack and liquid storage	26	(7.9%)
Bedded pack and hauled daily	23	(7.0%)
Open piles and hauled daily	15	(4.6%)
All other storage combinations	39	(11.9%)

Table 11. Nitrogen Fertilizers Used on Corn by Sample of Pennsylvania Dairy Farmers

	Use		Mean Number of
Fertilizer	Number	(%)	Acres
Anhydrous ammonia	22	(7.1%)	74.8
Urea	94	(30.7%)	70.0
Ammonium nitrate	21	(7.0%)	344.5
Ammonium sulfate	31	(10.4%)	58.9
Liquid nitrogen	101	(33.0%)	97.8
All types	276	(82.6%)	--

Table 12. Available Nitrogen from Fertilizers by Corn Rotation

Rotation	Available Nitrogen (Ave. Lbs. per acre)
Continuous corn	126.1
Corn, 1st year after alfalfa	87.5
Corn, 2nd year after alfalfa	121.2
Corn after soybeans	88.2
Corn after small grains	119.3

Table 13. Total Available Nitrogen

Rotation	Available Nitrogen (Ave. Lbs. per acre)
Continuous corn	202.4
Corn, 1st year after alfalfa	256.1
Corn, 2nd year after alfalfa	241.3
Corn after soybeans	232.5
Corn after small grains	187.5

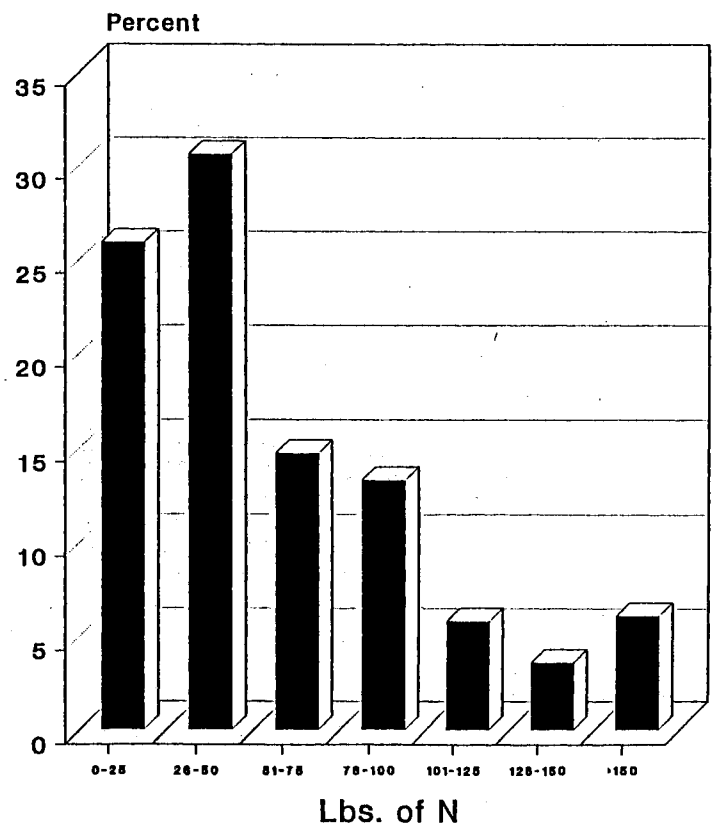

FIGURE 1

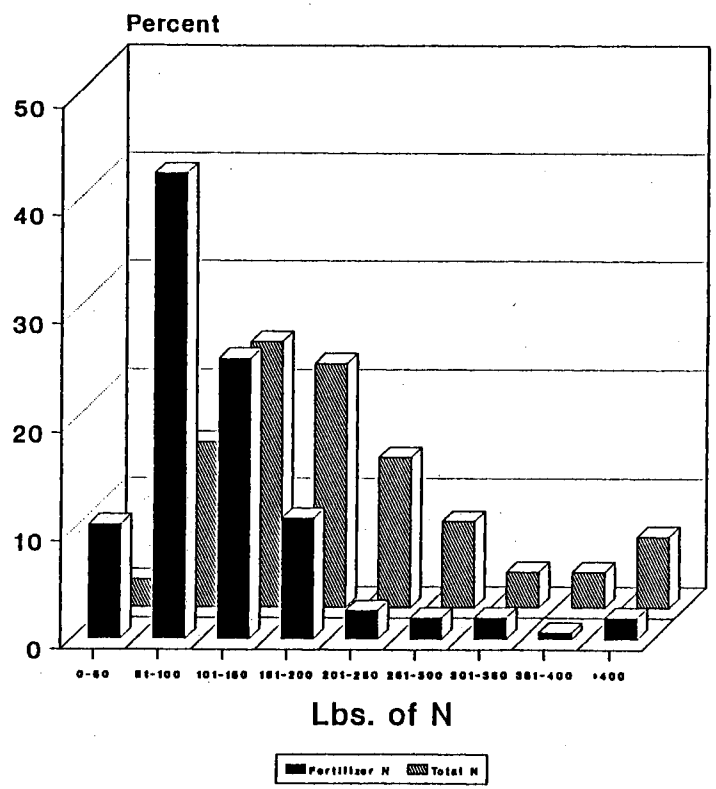

FIGURE 2

AGRICULTURE AND THE ENVIRONMENT IN THE EUROPEAN COMMUNITY

J. S. Shortle*

INTRODUCTION

Farming in Pennsylvania and elsewhere in the United States is increasingly subject to environmental regulation. This trend is not limited to the US. Compliance with environmental protection laws is becoming more and more a dimension of the business of farming in Europe and Australia as well. There are interesting similarities as well as differences between the situation in these countries and that in the US, as well as some direct and indirect linkages. My goal here is to present an overview of the environmental problems and policy developments related to agriculture in Europe, focusing primarily on the countries that are members of the European Community (EC).[1]

EUROPEAN COMMUNITY AGRICULTURE AND THE ENVIRONMENT

European agriculture has undergone a structural transformation in the past several decades comparable in many ways to that which has occurred in the US. Agricultural production has become highly specialized, mechanized and chemical intensive (See Table 1). These and other developments have brought about a huge increase in agricultural output despite a fairly steady decline in the use of land and labor. These developments have also made agriculture a major cause of water pollution and other forms of environmental stress.

The negative impacts of agricultural production on the quality of the environment have become an important issue in Europe. As in US, the focus of present concern about the relation of agriculture to the environment in Europe is the effect of plant nutrients, especially nitrates, on water quality. Other important issues are the impacts of

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[1]The EC is a supranational authority currently composed of Belgium, Denmark, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain and the United Kingdom. It was formed by the Treaty of Rome in 1957 in which members ceded specific powers to the EC. These powers were subsequently expanded in 1986 by a treaty known as the Single European Act and again this year by the Maastricht treaty. Agricultural policy has been a major function of the EC and has commanded more than half of the EC budget for many years. Environmental policy is a more recent but rapidly growing area of EC responsibility.

pesticides on water quality and flora and fauna, the loss of natural environments to "structural measures" such as drainage and irrigation projects intended to support agriculture and the management of agricultural land to supply "countryside amenities".

Nitrates and Phosphates

The presence of nitrate and phosphate compounds in water is normal and natural. Water quality problems occur when the concentrations are increased by agricultural or other activities. In surface waters, elevated concentrations of nitrates and phosphates lead to excessive growth of algae and aquatic plants. This condition is referred to as eutrophication. The growth and subsequent decomposition of the algae and plants associated with eutrophication can be an unsightly and stinking mess, harm fish life as a consequence of the oxygen depletion, and reduce the quality of drinking water supplies (OECD, 1986). Eutrophication of inland and coastal waters is a serious problem in many areas of Europe, perhaps most notably along the Atlantic coast of the Netherlands and the Mediterranean coasts of France and Italy. Parts of the lagoon in which Venice is located are now periodically carpeted by unsightly algae blooms. The eutrophication of the lagoon is harming tourism and fishing in this unique area. Similar problems occur in many other coastal areas.

Nitrates in drinking water supplies, whether from ground or surface supplies, also pose health risks. Nitrites (a reduction product of nitrates) are known to cause a blood disease in infant humans that reduces the capacity of the blood to carry oxygen. This disease is known as methemoglobinemia ("blue baby disease"). Nitrates have also been linked to stomach cancer but there is much uncertainty about the magnitude of the risk. Despite this uncertainty, a number of countries have established drinking water standards limiting nitrate concentrations in drinking water. EC legislation mandates standards for all EC countries comparable to those recommended by the World Health Organization (Johnson and Corcelle, 1989). Nitrate levels in excess of these standards have been found in some water supplies in a number of EC countries and public authorities generally expect the incidence of contaminated supplies to grow, especially in intensively farmed areas (TEAGASC, 1989).

Much has been done by EC member countries, especially in the more developed northern countries (Belgium, most of France, Germany, Luxembourg, the Netherlands and the United Kingdom) to reduce industrial and municipal sources of nitrates and phosphates over the past two decades. At the same time, the use of fertilizer has increased dramatically (see Table 2) and there has been a trend towards more intensive livestock production, especially in Belgium, the northern coast of France, and the Netherlands (see Table 3). The policy emphasis now is shifting from the control of industrial and municipal sources to the control of agricultural sources of nitrogen and phosphorous. Although there are variations in the relative importance of agricultural, industrial and municipal sources of nitrogen and phosphorous from place to place, agriculture is generally the major source of nitrate and an important source of phosphate

loadings across Europe. In many European countries, 70% to 85% of nitrogen loadings and 30% of phosphorous loadings in rural areas are from agricultural activities; in urban areas 50% of the nitrogen and 5% of phosphorous loadings are from agriculture (OECD 1991).

At present there is no Community wide legislation to control pollution by nitrates and phosphates from agriculture but the EC Commission is developing legislation to regulate agricultural sources of nitrates.[2] The EC has been developing programs to promote the voluntary adoption of "environmentally friendly" management practices. The first major step in this direction was a program initiated in 1985 that would compensate farmers in "environmentally sensitive areas" for a range of environmentally beneficial activities. However, the main purpose of the legislation was to promote rural development rather than environmental protection. Presently, Agricultural Commissioner MacSharry's proposal for reforming the Common Agricultural Policy (CAP) calls for funding of an "Agro-environment" program under which farmers could enter into management agreements obligating them to use environmentally sound practices in return for public payments.[3] Although the details are unclear at this time, it is certain that nutrient management practices would be eligible given current levels of concern for nitrates and phosphates. Compliance with EC drinking water quality legislation limiting nitrates in drinking water has placed indirect pressure on member states to take action to reduce nitrates from agricultural sources.

A wide array of measures to control nitrates and phosphates have been implemented by member states. Although there are sometimes quite stringent laws that could be applied to reduce water pollution, agriculture is generally treated much more gently than industry. The approach generally has been comparable to the approach in the US, with an emphasis on the use of moral suasion and technical assistance, sometimes supplemented by subsidies to encourage voluntary adoption of environmentally beneficial practices (OECD, 1989; TEAGASC, 1989). Regulations pertaining to animal manures are extensive. Restrictions include limits on animal densities and the treatment, storage and spreading of manure. These restrictions are generally imposed by local authorities so there is tremendous variation across the Community.

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[2]Pollution control policies in the member states of the EC are established at three basic levels. Since 1972 the Commission of the EC has taken a major role in aspects of pollution control policy. Prior to that time, policies were made by national and subnational authorities. The relative importance of the EC, national and subnational authorities in present policy making varies across members and issues.

[3]The CAP provides income support to EC farmers through a variety of mechanisms including price floors and direct payments. The CAP has encouraged a dramatic expansion of EC production but the expansion of the CAP budget has been equally dramatic. There are now substantial internal and external pressures for CAP reform. The internal pressures derive largely but not entirely from budgetary concerns. Externally, the US and other countries seek greater access to EC markets, which is now limited by the CAP.

The most interesting national level policy developments are in the Netherlands. The country has developed an industrial type of livestock production based on imported feed concentrates. It has the highest density of pigs, poultry and cattle of any nation in the EC. The lowest cost way for farmers to dispose of the animal manure is to spread it on their land but acreages are so small in relation to animal numbers that crops can only take up a fraction of the nutrients. The result has been severe water pollution and even air pollution problems. The Netherlands experiences acid rain problems caused by ammonia emissions from manure!

The Dutch National Environmental Policy Plan established ambitious goals regarding the reduction of nutrient problems from agriculture as well as other sources. The Manure Law banned new animal intensive farms and restricted the expansion of existing farms. It imposed a levy on manure applied to the land in excess of uptake and established a system of "manure banks" for farmers who cannot dispose of excess manure in legally acceptable ways. Depositors are charged for the use of the banks. The Law on Soil Protection established restrictions on the rates, timing and methods of applying manure on land. A tax has also been imposed on livestock feed manufacturers to support research and extension to help reduce manure surpluses.

Pesticides

Concern for the effects of pesticides on the environment emerged in the late 1950s in Europe as a consequence of harm to birds and other wildlife. Shifts to less persistent types of pesticides have helped to alleviate problems and anxieties associated with chemical use but issues remain. Pesticide use has continued to grow in the EC while uncertainties remain about environmental risks. (OECD, 1986 and 1991).

Western European countries have pesticide registration schemes comparable to that of the United States (OECD 1986). Pesticides must generally meet toxicological and environmental safety criteria to be registered for use, with the registrations subject to periodic review. Generally, there are also guidelines covering acceptable use and licensing of applicators. However, as is the case in the US, there is interest in Europe in reducing real and perceived risks to human health, flora and fauna associated with the use of pesticides. For example, Denmark is currently in the process of major re-evaluation of pesticide use. The nation has established a goal reducing pesticide use by 50% by 1997 relative to the levels of the early 1980s (Dubgaard, 1991). The "Agro-environment" program proposed by Commissioner MacSharry will surely include incentives for farmers to cut back on the use of pesticides.

Environmental Consequences of Structural Measures

Concern for the environmental consequences of intensive use of fertilizers and pesticides in crop production and intensive livestock production is especially acute in the more developed northern European countries and Italy. In the less developed countries of Greece, Spain, and Portugal as well as in parts of France and Italy the greater concern is conversion of natural and semi-natural areas to agricultural land use or to reservoirs used in agricultural irrigation projects.

Irrigation, land clearing and drainage projects have been supported by European governments directly and also by the EC as part of the CAP and EC regional development policy for many years. However, the level of spending on infrastructure projects of these and other types in the "peripheral" or "less favored" regions of the European Community has been increased dramatically since the adoption of the Single European Act in 1986 to improve the economic competitiveness of these regions. The peripheral regions contain the lion's share of what little remains of undisturbed or relatively undisturbed natural areas and European biodiverity (Task Force Report, 1991). Structural projects have drawn sharp criticism from European and international environmental groups because projects have destroyed or threaten important natural areas.

Environmental groups are calling on the EC to consider the environmental impacts of irrigation, drainage and other structural projects when making funding decisions, and for other measures to protect Europe's natural heritage. The battle over preservation versus development of natural areas is intense because of the sometimes sharp tradeoff between economic development and environmental protection in the south.

Country Side Amenities

Agricultural land preservation is of interest in Europe as it is in the US. However, the motivations are somewhat more complex there than here. Agricultural land preservation in the US is presented primarily as a food security issue and to a lesser degree as an open space issue. In Europe, food security and open space are also motivating factors but in addition the visual physical characteristics of the rural landscape are important. European farming has produced distinctive rural landscapes that are highly valued as public amenities. Protecting traditional types of farm structures, hedgerows and other landscape features has become a matter of public policy in several European countries. Several countries have programs where farmers can receive payments for managing their land in aesthetically pleasing ways. The EC "environmentally sensitive areas" programs also provides funding to encourage farmers to undertake environmentally desirable measures in selected regions (Hodge, 1991; Whitaker et al., 1991). It seems likely that programs of this type will be expanded.

CAP REFORM AND ENVIRONMENTAL POLICY

EC member countries have taken a range of actions to address environmental problems associated with the changing structure of agriculture. The primary approach to date has been on the use of moral suasion, technical assistance and subsidies to encourage farmers to adopt production practices that are less harmful to the environment. However, direct regulations and taxes on the use of polluting inputs and practices have been implemented and there is interest on the part of environmental and other groups in increased regulation and use of economic penalties on polluting activities.

One of the key factors that will influence the evolution of environmental policy for agriculture in the near future is CAP reform. The CAP is likely to undergo substantial reform in the near future. Numerous proposals for major overhaul have been floated but the spotlight is on the MacSharry plan which calls for specific price reductions, supply controls, direct compensation payments and the "Agro-environment" program mentioned above.

CAP reform has great potential for alleviating some of the causes of environmental stress that has been experienced in recent years. The CAP supports the EC farm prices substantially above world levels and has greatly encouraged the transformation of EC agriculture that has occurred since the 1960s. Substantial price reductions could lead to substantial reductions in the use of chemical inputs and land (Abler and Shortle, 1992a and 1992b). Accordingly, CAP reform could diminish the growing pressures from environmental and other groups for stronger policies.

The political power of EC farmers makes compensation for revenue losses an essential component of successful reform. Increased subsidies for the adoption of environmentally beneficial practices could be used as part of a compensation package. The MacSharry "Agro-environment" proposal represents compensation of this type.

Finally, reform offers an opportunity to integrate farm income support policies with environmental policies. In the US we have been moving in this direction with the major step being the cross-compliance provisions of the 1985 Farm Bill. The MacSharry proposal does include cross-compliance provisions but integration of this type is under consideration by the agricultural and environmental directorates of the EC and widely discussed in the member countries.

IMPLICATIONS OF EUROPEAN DEVELOPMENTS FOR PENNSYLVANIA AGRICULTURE

What are the implications of environmental policy developments related to European agriculture for Pennsylvania farmers? There are two basic avenues through which such developments might have impacts. One avenue is changes in the prices

Pennsylvania farmers receive for their products and pay for inputs. The second is through changes in policies for protecting the environment from agricultural production in Pennsylvania.

Speakers at this conference last year discussed the linkages between Pennsylvania agriculture and international commodity and credit markets (Abler, 1991; Hallberg, 1991). A key message was that Pennsylvania agriculture can be affected by developments on international markets even though only a small proportion of Pennsylvania farm products are exported. For example, Professor Abler noted that the prices of feed grains, fuel, fertilizer and credit are determined on international markets.

EC agriculture is not a large enough component of the international economy to have an impact on the prices of fuel, fertilizer and credit in the US. The price of feed grains in the US could be influenced by changes in EC policies with some impact on the costs of livestock production in Pennsylvania. Policies that reduce the use of fertilizers and pesticides would reduce EC supplies, and put upward pressure on world prices. However, the potential price increases would be negligible. The EC is not a major supplier of feed grains and decreased supplies there would easily be made up by increased supplies in the US and other countries (Abler and Shortle, 1992a). Overall then, EC policy changes will have little if any effect on Pennsylvania farm input prices. The same conclusion holds for Pennsylvania farm product prices. The reason is simply that EC agriculture has essentially no impact on the prices of milk, eggs, pork and other important Pennsylvania farm commodities.

With regard to policy linkages, there are formal and informal processes at work that can link policy development in Europe to the US and vice versa. The most important formal process at present is the negotiation of the General Agreement on Tariffs and Trade (GATT). The GATT process was initiated after World War II to promote international trade by reducing tariffs and other trade barriers. Agricultural policies that restrict trade are a major target of the current Uruguay Round. New agreements may limit the types of policies that countries can use to support farm incomes as well as the levels of support. These same limitations can restrict the flexibility of countries when choosing politically acceptable policies for alleviating environmental problems. Environmental policies generally are also an important topic in the negotiations. Trade policies can have major environmental impacts and environmental policies can conflict with trade liberalization.

Informally, there is growing interest in the US in environmental policy approaches in Europe and vice versa. Environmental policy administrators and scholars recognize that there are lessons to be learned from the successes and failures of others. For example, there is clearly much that policy makers in Pennsylvania can learn from the Netherlands about alternative approaches to contending with surplus manure. The problems in Lancaster County are in many ways quite comparable to those in the Netherlands. The US Environmental Protection Agency, Department of Agriculture and state environmental and agricultural agencies participate in professional exchange programs with European counterparts. The Organization for Economic Cooperation and

Development and other organizations are sponsoring conferences and other programs to promote international exchange of information on technology and policy for reducing environmental problems from crops and livestock production.

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Table 1. Agriculture and the Environment: Selected Indicators for US and OECD Europe[a]

	USA	OECD Europe
1988 Agricultural Land Area (1000 sq. miles)	1666	717
% Change 1970-1988	-1	-5
1988 Manpower (1000 persons)	3326	18814
% Change 1970-1988	-7	-29
1988 Farm Machinery (1000 tractors and combines)	5310	8824
% Change 1970-1988	-1	47
1988 Energy Consumption (1000 tons oil equivalent)	19	22
% Change 1970-1988	NA	54
1988 Nitrogenous Fertilizer Use on Arable and Cropland (tons/sq.mile)	14.3	11.4
% Change 1970-1899	32	72
1988 Pesticide Use on Arable and Cropland (tons/sq. mile)	.5	1.29
% Change 1970-1988	NA	NA
1988 Irrigated Land Area (1000 sq. miles)	70	52
% Change 1970-1988	14	38

Source: OECD 1991

[a]EC members plus Austria, Finland, Iceland, Norway, Sweden, Switzerland and Turkey.

NA means not available.

Table 2. Nitrogenous Fertilizer Application on Arable and Crop Land, 1970-1988

	Nitrogen Fertilizer Applied (tons/square mile)				
	1970	1975	1980	1985	1988
USA	11.1	14.3	16.3	14.3	14.6
Belgium	55.1	59.1	66.3	70.0	70.0
Denmark	30.8	36.3	40.3	41.7	42.0
France	22.6	26.3	32.6	35.7	40.0
W. Germany	42.5	46.3	59.1	58.0	58.8
Greece	14.6	19.1	24.3	33.1	30.3
Italy	14.0	17.4	23.7	24.8	21.7
Netherlands	131.6	152.2	160.5	158.8	133.4
Portugal	8.2	10.8	10.8	11.1	12.6
Spain	7.7	10.6	12.6	13.4	15.7
UK	35.4	42.8	50.5	63.4	59.7

Source: OECD, 1991.

Table 3. Number of Animal Holdings and Animals per Holding in the EC[a]

	Cattle		Dairy		Pigs	
	Holdings (000s)	Animals per Holding	Holdings (000s)	Animal per Holding	Holdings (000s)	Animal per Holding
1973	3290	24.0	2432	10.5	2809	25.0
1983	2406	32.8	1621	15.7	1862	42.0
1984	2406	33.0	1621	15.7	1862	42.0
1985	2150	36.2	1379	17.8	1456	58.0
1986	2150	36.0	1379	17.8	1396	58.0
1987	2436	31.6	1600	15.7	1874	56.0

[a]The numbers reported exclude Portugal and Spain except in 1987.

Source: EC Commission. Agricultural Statistics of the European Community. Various issues.

Table 4. Number of Animals Per Acre of Cultivated Area in the Regions With the Highest Density of Animals in EC

	Number of Animals per Acre		
Region	Pigs	Poultry	Cattle
Belgium	9.6	38.0	5.4
Brittany	6.9	111.1	4.0
Denmark	7.9	13.3	2.2
Lombardy	6.4	99.3	4.4
Netherlands	15.0	111.4	6.4
North-Rhine Westphalia	9.4	18.5	3.2
Yorkshire and Humberside	3.7	23.2	4.9

Source: Tammiga and Wijnands, 1991.

WATER ISSUES IN PENNSYLVANIA'S FOOD INDUSTRY

J. W. Dunn*

INTRODUCTION

The Pennsylvania food industry comprises a diverse set of firms. These firms are of all sizes from family-run bakeries to Hershey Foods with thousands of employees and many plants. Of course, the industry produces an enormous array of products. Some food processors buy Pennsylvania produced farm products for ingredients; others do not. Some are located near the farm; others near the consumer. Some sell directly to the consumer; some sell to retailers; some sell to other processors. Feed mills, which are grouped with food processors because of their ingredients, sell mainly to farmers.

With this diversity in source of inputs, locations, customers, and products, the industry members have not traditionally viewed themselves as a group with common goals and problems. Instead sub-groups formed trade associations such as the Pennsylvania Association of Milk Dealers, but had few dealings with other food processing associations. Associations like the Pennsylvania Bakers Association and the Pennsylvania Association of Meat Processors didn't communicate often because they felt they had little in common.

The 1980s changed that. The operating environment of the industry changed and increased what the member firms had in common. Although a bakery and a meat processor differ in many ways, they each need water to operate their plant. They also each have increasing problems with solid waste disposal, labor availability and quality, and waste water. As these and similar issues became more important to the profitability of the firms, the industry began to see their common interests and problems.

With the 1988 Governor's Economic Development Partnership Committee on Food Processing came formal state recognition of the importance of the industry to the state's economy and also of its vulnerability to economic pressure from these new sources. Food processing was finally viewed as an industry both by its members and the government.

Some of the major obstacles for the industry in the next decade are water issues. Adequate supplies of potable water are essential for virtually all food processors. In addition to water as an input the industry faces difficulties with water as an output. Concern over the quality of ground and surface waters have been translated into restrictions on the quality of water that can be discharged into these waters from municipalities, factories, and farms. Waste water treatment requirements are growing

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steadily. As a result food processing firms must often provide waste water treatment at the factory. Such expenditures particularly rankle food firms since they add nothing to overall productivity.

In 1990 a sample of Pennsylvania food processors were surveyed about their water usage and treatment practices. This survey provides some perspective on the current situation, the prospects for the future, and the implications of these prospects on the competitive position of the industry. [1]

WATER USAGE

The firms surveyed were asked about their water usage, whether they have had any quality problems, and their water recycling efforts. The responses are best understood when broken down by activity. The 3 digit Standard Industrial Classification (SIC) codes will be used for this breakdown. In general, this combines similar firms and separates them from dissimilar firms.

The water usage by the food industry, adjusted to represent the entire industry by weighting usage by employment within a 3 digit SIC group, is presented in Table 1. This calculates water usage per employee for each responding firm and averages this for each SIC group. This value is multiplied by the total employment in that SIC group to estimate total water usage in that group. The food processing industry total is obtained both by summing the 3 digit SIC group totals and by calculating an average water usage per employee for the entire industry based on the individual responses and then multiplying by total industry employment.

The estimates of total water usage in Table 1, whether by industry or by the entire food processing industry, contain considerable error. The aggregate estimate for the industry in 1989 of somewhat less than 10 billion gallons is probably reasonable. Because all firms did not supply estimates for all years and because all industries are not equally represented in the 1986 and 1992 industry totals, water usage for 1986 and 1992 is probably overestimated. In general those parts of the industry that use a lot of water are trying to conserve it, mainly because water availability may limit firm growth. Most firms that provided estimates for all three years on average expected water usage to grow, primarily because they expect to grow. The fruit and vegetable processors and dairy processors used the most water. The water usage by these two groups is a larger share of the industry total than their employment share. Both use large amounts of water in their operations, especially for cleaning.

The firms were asked for their water usage by source. In Table 2 the distribution of usage by source for the responding firms is indicated. About two-thirds of responding

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[1]Dunn and Fuller (1992) contains the complete results of this survey, including many other topics concerning the Pennsylvania food processing industry.

firms use municipal water with most of the remainder using water from their own wells. Bakers and candy companies, who tend to be in cities, use mostly municipal water, while other food firms, which are more often located in rural areas or smaller towns, used more well and surface water. About one-sixth of the firms using municipal water and one-eighth of the firms using well water indicated they have had water quality problems (Table 3). In addition 5 percent of firms on municipal water and 7 percent on well water had faced availability problems. In another study of food industry water usage, all portions of the industry except the millers indicated water quantity control would present a problem for them. The drought of 1991 with some water usage restrictions undoubtedly has made other food processing firms conscious of their dependence upon a water supply with potential quantity and quality problems.

A wide variety of water quality problems were encountered by responding firms, some more critical than others. For example hardness is more easily handled than bacterial problems. The duration of the problems is also important. Although some problems can be treated at the plant level, most firms have little they can do if they have problems. Water is an essential ingredient in many of the products and no firm wants to have any water-quality specter hanging over their product. The recent problem Perrier had with traces of benzene is ample evidence. Many products cannot be manufactured without water. Most other firms use water for cleaning.

The firms were asked about their current and potential water recycling efforts. Approximately 25 percent do some recycling, with a number recycling either internally or from a treatment facility. Table 4 indicates the average percentage of water recycled by firm size. Large firms recycle a larger portion of their water than do small firms, 11 percent versus 7.9 percent. This is probably because a large firm can more readily adopt recycling technology since it can spread the investment over more units. Also large firms are more likely to exceed the capacity of their wells or to face restrictions by water companies. About 22 percent of the firms indicated that technology is now available for them to significantly increase the percent of water usage that is recycled. However, most indicated such adoption would not be profitable. Obviously the profitability of water recycling may change either as the technology advances or as water problems get worse.

WASTE WATER DISPOSAL

The firms were asked how their waste water is treated. Approximately two-thirds use municipal facilities, 20 percent have their own facility, and 15 percent do not treat their waste water. The distribution of practices by industry is shown in Table 5. As with water usage, bakers, who tend to be located in cities, tend to use municipal treatment facilities. Grain millers use very little water and also have the most firms with untreated waste water. Meat processors and fruit and vegetable processors are most likely to operate their own facility. These establishments tend to be located outside of municipalities and are often quite large. Many dairies are in a similar situation.

Waste water from a food processing plant is more homogeneous than municipal sewage. It usually has high levels of food wastes, such as milk, fat, or vegetable matter. Removal of these products may be simpler using a specialized facility at the factory than in the more general municipal facility.

In general, large firms, regardless of location are more likely to be involved in waste water treatment. Table 6 indicates the percentages. Nearly half of large firms own a water treatment facility, while about 15 percent of small firms do. Of firms that treat their own water, about half provide primary water treatment, about one-third provide secondary treatment, and the remaining one-sixth provide tertiary treatment.[2] Over time more firms may have to do their own treatment. For example York, PA was having problems with the biological oxygen demand coming from their waste water treatment facility. They identified a number of large firms, primarily food processors, and made them pretreat their waste water. The expense of treatment was shifted to the firms and the borough is now in compliance with the water quality regulations.

Over time, the required level of treatment is rising so that firms and the municipalities they are located in will have to increase treatment levels. Over half of the larger firms expect to have to either begin to treat their water or to improve their treatment system in the next five years. Fewer than 10 percent of the small firms have this expectation. Over 80 percent felt waste water treatment would be a critical expense for their firm. Industry members generally consider such expenses to be non-productive and especially worry that competitors in other locations can avoid these expenses, giving them an advantage. Most of the firms indicated that they might need both financial and technical assistance to upgrade or install a waste water treatment facility.

CONCLUDING COMMENTS

Pennsylvania has been an important food processor since colonial times. The industry has considerable experience dealing with issues of competition, pricing, market volatility, and unpredictable input markets. Their future is now being determined in a new arena. Instead of being governed by these traditional issues, the competitiveness of the industry is now affected by unpredictability in water quality and availability and by the costs of waste water treatment, solid waste removal, and taxes. These new issues can hit competitors unevenly, placing a firm at a substantial disadvantage because of its location--often a location that once gave it an advantage. Management has experience dealing with the traditional problems. Waste water treatment decisions are often outside

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[2]Primary treatment consists of separating the water from solid matter by letting the solids settle or by removing any floating scum. Primary treatment removes about one-third of the biochemical oxygen demand (BOD). Secondary treatment removes about 75-90% of the BOD. Tertiary treatment is designed to remove dissolved organic and inorganic compounds. The cost of treatment rises substantially at higher levels. (Stoker and Seager, 1972, pp. 178-184)

their experience. Few would argue that the industry should be exempted from cleaning up after themselves. Economic efficiency demands that the price of the product include the costs of waste water treatment and solid waste disposal. Whether the solutions being implemented by regulatory bodies are the efficient way of managing waste water treatment is another issue. In any case, the food firm that cannot resolve its water problems is a food firm that won't be in business in Pennsylvania in 2000.

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Table 1. Total Water Usage by SIC Group

SIC Group	Year		
	1986	1989	1992
	(million gals)		
Meat	1753	1476	1549
Dairy	2731	1817	2202
Fruit & Vegetables	2394	2068	2359
Grain	120	115	380
Bakery	1234	1201	872
Candy	725	276	261
Beverages	627	823	925
Other foods	1211	1457	1901
Total	10794	9231	10447
Total*	11364	9727	11637

*Uses aggregate average usage rather than sum of the industry usages

Table 2. Number of Firms Indicating Water Source Used

SIC Group	Source					
	Municipal	Well	Spring	Lake	Quarry	Other
Meat	25	19	0	0	0	3
Dairy	25	20	0	0	0	1
Fruit & Vegetables	13	12	2	0	1	0
Grain	23	15	0	0	0	2
Bakery	26	4	0	1	0	0
Candy	19	2	0	0	0	0
Beverages	16	9	0	0	0	0
Other foods	38	12	0	0	1	0
Total	185	93	2	1	2	6

Table 3. Water Quality And Availability Problems By Source

Source	% Of Firms Using Source Indicating Problems	
	Quality	Availability
Municipal	16%	5%
Well	13%	8%
Spring	0%	0%
Lake	0%	0%
Quarry	0%	0%
Other	17%	17%

Table 4. Water Recycling Efforts by Firm Size

	1-99 Employees	100+ Employees
Average Percent of Usage Recycled Internally	7.8%	11.0%
Average Percent of Usage Recycled at Treatment Facility	3.3%	0.8%

Table 5. Waste Water Treatment Practices by SIC Group

SIC Group	Municipal	Own Facility	No Treatment
Meats	55.4%	32.2%	17.9%
Dairy	64.6%	27.1%	14.6%
Fruits & Vegetables	55.6%	33.3%	18.5%
Grain Milling	53.7%	24.4%	29.3%
Bakery	92.0%	2.0%	6.0%
Candy	76.7%	13.3%	10.0%
Beverages	69.6%	17.4%	17.4%
Other Foods	76.3%	18.6%	11.9%

Numbers Add Up to More than 100% Because Some Firms Use More than One Method

Table 6. Waste Water Treatment Facility Ownership by Firm Size

Firm Size	Own Facility	Do Not Own Facility
1-99 Employees	14.8%	85.2%
100 + Employees	44.3%	55.7%

WATER POLICY DEVELOPMENTS AND THEIR IMPACTS UPON PENNSYLVANIA AGRICULTURE

Charles W. Abdalla*

INTRODUCTION

Most of us consider Pennsylvania a "water rich" state. Compared to the west, water is generally available. As last year's drought taught us, however, water is not always available to meet the demands of all users. When such shortfalls occur, there are adverse consequences for agriculture and many other sectors of our economy which depend on water. While droughts cannot be avoided, the losses associated with them can be substantially reduced through water resources planning and management. Currently the state does not, however, have the legal rules and institutional arrangements in place to allow for more optimal management of water resources and its allocation in drought and emergency situations.

A number of proposals for addressing Pennsylvania's water quantity issues have been introduced and we can expect more before the end of this legislative session. Local governments are also becoming more active in water resource planning and management. In the near future, it is quite likely that new legal rules and institutions for managing water resources will emerge. Such changes will have major implications for Pennsylvania agriculture and other sectors of the economy. If there is one message you leave with, I hope that it is that the complex problem of managing this shared water resource will be with us for long while. The problem will not go away nor are there any quick fixes. Therefore, agricultural firms and organizations need to make a long-run commitment to studying the issues, working with government agencies and other organizations to create mutually acceptable solutions, and actively participating in policy discussions and debates. If such steps are taken, I believe that there is a greater chance that the public policies that will emerge will be workable and in both agriculture's and society's interest.

I will first provide an overview of the state's water resources and highlight their importance to agricultural and rural businesses and residents. Several key issues facing the state as it tries to develop a system of legal rules and institutional arrangements for managing water resource are discussed. Water policy developments at the state and local level are then reviewed. Finally, several suggestions are offered which should hopefully lead to improved water resource planning and management in Pennsylvania.

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WATER RESOURCES IN PENNSYLVANIA

Pennsylvania's water resources are extensive and diverse. Each year we receive an average of 42 inches of rain, about one-half of which replenishes our surface waters and underground aquifers. Within our six major river basins, there are 65,000 miles of streams and more than 2400 lakes, reservoirs and ponds (Table 1). The Commonwealth also has 47 trillion gallons of groundwater. While the state appears to have a plentiful water supply, we also have placed tremendous demands on our water resources. It is estimated that 14.3 billion gallons of water were withdrawn from ground and surface sources in 1985. These withdrawals were for thermoelectric power generation (71.3%), industry/mining (17.1%), domestic/commercial (10.9%) and agricultural (0.6%) uses.

Agricultural withdrawals amounted to 81 million gallons a day (mgd) in 1985. Of this total, 10.7 mgd (13%) was used for irrigation. Withdrawals for this purpose were greatest in Lancaster, Franklin, Adams and Chester counties. The bulk (86%) of water for irrigation came from surface sources. The number of irrigated acres in the state has increased over time from 17,950 acres in 1954 to 29,505 acres in 1987 (Joint Conservation Committee, 1992). In 1985, withdrawals of water for livestock accounted for 70.4 mgd or about 86% of total agricultural use. Almost 90% of the water for livestock purposes was obtained from groundwater. Water uses are often divided into consumptive and non-consumptive uses. Most water used for irrigation and livestock is consumed in the process and not returned to the water source. As a result, agriculture accounts for a significant proportion (12.2%) of consumptive water use in the state even though it represents less than one percent of total water withdrawals (Table 3).

Almost 800 million gallons of water are withdrawn from underground sources in the state every day. Groundwater is vital to our state, especially to farmers and rural businesses and residents. The major users of groundwater are industry and mining, public water suppliers, domestic and commercial users, and agriculture (Table 4). Almost 50 percent of the water withdrawn from underground sources is used for domestic water supply. Four and one-half million citizens, or 37 percent of the state's population, rely upon groundwater as their primary source of drinking water (Makuch and Ward, 1986). Dependence upon groundwater is greater in rural areas. Of the 21 counties obtaining more than half of their water supply from groundwater, 19 of these counties have rural populations exceeding 50 percent of their total residents. Migration of people and industry into rural areas over the last several decades has led to development of groundwater at a rate three times that of surface water (Barker, 1986).

Pennsylvania's power facilities, industries, farmers, municipal governments and citizens depend on an adequate supply of quality water. When droughts occur, as they have four times in the last decade, pain and economic losses are inflicted upon many sectors of our economy and conflicts occur among competing users. Droughts, like many other natural events such as flooding or tornados, are inevitable. Unlike these other events, they are not sudden and consequently can be managed. The frequency and magnitude of the impacts of droughts on water resources and water users depends on

the effectiveness of planning (Pennsylvania Department of Environmental Resources, 1991).

KEY WATER PLANNING AND MANAGEMENT ISSUES

Whose Water is It?

Pennsylvania has no comprehensive law which establishes the rights of water users. Rather rights are based upon a set of precedents in court cases, many of which occurred in the 18th and 19th century. Dependence on case law implies rights are not predetermined. Consequently, every water conflict must be resolved on a case by case basis in the courts. Even though all water is connected through the hydrologic cycle, these rules divide surface water and groundwater into separate categories and treat each source quite differently.

Surface water is basically allocated by the riparian rights doctrine. Property that borders or is crossed by a stream or other water body is defined as riparian. Under this doctrine, owners of riparian land have the right to make "reasonable" use of the water flowing by or through their property. That is, riparian owners are allowed to take quantities of water for use on their land that reduces the flow of the watercourse so long as other riparian users are not unreasonably harmed. Pennsylvania's rules give priority to domestic or "ordinary" uses over non-domestic uses on riparian land. For example, a riparian may take water for general household purposes, such as drinking, bathing, livestock watering, even to the point where a stream is entirely consumed. Non-domestic uses, such manufacturing, commercial, municipal water supply, and irrigation are considered "extraordinary" and therefore subject to the test of reasonableness given the rights of other users on stream (Weston, 1990). The riparian doctrine does not protect water users by establishing a right to a particular water use. Since this rights system is based on common law, reasonableness is determined by a court "after the fact."

Rights to groundwater are currently subject to a quite different doctrine, called the "American rule" doctrine. Under this rule, a landowner may withdraw water beneath his or her land for beneficial uses taking place on that land regardless of the consequences to uses on neighboring lands (Weston, 1976). In this situation, "might makes right." The landowner with the deepest well or most powerful pump wins. Some states have replaced the American rule with a legal system that allows groundwater to be shared among users. In Maryland, for example, a permit is required for groundwater (and surface water) use, with exemptions for certain domestic and agricultural water uses under 10,000 gallons per day on an average basis. During water shortages or emergencies, priorities for water use are: 1) domestic and municipal use for sanitation, drinking water and public health and safety; 2) agricultural uses including food processing; and 3) and all other uses (Joint Conservation Committee, 1992).

Who Decides How Water is Used?

Pennsylvania currently has limited means for affecting how water resources are used. Public water suppliers that use surface water are the only user required to obtain a permit for water withdrawals from the Department of Environmental Resources (DER). Such withdrawals make up about only 10% of total water withdrawals in the state.

Interstate river basin commissions, established through federal-state compacts, determine how water is used in the Delaware River and Susquehanna River basins. The Delaware River Basin Commission (DRBC) requires approval of projects that withdraw more than 100,000 gallons of groundwater per day and 10,000 gallons per day in a special protected area within the counties of Berks, Bucks, Lehigh, and Montgomery counties. While the original intent of the DRBC was to settle interstate water conflicts, the lack of a meaningful state water management program has led to its involvement in disputes among Pennsylvania water users.

The Susquehanna River Basin Commission (SRBC) has project review authority for certain water withdrawals and uses. For example, withdrawals of water from surface or groundwater sources for consumptive uses, such as agricultural irrigation, that exceed 20,000 gallons per day for a thirty day period must obtain commission approval. Projects that withdraw more than 100,000 gallons per day from underground sources or increase usage by this amount for a thirty day period also must obtain SRBC approval. There are grandfather provisions for uses existing before the SRBC compact was created in 1971. Currently, agricultural users are exempt from the application fee for project review, but still must obtain approval if water withdrawal levels exceed those stated above (Susquehanna River Basin Commission, 1991).

Local governments also have the potential to affect water use. Through the codes for different classes of local governments (e.g., cities, boroughs, townships), municipalities have authority to adopt ordinances and regulations necessary for the peace, health, safety, and welfare of their jurisdiction. However, water resource considerations have not been well integrated into land use planning, which in Pennsylvania is a municipal level function. Also, most water resources problems and span municipal boundaries. Consequently, it is difficult for one governmental unit to effectively manage the resource on a broader or regional basis unless there is an institutional arrangement for cooperation (e.g., authority) in place.

In a state-wide Local Government Groundwater Activity Survey conducted by Penn State University in Spring 1991, municipal officials most frequently identified the state as the governmental level with primary authority for groundwater management (Table 5). When asked their preference regarding responsibility, officials responding to the survey most frequently identified the municipal level as the appropriate level for prime responsibility for groundwater management (Table 6).

Information Needs for Decision-making

While local officials have authority through their land use power to affect water management, they are generally are not well-informed about water resource issues and often lack the tools and information needed to address water resource problems. The awareness, expertise and information for water management is fragmented but generally is found in regional and state-level agency offices, such as the Department of Environmental Resources and U.S. Geological Survey regional offices. Water resources decision-making can be complex and require resources beyond that available to local municipal governments. When asked about what type of assistance would allow local officials to address groundwater problems, about 40% of those responding to the Spring 1991 Local Government Groundwater Activity Survey identified localized data and technical assistance (Table 7). Funding and education were also frequently selected.

Despite the need for accurate information on water supplies, the state does not have adequate current information in a form that can easily be used by the local governments and others in their decision-making. The State Water Plan, which the Department of Environmental Resources completed in the late 1970s, has become outdated. As a result, the extensive set of information compiled on groundwater and surface water, land use, and water use for various subbasins in the state is not being used (Joint Conservation Committee, 1992).

STATE WATER POLICY DEVELOPMENTS

Several events in 1991, especially the drought emergency declared in 55 counties, elevated the issue of water availability on the agendas of interest groups, government agencies and legislative committees. At least 16 different bills related to the state's water resources had been introduced thus far in the 1991-92 legislative session (Joint Conservation Committee, 1992). At least one additional comprehensive water management bill is expected to be introduced into the state legislature this spring.

One proposal that has received considerable discussion is the "Water Resources Planning and Emergency Management Code" (Senate Bill 1054, P.N. 1165). If enacted, this bill would create a 13 member State Water Resources Board, - independent of the Department of Environmental Resources, responsible for coordinating regional water resources management. The proposal would require the development of a state plan tailored to the situations of regions consisting of the six major watershed drainage basins in the state. Authority for planning would be given to six independent regional boards made up one member from each Conservation District within the region, one member representing water suppliers, one member representing residential users, one member representing public interest groups, and three members representing industrial commercial, energy development, and agricultural users, and one member appointed by the Secretary of DER. In addition to preparation and adoption of the water plans, Senate

Bill 1054 specifies procedures for declaring a drought emergency, state-wide water use registration and reporting, and water conservation credits. The requested appropriation to implement this bill is $3 million per year.

In the last six months, a considerable amount of activity related to water resource issues has been occurring. In late 1991, the Susquehanna River Basin Commission held hearings and passed resolutions regarding the Commission's fees for project review and compliance monitoring. During September of 1991, the Joint Legislative Air and Water Pollution Control and Conservation Committee held four hearings across the state on water resource issues. A report of the committee's findings was released in January 1992. The report includes recommendations relating to: revision of a state water plan; need for legislation authorizing a permit and registration for groundwater withdrawals; comprehensive drought management planning; water conservation; management of groundwater and surface water as one hydrologic unit (conjunctive use); and the need for a water resources conference to serve as a forum for discussion of the report's findings and alternative water policy options.

The Committee specifically recommended that all agricultural interest groups participate in the development of water resources legislation and programs. Representatives of some agricultural organizations that testified at hearings felt that water use should be registered. Additional input from agricultural groups included concerns that agricultural irrigation have some priority as a water use; a preference for regional over state control of water resources; and concerns about excessive permit fees and possible duplication of efforts between the state's and the river basin commissions' programs.

LOCAL WATER POLICY DEVELOPMENTS

In 1988, the Pennsylvania Municipalities Planning Code was amended to include water supply and quality issues. The amended code encourages municipalities, such as cities, boroughs and townships, to consider water resource limitations in their planning, zoning and subdivision approval decisions.

A significant proportion of municipalities have land use management tools which could be used for groundwater management. In the state-wide Local Government Groundwater Activity Survey conducted in Spring 1991, it was found that over half of Pennsylvania's municipalities have zoning and a site plan review process and about two-thirds have subdivision regulations. Of those having these measures, most considered water in their deliberations at least sometimes (Table 8). About 13% of the municipalities reported specific policies or programs in place for groundwater management. Almost one-third of the municipalities that responded indicated that they expected their local water management activities would increase by 1995.

Recent developments suggest opportunities may be increasing for local water resource planning and management. Development of new approaches and tools,

including computers and automated data management systems, is increasing the feasibility and lowering the cost of utilizing available data and information in water decision-making.

CONCLUSIONS

As a result of the growing conflict over rights to water and the losses experienced by various water dependent sectors during droughts, the Commonwealth's water is increasingly being viewed as a finite resource facing the claims of many diverse users. There is also growing recognition that the state's water is a shared resource and that users are interdependent. The existing "rules of the game" are perceived by many as antiquated, fragmented and ineffective in dealing with the state's water problems and conflicts. A number of interest groups representing water users now recognize that protection of their existing uses and improvements in overall water use depends upon creation of a more defined set of legal rules and institutional arrangements.

A number of proposals for addressing Pennsylvania's water quantity issues have been introduced into the legislature and more can be expected in the future. While only a few local governments have been managing water resources, they are becoming more active in this area. In the future, it is quite likely that decisions will be made concerning new legal rules and institutions for managing water resources. Such changes will have important implications for Pennsylvania agriculture, rural businesses and residents.

I will conclude by emphasizing three points. First, agricultural firms and interest groups need to make a long-term commitment to water resources issues, regardless of how much rain falls this spring and summer. As I said in the beginning of my presentation, water resource issues will be with us for some time. Agricultural representatives should continue to study the issues, work with agencies and other organizations to create alternatives, and participate in the public policy development process. Second, given the present uncertainty about water rights, especially to groundwater, some legislative proposals should provide net benefits to agricultural firms by defining their rights to existing water uses. It is important that agricultural and other groups closely examine the possible benefits provided through protecting water uses as well as the costs of any proposed programs. Finally, water is a shared resource and thus control over its management has to be shared with the many significant users within the state. Those that participate in the upcoming discussions and debates over water resource issues need to be aware of this political reality. In addition, institutional arrangements will need to be created for exploring mutually acceptable alternatives, resolving conflict and developing consensus on water resource issues and policies.

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Table 1. Selected Water Resources Data For Pennsylvania

Precipitation (average):	42 inches per year
Major Drainage Basins:	Delaware River Susquehanna River Ohio River Lake Erie Potomac River Genesee River
Total Stream Miles (approximate):	65,000
Lakes, Reservoirs and Ponds:	2400+
Groundwater (estimated):	47 trillion gallons

Source: Joint Conservation Committee, 1992.

Table 2. Water Uses In Pennsylvania, 1985

Category	Millions of Gallons/Day	Percent of Total
Power Generation	10,200	71.3
Industry and Mining	2,450	17.1
Domestic/Commercial	1,570	10.9
Agricultural	81	0.6
Total Freshwater Withdrawals	14,300	99.9*

*Does not equal 100% due to rounding.
Source: U.S. Geological Survey, 1987.

Table 3. Consumptive Water Use In Pennsylvania, 1985

Category	Millions of Gallons/Day	Percent of Total
Industry and Mining	206	34.9
Power Generation	193	32.8
Domestic/Commercial	118	20.1
Agricultural	72	12.2
Total Consumptive Use	589	100.0

Source: U.S. Geological Survey, 1987.

Table 4. Groundwater Withdrawals In Pennsylvania, 1985

Category	Millions of Gallons/Day	Percent of Total
Industry and Mining (self-supplied)	267	33.4
Public Water Supply	258	32.2
Domestic/Commercial (self-supplied)	211	26.4
Agricultural	64	8.0
Total Groundwater Withdrawals	799	100.0

Source: U.S. Geological Survey, 1987.

Table 5. Pennsylvania Municipal Officials' Perceptions Of Governmental Level With Primary Responsibility For Groundwater Management, 1991

Governmental Level	Number of Responses	Percent*
Federal	129	10.3
State	530	42.2
County	129	10.3
Municipal	317	25.2
Other (combination of above or designation of a region)	152	12.1
Total	1257	100.1

*Of those responding to this question. Total does not equal 100% due to rounding.

Source: Sobel and Abdalla, 1992.

Table 6. Pennsylvania Municipal Officials' Preferences For Governmental Level Having Primary Responsibility For Groundwater Management, 1991

Governmental Level	Number of Responses	Percent*
Federal	103	8.2
State	372	29.7
County	199	15.9
Municipal	446	35.6
Other (combination of above or designation of a region)	134	10.7
Total	1254	100.1*

*Of those responding to this question. Total does not equal 100% due to rounding.

Source: Sobel and Abdalla, 1992.

Table 7. Pennsylvania Municipal Officials' Assistance Needs For Groundwater Management, 1991

Type of Assistance Needed	No. of Respondents Identifying Need*	Percent**
Funding	837	61.0
Education	674	49.1
Data on Local Water	591	43.1
Technical Assistance	572	41.7
Clearer Designation of Authority	300	21.9
Legal Assistance	174	12.7

* Respondents could identify more than one type of assistance.

** Percent of 1372 respondents who answered this question. Since more than one assistance category could be selected, the total exceeds 100%.

Source: Sobel and Abdalla, 1992.

COOPERATIVES' LINKAGES TO PENNSYLVANIA'S RURAL ECONOMY

Cathy A. Hamlett*

INTRODUCTION

Agricultural cooperatives have provided farmers and rural residents with alternative business organizations for over 50 years. A cooperative allows farmers or others to organize as a business to provide themselves services. For example, dairy farmers can come together to form a dairy marketing cooperative through which they can jointly market their milk or even further process their milk into other commodities such as cheese, ice cream, or yogurt. Through these cooperatives, members can decrease marketing costs, strengthen their bargaining power and, if appropriate, increase value added. Rural residents can also take advantage of this form of business when they receive their electricity from a rural electric cooperative or get a loan from an organization within the Farm Credit System. Cooperatives can help meet a variety of needs in rural areas. As a result, in many rural areas of the United States, the local or regional cooperative has grown into a primary business and employer for the community (Nadeau, 1989).

This paper provides a brief overview of the linkages between cooperatives and the rural communities in which they operate. First the scope of cooperatives in Pennsylvania is reviewed along with a discussion of why cooperatives are considered important in the United States. The current plight of the rural economy in Pennsylvania is described next. Important components of rural economic development are also reviewed. Finally, a section on new roles for cooperatives and current legislative activity concludes the paper.

AGRICULTURAL COOPERATIVES

The cooperative business form has a long history in the United States and in Pennsylvania. The first cooperative in the United States is considered to be the one formed in 1752 by Benjamin Franklin to offer Philadelphia residents cooperatively-provided fire protection (ACS, 1983). Cooperatives still remain strong in Pennsylvania; for example, agricultural supply, service, and marketing cooperatives generated over 2 billion dollars in gross sales in 1989. Membership in agricultural cooperatives exceeded 80,000 with 72 cooperatives headquartered within the state (ACS, 1990). Other cooperatives including those that are part of the Farm Credit System (Federal Land Bank Associations, Production Credit Associations, Agricultural Credit Associations, Farm Credit Banks, and

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the Banks for Cooperatives) along with rural electric cooperatives, rural credit unions, and dairy herd improvement associations are also very active within Pennsylvania. Rural electric cooperatives had approximately 172,000 members and revenues of 290 million dollars in 1989. Forty-one thousand people in Pennsylvania belonged to rural credit unions who held 62 million dollars of savings.

Dairy herd improvement associations included 3,202 herds with 198,000 cows tested (ACS, 1990). The dairy industry especially enjoys a significant symbiotic relationship with cooperatives. In Pennsylvania, 72 percent of the milk flowed through cooperative organizations in 1989 (ACS, 1989 and PA Ag. Stat., 1989).

The commonwealth government of Pennsylvania leads many other states by providing strong support of agricultural cooperation through education. A law passed in 1968 (Cooperative Agricultural Association Act) provided for a continuing education program for cooperatives' board's of directors. The Pennsylvania State University receives funds annually through the Pennsylvania Department of Agriculture to offer this educational program.

Federal and state governments generally view cooperatives as a positive force in the economy. Provision of a competitive yardstick normally heads the list of rationales for cooperatives. The notion is that the presence of a cooperative in a market can forestall or remove problems associated with imperfectly competitive markets. The cooperative can balance the market power when one or a few sellers or buyers dominate the market. Farmers who are almost always on the side of the market that is highly competitive can help themselves by organizing into a cooperative. Their right to do this is protected by federal statutes, specifically the Capper-Volstead Act passed in 1922. This act expressly authorizes producers of agricultural products to act together in associations--corporate or otherwise (ACS, 1977).

In addition to serving economic functions, cooperative organizations have a long history of responding to the service needs of their members and in providing leadership within communities (Christy, 1987). Or to paraphrase Williams, these are institutions that stress social change and which have a role in helping rural communities achieve the goals they are pursuing. The cooperative is organized primarily for economic goals but it also responds to social goals as well. More on this is included in following sections.

PENNSYLVANIA'S RURAL COMMUNITIES

Pennsylvania's rural economies face a number of structural changes. Generalization about rural communities in Pennsylvania is difficult because obviously each community is unique and not all are in serious trouble. Also, a thorough discussion of the problems in rural areas is beyond the scope of this paper. But at the risk of overgeneralization and understatement, some major trends affecting Pennsylvania's rural economy can be identified. Employment and income trends reveal that rural economies

have begun to shift from their traditional economic activities (including farm production, agriculturally related business, mining, and manufacturing) toward an increase in service provision. Pennsylvania is not alone in this as similar shifts are also occurring in other mid-Atlantic states.

Total employment in these traditional rural sectors declined on average (for both metro[1] and nonmetro counties) 19.8 percent over the 1975-1987 period. This aggregate decline masks some of the more dramatic losses such as the 53 percent decline in metro counties mining employment. The result of these shifts is that Pennsylvania residents are being forced to change how they earn their living. With service sector employment increasing by 60.5 percent in metro counties and 30 percent in nonmetro counties, more people are now employed in this sector. Today additional services make up more of the final value of the products we consume (Smith, 1991).

In today's world of increasing ties to national and global trends, rural economies find themselves increasingly tied to events in broader regions and international spheres. As countries around the world proceed on their development paths, products or services that were once provided at a comparative advantage in a given rural economy may within a span of a year or two be produced more cheaply in another country or another part of the United States. Communities that are sustained by one industry will not have the flexibility to shift away from the now uncompetitive production without a major upheaval in the local economy.

This transformation in local economies often leaves individuals behind. Many face long-term unemployment as old jobs disappear and new jobs (if there are any) require different skills. As a result, social problems have increased in the rural areas. Low educational attainment, poverty, poor health conditions, inadequate physical infrastructure, and a shortage of capital constitute some of the major problems (OTA, 1991).

RURAL ECONOMIC DEVELOPMENT

The concept of economic development is a broad one and encompasses many ideas and approaches. Most agree that local leadership must be present and involved for rural revitalization to proceed (Nadeau, 1989). But a search for a better life often draws promising leaders from the rural areas to larger urban centers leaving behind a vacuum of leadership. Development also requires knowledge by a group of committed people about the workings of the political machinery and how to utilize this knowledge to improve the quality of rural life. Any attempt to build this local "critical mass" suffers as

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[1]A county is defined as metro if it has a city with a population of at least 50,000 or an urbanized area of at least 50,000 and a total metropolitan area population of at least 100,000. A county is also classified as metro if it has close economic and social relationships with the central counties (Smith, 1991).

potential leaders leave the rural areas (Williams, 1974). Those left behind often look to local organizations to provide leadership.

Importantly, cooperatives and their employees can fill and have been filling these leadership gaps. Several cases provide excellent examples of this point. Eastern Iowa Rural Electric has recently established a subsidiary called New Ventures that provides business development services such as site locations, identification of public financing programs, and low-cost operating loans. In Wisconsin, Federation Cooperative (a member cooperative of Land-O-Lakes and Cenex) purchased a commercial center that now includes a service station, gift shop, restaurant, art gallery and motel. Jackson County Electric Cooperative, the local rural electric, provided the organizing push for establishment of the center and for the development of a local industrial park (Nadeau, 1989). Another example is the Blue Ridge Electric Cooperative in North Carolina which has had a rural development department for many years and actively seeks out methods for strengthening the communities in its large service area.

In Pennsylvania, cooperatives have regularly supported the long-term viability of the communities in which they operate through local or regional cooperative councils. Such councils bring cooperative employees, cooperative members, agriculture teachers, and university extension personnel together into think tanks and action committees. These councils regularly provide educational opportunities, leadership enhancement experiences, and network building occasions for rural residents, teachers, and farmers. One program developed within Pennsylvania's Southeast Council and coordinated through The Pennsylvania State University offers outstanding one-day conferences each year. The Pennsylvania State University works with the council to allow this conference to be counted as a one-credit course in Agricultural Economics. The upcoming conference, Ag Horizons III, will be offered in August 1992 and will focus on changes within agriculture in the northeast and strategies for coping with change. The program features a nationally-known psychologist who has worked extensively with rural residents in their efforts to adapt to change.

NEW ROLES FOR COOPERATIVES

Cooperatives and Technology Advances

Advances in communication technologies and information services hold promise for rural America. Rural communities often find themselves at a disadvantage when trying to attract and maintain businesses because of their distance to metropolitan areas. Emerging technologies can likely reduce this disadvantage, which means that rural communities have a great deal to gain or lose depending on how these technologies are deployed. Further, if emerging technologies allow businesses to operate more efficiently or to gain competitive advantage over competitors, the rural businesses must not be left

behind. Rural businesses need mechanisms to pool their communications needs and benefit from efficiencies enjoyed by larger, urban-based businesses (OTA, 1991).

Fiber optics and satellite transmissions are two types of technology that could greatly aid rural communities. These represent new communication systems and new ways of delivering communication services to rural areas. Rural Area Networks, RANS, pool diverse users to capture considerable economies of scale. They can overcome problems of limited technological expertise in rural areas since they can be designed by one systems integrator. Rural networks could be configured around the needs of the entire community and would link as many users as possible. For example, those included could be businesses, educational institutions, health providers, and local government offices. Once linked in a RAN, the participants could transmit data, voice, or FAX transmission along the network. If the local network was hooked to a larger state or regional network, then the local network subscribers could be directly linked to businesses, hospitals, libraries, or government agencies in metropolitan areas. This would provide a strong selling point in trying to entice new business into rural communities.

The cooperative provides an ideal organizational scheme for administering such networks. Examples already in existence include a telecommunication cooperative in North Dakota, which is currently operating a network that links population centers with fiber optic cable which in turn is linked to a statewide fiber network. Dairyland Power Cooperative has entered into a joint venture with other investor-owned utilities to provide fiber optic services to parts of Illinois, Wisconsin, and Minnesota. The Western Wisconsin Communications Cooperative provides interactive cable television services to eight rural high schools and to Western Wisconsin Technical College (Nadeau, 1989). Established by the National Rural Electric Cooperative Association, the National Rural Telecommunications Cooperative (NRTC) allows satellite communications to be accessible to rural communities through local electric and telephone cooperatives.

Cooperatives and Rural Health

Rural health care is in a critical condition. Rural counties in the United States (nonmetropolitan) report much higher rates of chronic health conditions and mortality from injuries and accidents than do metropolitan areas. Rural residents are more likely to be uninsured or self-insured than urban residents and are more likely to report that they are in fair or poor health. Nearly 25 percent of the population lives in rural areas yet only 12 percent of all physicians practice in rural counties (Kushner, 1991). For further background information on rural health see Norton and McManus (1989).

Rural leaders have begun to look at an old idea--rural health care cooperatives--as a possible solution to current health care problems. The idea is old because the first recorded medical cooperative was formed in rural Oklahoma in 1929 by Dr. Michael Shadid. The medical profession was very much against this consumer-run medical

service and lobbied to have them made illegal. By 1939, 26 states had passed laws barring these organizations (Kushner, 1991). Despite the disapproval of the American Medical Association, over 100 health care cooperatives were formed in rural areas after 1929. In 1988, only 13 were still operating albeit these 13 had over one million members (Kushner, 1991).

The old idea of health care cooperatives is being resurrected in a form that is slightly different from the type of cooperative formed by Dr. Shadid. His idea was to form "primary" cooperatives where patients were members. The four principals around which these cooperatives were formed are group practice, prepayment, preventive care, and community control. Such primary cooperatives were formed to provide health care to an area where none had existed. This form differs from that of a secondary cooperative.

Today's cooperatives tend to be secondary cooperatives where the members are health care institutions. These are formed to lessen the economic problems surrounding small populations. They allow members to lower per unit costs and thus stay competitive with the larger urban-based medical groups (Kushner, 1991). A survey conducted by the University of Minnesota in 1990 found that there were 127 hospital networks or consortia around the nation. Nearly 40 percent of these were formed since 1987 (Division of Health Services, 1990). The cooperatives are formed around various needs including debt collection, group purchasing, and joint recruiting and training of personnel (Kushner, 1991). These secondary cooperatives are attempting to capture economies of scale.

Some health care officials hope that the secondary cooperatives will eventually provide good "parents" to primary health care cooperatives. Establishing and maintaining a primary health care cooperative requires enormous community support and organization. This has been a major drawback to the success of primary cooperatives in the past. Possibly the growth in secondary cooperatives will provide a needed ingredient for future success of primary cooperatives. For example, the Rural Wisconsin Hospital Cooperative was founded in 1979 and is a secondary cooperative with hospitals as members. The cooperative develops joint ventures among the hospital members. In 1983, the cooperative developed a health maintenance organization that became the third largest rural-based prepaid plan in the nation (Kushner, 1991).

Other Cooperative Roles

Three other examples of roles cooperatives can play in rural revitalization come from three different areas of the United States. The first is the Watermark Cooperative in North Carolina, which is now a well-known craft cooperative. What started with 35 women who wanted to market products they could make at home has grown into a business that wholesaled $250,000 in products and had 450 members in 1987. Watermark definitely has a social conscience. The cooperative regularly brings in new craftspeople with an innovative educational program that requires members to eventually take on an apprentice or teach craftmaking to new members. The cooperative also

targets women referred by the local battered women's shelter, the Food Bank, and the Department of Social Services for their craftmaking classes. Watermark's training director, whose salary is paid by a grant from the private Northeastern Education and Development Foundation, also teaches classes in recordkeeping and assertiveness (Herndon, 1988).

Green Lion Marketing Cooperative in Southern Minnesota was formed by a group of local farmers to identify new markets and crops. The intent is to identify niche markets into which the farmers can move. Current specialty products include blue corn, white corn, squash, pumpkin, and edible soybeans (Nadeau, 1991).

And finally, in California, biotechnology and sustainable agriculture have brought a new use for a cooperative. Apple and pear producers have formed a cooperative to buy a caterpillar-killing virus in larger quantities. The virus is a nonchemical method for controlling a certain species of caterpillar which can be a serious problem for apple and pear producers.

A LEGISLATIVE UPDATE

The national cooperative community has recognized the past influence and future potential for the cooperative organization in rural development and has come together to put legislation in place to support rural development through cooperatives. A National Rural Cooperative Development Task Force has been formed by the National Cooperative Business Association, the National Council of Farmer Cooperatives, and the National Rural Electric Cooperative Association along with many state, regional, and local cooperative associations. The Task Force introduced legislation into Congress, which provides for the establishment of a national system of university-based cooperative centers. The legislation is part of the 1990 Farm Bill. The next step is to secure funding appropriation for the centers. The centers would provide or fund educational activities for cooperative formation or maintenance, supply technical assistance to cooperatives, help groups develop feasibility studies and business plans, and assist with loan packaging. The ultimate purpose of the centers is to "stimulate economic growth and employment in rural areas through a new generation of cooperatives." (Ohio Council of Cooperatives, 1991)

SUMMARY

Cooperatives have been an integral part of agricultural and rural development for over 50 years. Farmers have organized to provide themselves with bulk purchase of supplies, marketing services for all types of products, and other production-related services such as artificial insemination, animal testing, and recordkeeping. These cooperatives contributed to the current high productivity of United States agriculture. Rural areas also benefitted from cooperative development. Rural electric and telephone

cooperatives brought new technologies to the rural areas. Capital was also made available to rural borrowers and farmers through the cooperatives of the Farm Credit System.

The linkage of cooperatives to rural development has not weakened and potentially may be growing stronger. Established cooperatives continue to provide leadership in their communities by helping to organize development efforts. The cooperative form of business also holds promise for bringing new technology to the rural areas as they once did with electricity and the telephone. Health care cooperatives are also being discussed as possible vehicles for helping local medical groups survive by capturing economies of scale and bringing primary health care to areas where it is currently unavailable.

This paper does not suggest that cooperatives are a potential panacea for what ails rural America. It does point out, however, certain areas where cooperatives have strengths and may play key roles in the future. Federal legislation to establish regional cooperative development centers for support of the next generation of rural-based cooperatives is only one indication of the new interest in cooperatives.

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HIRED FARM LABOR TRENDS IN THE U.S. AND PENNSYLVANIA

Jill L. Findeis and Timothy Bowser*

INTRODUCTION

The Workforce 2000 predicted the development of a labor shortage in the U.S. beginning in the 1990s and continuing into the twenty-first century. Predictions of future labor shortages have raised concern among employers, including operators of U.S. farms. Two important questions have been raised by American farmers:

(1) Will a national labor shortage significantly affect the availability and cost of the farmworkers I need?

(2) Shortage or not, how can my farm attract and keep farmworkers with the necessary skills?

These questions are important, given that almost 10 percent of the total cost of production on U.S. farms is the cost of hired labor (see Table 1). In Pennsylvania, the percentage is slightly higher (see Table 2). Although the proportion of total costs paid for hired labor has remained relatively constant over time in both the U.S. and Pennsylvania, predictions of a national labor shortage raise concern that either labor costs will increase significantly or that farmworkers will become increasingly more difficult to hire.

This paper examines trends in the hired farm labor workforce in the U.S., the Northeast and Pennsylvania. Trends in the numbers of workers employed year-round, casually, or on a seasonal basis are discussed, as well as trends in what farms have to pay to keep a qualified workforce. In addition, Pennsylvania farmers' perceptions of labor availability and additional needs for hired farm labor will be examined using data from the 1991 Hired Farm Labor Survey conducted by Penn State.[1]

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[1]The 1991 Hired Farm Labor Survey was funded by the Pennsylvania Department of Agriculture and includes questions related to use of hired and family farm labor by season. Respondents were asked about the numbers of full-time, part-time (full-year), and seasonal workers hired; wages paid and perquisites provided for each type of labor; and the perceived availability of farmworkers and current needs. A full description of the data from this questionnaire will be available upon request from the authors in August, 1992.

U. S. TRENDS

At the national level, the numbers of hired farmworkers have declined over time (see Chart 1), as farms have consolidated and become more mechanized. As shown in Chart 1, significantly more farmworkers were employed in the U.S. in the 1960s than in later years. However, since the 1960s, the total number of farmworkers has remained relatively stable, at least until the late 1980s.

Of particular concern for the future are recent hired labor employment statistics. In 1987, the Economic Research Service (ERS) found that fewer farmworkers (2.46 million) were hired than in any recorded year since at least 1961. Statistics from the National Agricultural Statistics Service (NASS) show a similar trend, which is particularly evident during the summer. For example, in July 1980, there were 1.79 million farmworkers employed in the U.S. By July 1985, this number had declined to 1.37 million, and by July 1990 only 1.10 million workers were employed (Chart 2). Farmworkers employed in other NASS reporting months have also declined in numbers, although not as substantially as in July (see Charts 3 and 4).

There has also been a significant change in the composition of the hired labor workforce. What has happened is that the number of full-time farmworkers in the U.S. has increased somewhat, while the numbers of "casual" or part-time workers have declined significantly. Chart 5 shows changes in the numbers of hired farmworkers by the number of days they work on-farm. As shown in Chart 5, there has been a slight upward trend in the number of farmworkers employed full-time (150 days or more annually) in the U.S., particularly in the 1980s. This trend has been accompanied by a substantial drop in the number of farmworkers working less than 150 days a year, and particularly those working less than 75 days a year (see Chart 5). The decline in farmworkers employed in July observed above likely reflects the decline in part-time workers. Employment declines in other months (when full- time labor comprises a larger proportion of total employment) have not been as substantial as that witnessed in July.

Why have these changed occurred? The trend toward fewer part-time workers is in part attributable to the long term decline in the number of farms in the U.S. However, fewer farmworkers may also reflect declines in the numbers of workers willing and able to work on farms on a part-time basis. For example, fewer older children are now available to work during the summer months on U.S. farms, given demographic trends toward smaller family sizes. The trend toward fewer part-time workers may also reflect differences in wages and benefits among full- and part-time workers. Full-time workers are more likely to be employed in supervisory roles, earning significantly higher hourly wages (see Table 3). Full-time workers are also more likely to enjoy nonmonetary benefits--e.g., sometimes housing, meals, and bonuses.[2]

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[2]In July 1990, 57% of all farmworkers received wages only; 6% received housing and meals; 15% received housing (no meals) and 6% had meals (no housing); 4% earned a bonus and 12% received other benefits (NASS/USDA, March 1991).

Finally, it should be noted that farm size has important implications for hired labor use. Over half of all hired farmworkers are hired to work on farms with sales of $250,000 or more annually. These farms generally pay the highest wages, perhaps a reflection of their employment of supervisory labor. However, as shown in Table 4, small farms also tend to pay higher than average wages. Mid-size farms pay lower wages on average, perhaps reflecting less dependence on full-time supervisory labor but more dependence on lower cost casual or part-time labor.

Situation in the Northeast

Farms in the Northeast region have also recently hired more full-time workers and now rely less heavily on a part-time workforce. These trends are observed for both Northeast I Region (New York, Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont) and Northeast Region II (Pennsylvania, Delaware, Maryland, New Jersey). As shown in Charts 6 and 7, both regions are heavily dependent on hired labor that works full-time, or at least more than 150 days per year. During the 1980s, not only did the *proportion* of full-time hired farmworkers in the Northeast increase but the *number* of full-time workers increased as well.

Compared to the U.S. in general, hired farmworkers in the Northeast are more likely to be employed full-time and are better educated (see Table 5). Workers are also less likely to be male, but are more likely to be white and not Hispanic, Black, Asian, or of other races. Comparing 1987 statistics from ERS, 25 percent of hired farmworkers in the Northeast were hired for 250 or more days annually, compared to 19 percent nationally. At the same time, only 25 percent of Northeast hired labor worked 25 days or less compared to 35 percent for the U.S. Not only has the reliance of the Northeast region on full-time help increased over time, but the Northeast is more dependent on full-time labor than the U.S. overall.

Hired farm labor in the Northeast also is better educated; 68 percent of Northeast farmworkers have a high school education or better compared to 59 percent for the U.S. In addition, 1 in 4 Northeast farmworkers are female compared to 1 in 5 for the U.S., and 11 percent are non-white compared to 22 percent for the U.S. overall. *Of the total number of hired farmworkers for whom this was not their primary occupation*, 43 percent in the U.S. "attended school" as their major occupation, compared to 48 percent for the Northeast. Also, 33 percent of part-time farmworkers in the U.S. were employed principally in an off-farm job, 10 percent were "keeping house," and 6 percent were unemployed. This compares to 34 percent of comparable farmworkers in the Northeast who reported working principally at an off-farm job, 12 percent that "kept house" and only 3 percent that were otherwise unemployed (Oliveira and Cox).

Comparisons of wage trend data show that before approximately 1986, average wages for farmworkers in the Northeast were lower than the national average (see Chart 8). However, since then, average wages in the Northeast have generally been higher,

reflecting higher rates of increase in farm wages in the Northeast relative to the Nation. It is likely that this increase is partly attributable to the sharper decline in the numbers of part-time or casual farmworkers witnessed in the Northeast.

Comparisons of wage data also show that both large and small Northeast farms tend to pay higher wages than mid-size farms. For example, in July 1990, smaller farms (<$40,000 annual sales) paid an average $5.57 per hour, large farms (at least $250,000 in annual sales) paid $6.04 per hour, while farms with annual sales in the $40,000 - $99,999 and $100,000 - $249,999 ranges paid $4.35 and $4.36, respectively (Table 6).

Hired Labor Availability on Pennsylvania Farms

To assess changes in hired farm labor availability in Pennsylvania and to determine what strategies Pennsylvania farmers now use to keep their labor, the Hired Farm Labor Survey was conducted by Penn State University in Spring, 1991. Previously, in 1986-87, 989 farm families had been interviewed to determine the prevalence of off-farm work in Pennsylvania.[3] This earlier survey also included questions on hired labor use and wages paid for full-time (year-round); part-time (year-round); and part-time (at harvest) labor.

In 1991, the families in the earlier sample were recontacted. Some operators had left farming and some were deceased, and a very few refused to answer the second survey. In total, 484 farm households responded. Questions were asked about the amounts of time the principal farm operator, spouse, children and other relatives spend doing on-farm work, by season. Questions were also asked about (1) the use and perceived availability of different types of farm labor, (2) wages paid and perquisites given to hired farm labor, (3) needs for additional hired farm labor, and (4) strategies used to keep their hired workforce.

The survey showed that smaller farms (<$40,000 in annual sales) hired fewer workers, especially full-time labor; only about 20 percent of small farms in Pennsylvania were found to hire labor. In contrast, about 60 percent of large farms (> $100,000 sales annually) hired some labor. Farms with sales of $100,000 or more hired relatively more full-time and seasonal workers than mid-size farms. Only 10 percent of mid-size farms hired full-time labor compared to 30.1 percent of larger farms. Larger farms were also more likely to hire seasonal labor than mid-size farms--23.0 percent of large farms compared to 15.0 percent of mid-size farms.

In addition, Pennsylvania farms reported that in the past five years they have, indeed, found hired labor to be less available (see Table 8). When asked *in general* about the availability of farm labor in their area compared to 5 years ago, 62 percent of the farmers believed labor was less available in 1991, while 31 percent saw no change,

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[3]See Hallberg, Findeis and Lass (1987) for a summary of the survey results related to off-farm employment and income.

and 7 percent perceived an increase. The survey also showed that more Pennsylvania farmers found full-time labor particularly difficult to hire (51 percent) but many farm families also had difficulty hiring seasonal (46 percent) and part-time, year-round labor (41 percent).

Some farmers responded that they would hire more labor if labor was available in their area (at a price they could afford). Interestingly, although farmers thought full-time farm labor had become particularly more difficult to hire, more farms reported needing additional seasonal and part-time labor. Of the over 450 farms that responded to questions related to labor needs, 85 reported wanting to hire more seasonal farm labor and 65 reported needing more part-time, year-round workers. In total, 26 farms wanted to hire more full-time labor.

When asked about the availability of local labor for farming, many farmers complained that jobs outside farming were attracting the students and others that they had previously relied upon for summer work. In some cases, farmers believed they were unable to compete with nonfarm jobs in terms of providing comparable wages and benefits. But in other cases, they perceived that these jobs did not necessarily pay more per hour, but that the fewer hours of work required per day (or per week) was attractive compared to farming.

A further problem was that few Pennsylvania farmers had adopted practices designed to attract and retain labor other than being kind, friendly, and considerate to their workers. Farms that need labor will need to find other methods for meeting their labor needs, if not in the short run during this recessionary period, at least in the long run.

Future Trends Affecting Pennsylvania Farms

From the viewpoint of Pennsylvania farmers, several trends are important for the future:

*First, it is likely that the trend toward fewer part-time workers will continue. The hired farm workforce will continue to evolve toward a labor force comprised of an increasingly greater proportion of full-time workers.

*Second, mid-size farms may have the most difficulty attracting and retaining farmworkers now and into the future. Small and large farms on average pay higher wages and, therefore, are more likely to attract hired labor than mid-size farms.

*Third, as nonfarm opportunities increase, farmers will need to provide potential farmworkers with competitive salaries, benefits, and hours. Some farms will be unable to match conditions in the nonfarm sector, but those that do will be able to find the labor they need.

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Table 1. Hired Labor and Total Production Expenses for the U.S., 1970-88

Year	(1) Hired Labor Expenses[a] (mil. $)	(2) Total Production Expenses (mil. $)	(1) ÷ (2) Proportion of Total Expenses (%)
1970	$5,197	$47,775	10.88%
1971	5,354	50,283	10.65
1972	5,550	55,645	9.97
1973	6,420	69,393	9.25
1974	7,337	74,302	9.87
1975	8,078	78,090	10.34
1976	8,997	85,813	10.48
1977	9,569	91,750	10.43
1978	10,055	105,306	9.55
1979	11,045	124,698	8.86
1980	11,117	134,791	8.25
1981	10,916	140,956	7.74
1982	12,099	145,456	8.32
1983	11,621	146,490	7.93
1984	11,899	149,042	7.98
1985	11,983	140,292	8.54
1986	11,700	132,240	8.85
1987	12,777	136,281	9.38
1988	13,373	143,427	9.32

[a] Includes "cash wages, Social Security, perquisites, and contract labor, machine hire and custom work expenses" (REIS, BEA, April 1990, Table CA45).

Source: Regional Economic Information System, U.S. Department of Commerce, Bureau of Economic Analysis, April 1990, Table CA45.

Table 2. Hired Labor and Total Production Expenses for Pennsylvania, 1970-88

Year	(1) Hired Labor Expenses[a] (thous. $)	(2) Total Production Expenses (thous. $)	(1) ÷ (2) Proportion of Total Expenses (%)
1970	$119,508	$939,906	12.71%
1971	116,251	967,186	12.02
1972	118,481	997,728	11.88
1973	155,430	1,247,000	12.46
1974	187,982	1,481,197	12.69
1975	197,792	1,590,108	12.44
1976	236,315	1,802,115	13.11
1977	239,557	1,937,167	12.37
1978	226,270	2,159,400	10.48
1979	248,380	2,503,508	9.92
1980	254,064	2,834,253	8.96
1981	248,318	3,033,512	8.19
1982	277,100	2,998,247	9.24
1983	266,228	3,240,958	8.21
1984	268,332	3,184,539	8.43
1985	271,000	3,087,494	8.78
1986	267,590	3,005,574	8.90
1987	292,069	3,102,357	9.41
1988	304,233	3,248,678	9.36

[a] Includes "cash wages, Social Security, perquisites, and contract labor, machine hire and custom work expenses" (REIS, BEA, April 1990, Table CA45).

Source: Regional Economic Information System, U.S. Department of Commerce, Bureau of Economic Analysis, April 1990, Table CA45.

Table 3. Hourly Wages Paid to Hired Farm Labor in the U.S., Northeast I and Northeast II Regions (Includes Pennsylvania), 1991

1991 Wage Rates by Worker Type	U.S.	Northeast I[a]	Northeast II[b]
		($ per hour)	
Field			
April 7-13	$5.45	$5.98	$5.50
July 7-13	5.26	5.81	5.44
October 6-12	5.67	6.29	5.81
Livestock			
April 7-13	5.35	5.08	5.01
July 7-13	5.16	5.18	5.14
October 6-12	5.32	5.13	5.10
Field and Livestock			
April 7-13	5.42	5.54	5.30
July 7-13	5.24	5.56	5.36
October 6-12	5.61	5.85	5.66
Supervisory			
April 7-13	8.82	8.43	7.85
July 7-13	8.56	8.13	8.59
October 6-12	8.50	8.78	9.35

[a] Northeast I includes New York, Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont.

[b] Northeast II includes Pennsylvania, Delaware, Maryland, and New Jersey.

Source: Farm Labor (selected quarterly reports), National Agricultural Statistics Service, USDA.

Table 4. Distribution of Hired Farmworkers and Wages Paid by Value of Annual Farm Sales, U.S, 1990

	Annual Farm Sales				
	Less than $40,000	$40,000-$99,999	$100,000-$249,999	$250,000 or more	All Farms
Number of Workers			(% of total employment)		
January	11%	15%	19%	55%	100%
April	10	17	18	55	100
July	15	14	21	50	100
October	11	13	23	53	100
Average Hourly Wages Paid			(dollars per hour)		
January	$5.35	$4.97	$4.88	$6.10	$5.66
April	5.33	4.86	4.80	5.91	5.51
July	4.81	4.75	4.72	5.66	5.27
October	4.89	5.11	5.21	5.95	5.61

Source: Statistical Bulletin 822, National Agricultural Statistics Service, USDA.

Table 5. Characteristics of Farmworkers in the U.S. and in the Northeast, 1987

Characteristics[a]	U.S.	Northeast
	(% by category)	
Racial/ethnic Group		
White	78%	89%
Hispanic	14	3
Black and other	8	9
Sex		
Male	80%	74%
Female	20	25
Years of Education		
0-4	11%	7%
5-8	16	6
9-11	14	19
12	39	46
13 and over	20	22
Days of Farmwork		
Less than 25	35%	25%
25-74	20	19
75-149	13	17
150-249	13	14
250 and over	19	25
Primary Employment Status		
Hired farmworker	29%	29%
Operating a farm	5	5
Unpaid farmworker	0	0
Nonfarmworker	22	23
Unemployed	4	0
Keeping house	7	8
Attending school	29	32
Other	4	2

[a] Percentages summed over characteristic categories may not sum to 100% due to rounding.

Source: V. J. Oliveira and E. J. Cox, The Agricultural Work Force of 1987: A Statistical Profile.

Table 6. Distribution of Wages Paid by Value of Annual Farm Sales, Northeast Region, 1990

Average Hourly Wages Paid	Annual Farm Sales				
	Less than $40,000	$40,000-$99,999	$100,000-$249,999	$250,000 or more	All Farms
	(dollars per hour)				
January	$4.65	$4.20	$4.04	$6.04	$5.21
April	4.06	4.94	4.41	6.39	5.52
July	5.57	4.35	4.36	6.04	5.39
October	4.79	4.64	4.93	6.29	5.55

Source: Farm Labor (selected quarterly reports), National Agricultural Statistics Service, USDA.

Table 7. Distribution of Farm Labor by Annual Farm Sales, Pennsylvania, 1991

Type of Hired Labor	Annual Farm Sales			
	Less than $40,000	$40,000-$99,999	$100,000 and more	All Farms
	(percent of total employment)[a]			
Full-time, Year-round	4.0%	10.0%	30.1%	11.2%
Seasonal	13.9	15.0	23.0	16.4
Part-time, Year-round	3.7	8.3	8.9	5.6
No Hired Labor	78.4	66.7	38.1	66.7

[a] Columns may not sum to 100% due to rounding.

Source: 1991 Hired Farm Labor Survey, The Pennsylvania State University.

Table 8. Availability of Hired Farm Labor in Pennsylvania, 1991

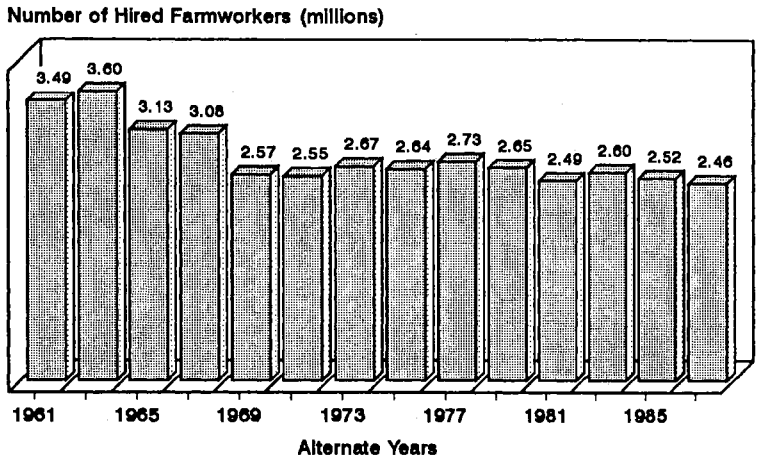
	Type of Hired Farm Labor[b]		
	Full-time, Year-round	Seasonal	Part-time, Year-round
Degree of Hiring Difficulty			
Difficult to Hire	46 (51%)	61 (46%)	40 (41%)
Not Difficult	45 (49%)	73 (54%)	58 (59%)
Availability of Hired Labor Compared to 5 Years Ago[a]			
Easier to Hire	6 (7%)	9 (7%)	3 (3%)
Harder to Hire	42 (45%)	54 (42%)	39 (41%)
No Change	45 (48%)	66 (51%)	54 (56%)
Need for Additional Hired Farm Labor			
Would Hire if Available	26 (6%)	85 (18%)	65 (14%)
Not Needed	435 (94%)	377 (82%)	398 (86%)
Skills of Hired Labor			
Sufficient	64 (79%)	102 (77%)	72 (78%)
Not Sufficient	17 (21%)	31 (23%)	20 (22%)

[a] When asked about the general availability of all types of farm labor in their area compared to 5 years ago, 27 farmers (7%) responded that there is now more labor, 242 (62%) answered that labor was less available in 1991, and 120 (31%) noted no change in availability in their area.

[b] Percentages are calculated relative to the respondents answering a question.

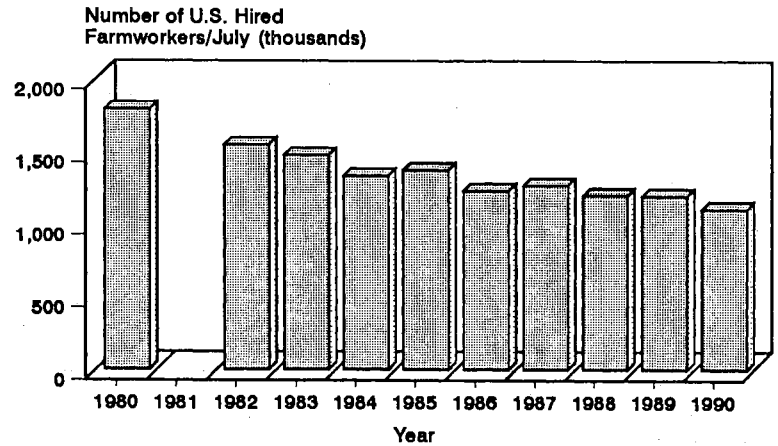
Source: 1991 Hired Farm Labor Survey, The Pennsylvania State University.

Chart 1. Hired Farmworkers in the U.S., Alternate Years 1961-1987



Source: V. J. Oliveira and E. J. Cox, The Agricultural Work Force of 1987: A Statistical Profile.

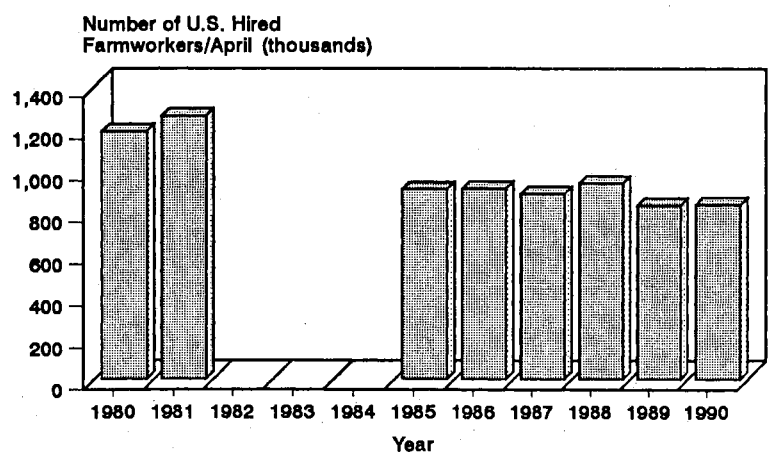
Chart 2. Numbers of Hired Farmworkers Employed in U.S. - July



Sources: Statistical Bulletin 822 and Farm Labor (1991 quarterly reports), NASS, USDA.

Note: Comparable data for the year 1981 are not available.

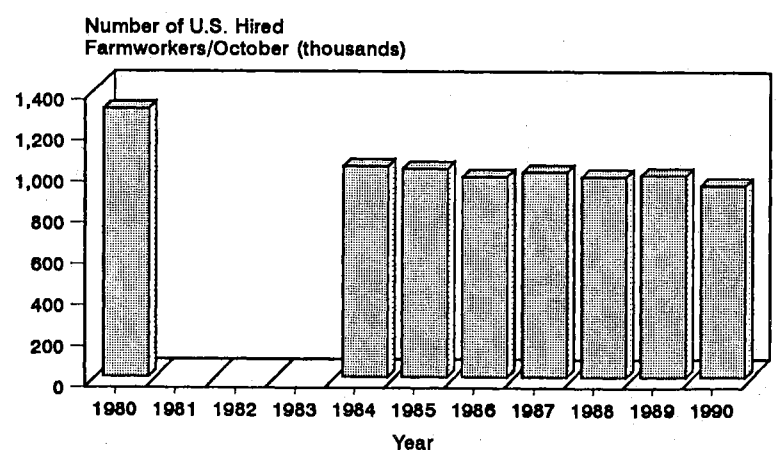
Chart 3. Numbers of Hired Farmworkers Employed in the U.S. - April



Sources: Statistical Bulletin 822 and Farm Labor (1991 quarterly reports), NASS, USDA.

Note: Comparable data for the years 1982-1984 are not available.

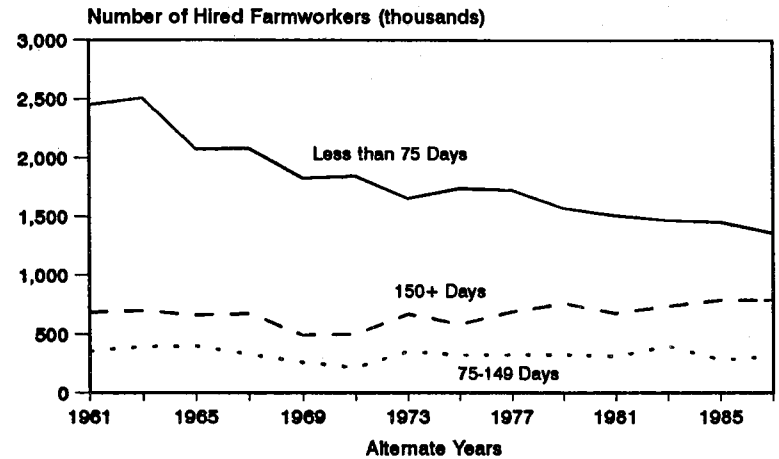
Chart 4. Numbers of Hired Farmworkers Employed in U.S. - October



Sources: Statistical Bulletin 822 and Farm Labor (1991 quarterly reports), NASS, USDA.

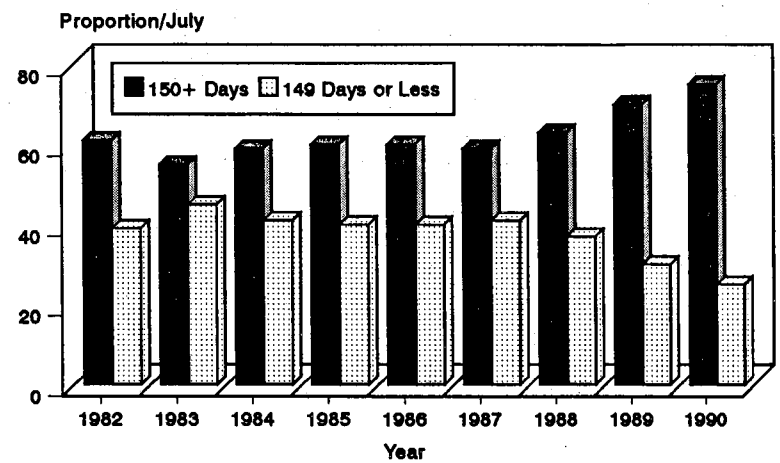
Note: Comparable data for the years 1981-1983 are not available.

Chart 5. Changes in Numbers of U.S. Hired Farmworkers by Number of Days of Farm Work, Alternate Years 1961-87



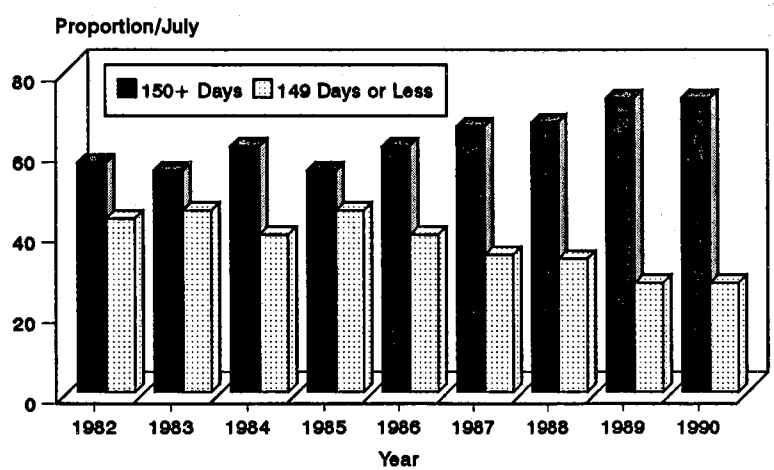
Source: V. J. Oliveira and E. J. Cox, The Agricultural Work Force of 1987: A Statistical Profile

Chart 6. Proportions of Hired Farmworkers in Northeast I (NASS) Region by Days Worked



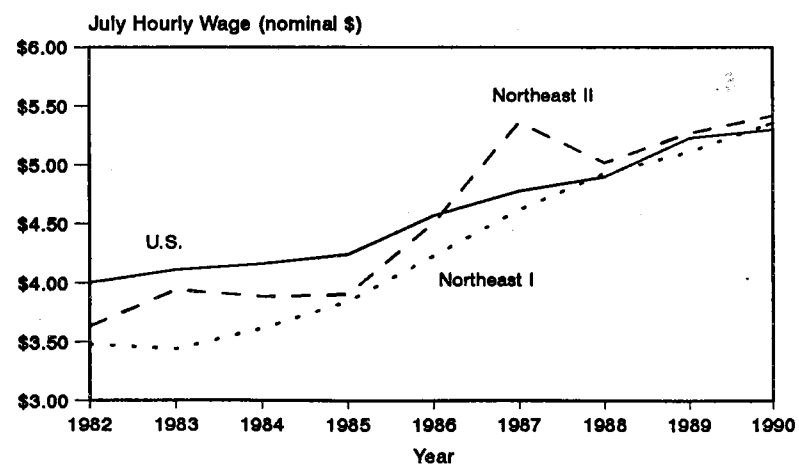
Sources: Statistical Bulletin 822 and Farm Labor (1991 quarterly reports), NASS, USDA.

Chart 7. Proportions of Hired Farmworkers in Northeast II (NASS) Region by Days Worked



Sources: Statistical Bulletin 822 and Farm Labor (1991 quarterly reports), NASS, USDA

Chart 8. Average July Hourly Wage for Hired Farmworkers, 1982-90



Sources: Statistical Bulletin 822 and Farm Labor (1991 quarterly reports), NASS, USDA

FREE TRADE WITH MEXICO AND THE DAIRY INDUSTRY

Stephen M. Smith, Milton C. Hallberg, and James R. Cranney*

INTRODUCTION

In June 1990, President Bush and Mexican President Carlos Salinas de Gortari agreed to initiate a bilateral agreement to reduce and/or eliminate tariff and non-tariff barriers to trade between the U.S. and Mexico. In December 1990, Canada was invited to join the negotiations, and accepted in February 1991. In May 1991, the U.S. Congress voted to extend *fast-track* authority to allow President Bush to negotiate a trade agreement directly with Mexico and Canada. The three countries began negotiations in July 1991 with the hope of concluding an agreement in 1992.

The economic impacts of this agreement are a matter of concern in both Mexico and the U.S. Impacts cannot be determined without knowledge of Mexico's dairy industry, from production to marketing to government policy. The purpose of this paper is to provide information that will help assess the potential effects on the U.S. dairy industry. Such impacts will revolve around the structure of the Mexican dairy industry and its production potential; the future demand for dairy products in Mexico, based on income and population changes and government social policy; and trade and dairy support policies in Mexico, the U.S., and the European Community (EC). The report is based on information obtained during a visit to Mexico in June 1990, talks with government officials, consultants, university researchers, producer and marketing organizations, and dairy farmers.[1]

MEXICAN ECONOMIC POLICIES

Mexican economic development policy historically has emphasized industry. With respect to agriculture, the country has been characterized by the classic development dilemma of trying to maintain high producer prices while at the same time providing food to its consumers at low prices. Generally, this dilemma was managed through a complex arrangement of price controls administered by government agencies--closer to a centrally planned system than to a free market system. Subsidies were plentiful for both consumers and producers, especially during the petroleum-led development era. Lack

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[1]This research was conducted under Cooperative Agreement 43-3AEL-1-80069 with the Agricultural and Trade Analysis Division, Economic Research Service, USDA.

of attention to the agricultural sector, a rapidly growing population, and a major drought in 1979 led to increased imports of basic agricultural commodities.

Since 1981, Mexico has shifted to a crisis and austerity-based economic policy. Oil prices plummeted and oil revenues diminished, which together with a stagnating general economy, led to high inflation and an inability to service an expanding external debt. All this forced the Salinas government to implement new strategies. A particularly significant new strategy was the opening of Mexico's borders to greater international trade, and thus the movement toward a more market-oriented economy. This movement was reinforced in 1986, when Mexico joined the General Agreement on Tariffs and Trade (GATT). Finally, the Salinas government is now seeking to further its free-trade objectives through trade agreements with Chile and Venezuela, and through the North American Free Trade Agreement with Canada and the United States.

The dairy economy was not initially included in the new open market strategies, however. As part of social welfare and anti-inflation policies, certain key retail food prices (and hence also key farm product prices) were fixed, and not allowed to rise even though production costs were rising. Dairy products were among those subject to price controls. However, lack of a price incentive meant that milk production not only failed to expand so as to keep pace with increased demand, but actually fell absolutely, since the mid-1980s. The ever-widening domestic production shortfalls have led to steadily increasing imports of dairy products since the early 1980s (see Table 1).

THE MEXICAN DAIRY ECONOMY

Marketing

On the marketing side, the formal system for distributing fluid milk and manufactured dairy products in Mexico is similar to that of the United States. Milk is collected from farmers, transported to handlers, processed, shipped to retailers and purchased in a variety of retail outlets by consumers, or home delivered. Size and location of producers determines whether milk will first be assembled at a cooling station prior to delivery to the processor. Mexico's domestic milk market also has a large nonformal component, in that an estimated 30-50 percent of domestic raw milk production is consumed either as unpasteurized, unchilled fresh fluid milk, or processed into cheese by dairy farmers and sold direct to consumers. This milk is produced by *traspatios* and *dual-purpose* farms, which will be described below. Since this milk is difficult to track, it is also difficult to precisely quantify total milk production, processing and consumption in Mexico.

Another salient feature of the Mexican milk industry is the high level of government involvement, at least up to recent times. On the import side, a single quasi-government organization is authorized to import nonfat dry milk, CONASUPO (Compania Nacional de

Subsistencias Populares). A past goal of CONASUPO was to increase farmers' incomes as well as to provide dairy products to consumers at low cost. It accomplished this through a variety of producer and consumer subsidy programs. One means of providing consumer subsidies was to ensure a limited amount of competition to private sector operators while at the same time performing certain essential marketing functions in such a way as to guarantee low prices to consumers, especially low income consumers.

LICONSA (Leche Industrializada Conasupo), an arm of CONASUPO, is responsible for processing milk products and for administering the milk subsidy programs. Between 40 and 50 percent of the pasteurized milk market and an estimated 30 percent of the nonfat dry milk market is supplied by LICONSA.[2] Milk products processed by LICONSA are sold through conventional marketing channels or distributed directly to low income consumers. In the latter activity, LICONSA performs various marketing functions that would otherwise be performed by the private sector--dairy product storage, transportation, and coordination of wholesale and retail services--in order to keep the final cost to consumers low.

Since 1990, however, LICONSA's role has greatly changed. Its production subsidy programs have now been entirely suspended, and it is seeking to retire from the milk processing and distribution business by privatizing its processing facilities. In the future it will focus entirely on consumer subsidy programs, with a goal of reaching 80 percent of the population targeted for such assistance by 1994. Those targeted for assistance are children under 12 years of age from families earning less than twice the minimum wage. LICONSA presently serves approximately 5.5 million children, distributing 3.5 million liters of milk a day. It seeks to serve 11 million children by 1994. While LICONSA's milk processing activities are still substantial, three of its rehydration facilities (at Chichuahua, Veracruz, and Aguascalientes) have recently been sold to Mexican producers in joint ventures with foreign investors (U.S. Department of Agriculture 1991). These plants will still process nonfat dry milk purchased by CONASUPO, but it is hoped that local fluid milk producers will be the major suppliers of these plants in the future.

Production[3]

Milk for the commercial market is produced under three distinct systems in Mexico: the *confined* system, the *pastoral* system, and the *dual-purpose* system. These systems differ geographically, in terms of the technology used and in productivity per cow.

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[2]Personal communication from Enrique Sada Fernandez, Director General of LICONSA, June 1991.

[3]This section is based on Asociacion Nacional de Ganaderos Lecheros 1988; U.S. Department of Agriculture 1990a and conversations with a variety of people in Mexico, June 1991.

The *confined* system comprises approximately 14 percent of the national dairy herd and yields 55 percent of the domestically produced milk. Cows in this system are mostly Holstein. The average herd size is 230 cows, although herds of 1,000 cows are not uncommon. Cows in these herds produce 4,000 to 6,000 liters per year,[4] and are fed alfalfa and other forages that dairy farmers produce themselves or purchase locally with concentrates. Balanced feed supplements are commonly used. Artificial insemination is the typical breeding practice used in this system of production. Some producers in this group replace their cows from their own high quality herds; many import heifers from the United States or Canada for replacement purposes. In general, the *confined-system* herds are very well managed, from record keeping and veterinary care to genetic management.

The farm operations of this system are quite similar to those of large dairy farms found in California and in the southwestern region of the United States. A major difference, however, is that due to the low cost of labor in Mexico, the majority of these herds are milked by hand. Only 32 percent of the *confined-system* dairy farms have milking machines. A limited number of producers use cooling tanks. The *confined-system* dairy farms are generally located around the border states of Jalisco and Coahuila and the altiplano states of Queretaro, Mexico and Hidalgo.

The *pastoral* system of dairy production represents approximately 23 percent of the national dairy herd and yields about 17 percent of Mexico's domestic milk production. Most of the cows in this system are crosses between Cebu and Holstein or Brown Swiss. This cross results in a hardier animal better able to withstand the rigors of the region, but one that is less productive than are the Holstein or Brown Swiss breeds. This animal generally produces 2,400 to 4,000 liters per year. The average herd size in this system is approximately 40 cows. These cows are generally maintained on native or improved pasture, and fed grains fortified with oilseed meals and corn stalks. Nutritional deficiencies are common and the herd's genetic makeup is not well-managed. Herds in this system are widely distributed throughout Mexico's central and northern regions. Facilities for cooling milk are rare on these farms, and other facilities are generally inadequate for achieving maximum production efficiency.

The *dual-purpose* system milk producers in Mexico are primarily beef producers who gain additional income from milking their lactating beef cattle. Cows in this system are fed on native pasture, which is abundant during the rainy season extending from September through December. This natural increase in the food ration also leads to increased milk supplies during this period. Cows in the *dual-purpose* system yield 540 to 750 liters per year.[5] Management of these herds is relatively crude compared to the

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[4]For purposes of comparison, the average production per cow in the United States in 1990 was 7,107 liters.

[5]Bredahl et al. 1985, and personal communication from Francisco Barba Hurtado, Director Corporativo de Asuntos Externos - Nestle - Camara de Productos Alimenticos Elaborados con Leche, June 1991.

other systems. *Dual-purpose* producers are generally isolated without easy access to good roads or marketing systems. The cattle in these herds are primarily Cebu. They are a hardy breed and well suited to survive the rigors of the Tropics where these operations are most commonly found, i.e., in the States of Tamaulipas, Veracruz, San Luis Potosi, Tabasco, Campeche, Oaxaca, Colina, Chiapas, and the Yucatan. This production system contains about 63 percent of all dairy cows in Mexico, but accounts for only about 28 percent of the total Mexican milk supply.

The low productivity and low cost of production have made the *dual-purpose* system a focus of attention by those interested in increasing domestic milk production. Associations of cattlemen are working to increase the productivity of this system by crossing the Cebu cattle with the Holstein or Brown Swiss breeds, and by improving the quality of pastures serving this system. A key to realizing this potential, however, is a high level of infrastructural investment (roads, storage facilities, transportation, etc.) to gain access to these isolated and underdeveloped regions. These areas are located far from the major dairy consumption centers, and currently lack good roads and efficient marketing and distribution systems.

Opinions differ as to which production system will likely experience the most growth in milk production. Proponents of the *confined* system believe producers in this system will remain the most competitive and most capable of overcoming expected future increases in costs of production. On the other hand, a representative of the cattlemen's association suggested that in the state of Jalisco, a leading milk producing state dominated by *confined* system dairy farmers, if every resource were available to milk producers, it would take 10 years to re-establish production to 1980 levels in this state, and another 20 years to bring these same herds up to the level of technology used in the United States.

A fourth system, known as *traspatio* (literally, in the backyard), is not very well defined nor well documented. Herds in this system can be found in and around the large cities of Mexico and range in size from 5 to 30 cows. They produce raw milk for sale directly to consumers, and it is believed that they make a significant contribution to the overall milk supply of these cities--perhaps as much as 30-50 percent as indicated earlier.

Cost of Production

The cost of producing milk in Mexico varies greatly by production system, by size and management of herd, and, undoubtedly, by region. Detailed analyses of the cost of producing milk in the whole of Mexico, based on systematic surveys or on synthetic methods and current data, are not available. The following costs are based on estimates provided by the Asociacion Ganadera Nacional Productores de Leche, and are representative of June, 1991 costs for confined dairies in northern Mexico with an average herd size of 120 cows producing an average of 5,490 liters (11,309 pounds) of milk per year. Depreciation on fixed assets and returns to capital were estimated at 10 percent and 2.6 percent, respectively, of beginning year building and machinery value (see Baker

et al. 1990). Depreciation on dairy animals or cost of replacements were *not* included here.

Assuming an exchange rate of 3,000 pesos per U.S. dollar in 1991, the total cost shown above is equivalent to $13.36 per hundredweight. This estimate compares favorably with estimates for the United States. USDA (U.S. Department of Agriculture 1990) estimates the 1989 total economic cost of milk production in the Pacific Region to be $12.44 per hundredweight and in the Southern Plains to be $14.39 per hundredweight. Studies by Guerrero et al. (1991) and Ramirez (1987) show cost estimates similar to these, and confirm that milk can be produced quite efficiently in Mexico.

Information supplied by FIRA (the National Development Bank of Mexico) suggests that feed and labor costs on *dual-purpose* dairy farms are only about 38 percent of the feed and labor costs on *confined-system* dairy farms. The capital requirements on *dual-purpose* farms are likely significantly lower than on the *confined-system* farms, so depreciation and capital charges are also less. This indicates why there is so much interest in increasing the productive efficiency on *dual-purpose* farms, and in promoting more of this type of dairy operation.

These cost estimates should only be taken as rough guides to the cost of producing milk in Mexico. They are likely biased in favor of the more efficient producers. Nevertheless, they suggest that milk can be produced very efficiently in Mexico. One of the reasons for this is the low cost of labor in Mexico. A second reason is the low capital requirements for dairying in Mexico. Offsetting factors, however, are the higher feed costs and the higher cost of replacement animals in Mexico.

It should also be emphasized that these cost estimates merely provide insight into the character of milk production in Mexico--they reveal little about how Mexican milk producers respond to changes in the price of milk and/or in the price of inputs used in milk production. For many purposes, including trade analyses, knowledge of the latter responses is essential. Again, we are unaware of any recent studies yielding such response parameters.

MEXICAN DAIRY IMPORTS

Estimates of total milk production, milk and dairy product imports, and apparent consumption of milk (measured at farm level quantities) in Mexico from 1960 to 1990 are recorded in Table 1. The import data are estimates reported by the Food and Agricultural Organization (FAO), updated with revisions supplied by Economic Research Service, USDA. These estimates appear to conform closely with most estimates available from other sources. FAO estimates of Mexican milk production, however, are substantially at

odds with those made by local agencies,[6] thus the latter were taken as the more appropriate estimates.

Clearly, milk production in Mexico has not kept pace with population increases since the early 1980s. Indeed, Mexican milk production declined by 14 percent between 1985 and 1990. Consequently, Mexico has had to rely on imports to satisfy much of its demand for milk and dairy product consumption. Even so, apparent consumption of milk declined from a high of 111 liters per capita in 1980, to 80 liters per capita in 1990. For comparison purposes, per capita disappearance of milk (measured at farm level quantities) in the United States was 245 liters in 1980 and 260 liters in 1990. This would seem to suggest there is great potential for additional sales of milk and dairy products in Mexico in the future.

Fluid Milk

Mexico has imported bottled and bulk fluid milk since the early 1970s, and substantial amounts of it during 1989 and 1990 (Table 1). Virtually all of this comes from the United States. Given the high cost of transporting fluid milk, one would presume all of this milk comes from Texas and other adjacent states.

Cheese

Mexico also imports substantial amounts of cheese, and has done so increasingly throughout the 1980s. Based on USDA data (U.S. Department of Agriculture 1991), of the 1990 cheese imports, 19.2 percent came from the United States, 29.3 percent from South America, 29.6 percent from the EC, and the remaining 21.9 percent from various other countries. Only Japan and Canada import more cheese from the United States than does Mexico. Still, only 15.4 percent of total U.S. cheese exports went to Mexico in 1990, representing less than 0.1 percent of total U.S. cheese production.

From 1983-87, about 75 percent of Mexican cheese imports came from the United States, 10 percent from Argentina and Uruguay, and the remainder mostly from the EC. Since 1987 the shares of both South America and the EC have increased, while that of the U.S. has declined to about 20%.

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[6]See, for example, Consejo Nacional Agropecuario 1990, and Rodriguez 1990.

Evaporated and Condensed Milk

Evaporated and condensed milk became a much less popular import item during the mid-to-late 1980s than it was during the 1970s and early 1980s (Table 1). The huge increase in the early 1980s was most likely a short-run response to Mexican milk-production shortfalls. The longer-term solution to production shortfalls was to substitute cheaper sources of fluid milk--i.e., milk reconstituted from butteroil and nonfat dry milk. Thus since 1982, Mexican imports of evaporated and condensed milk have become a rather insignificant part of her total imports of dairy products. Since 1983 well over one-half, and in some years over three-fourths, of Mexican imports of evaporated and condensed milk have come from the United States. Most of the remainder has come from Canada, mainly in the early 1980s, and from the EC in more recent years. Of the total evaporated and condensed milk exported by the United States in 1990, 35.4 percent went to Mexico. This amount represented about 1% of total U.S. production.

Nonfat Dry Milk

Nonfat dry milk, along with butterfat, are the largest dairy product import items for Mexico. On a milk equivalent basis, over 90 percent of Mexican imports of dairy products have been in the form of nonfat dry milk and butter or butteroil. This not only reflects the fact that Mexico is a deficit milk producer, it also indicates the emphasis the Mexican government places on providing a low cost consumer product to support its social programs for the poor.

Based on USDA data (U.S. Department of Agriculture 1991), of the total nonfat dry milk imported into Mexico in 1990, 7.4 percent came from the United States, 26.2 percent came from New Zealand, 54.4 percent came from the EC, and the remaining 12.0 percent came from various other countries. Nearly 41 percent of the nonfat dry milk exported by the United States in 1990 went to Mexico, accounting for 5.3 percent of total U.S. production of nonfat dry milk in 1990, down from 20 percent in some recent years. The U.S. share of nonfat dry milk exports to Mexico since 1983 has averaged about 35 percent, while that of Canada has averaged 10 percent, New Zealand 15 percent, and the EC about 40 percent. There has been a great deal of variability in these percentages from year to year due apparently to the availability of nonfat dry milk in the respective countries. For example, U.S. supplies were severely restricted during 1988-90, so that U.S. exports (to Mexico in particular) were greatly reduced through this period.

Butter and Butteroil

Mexico imports substantial amounts of butter and butteroil, primarily for use in reconstituting fluid milk. Based on USDA data (U.S. Department of Agriculture 1991), of

the *butter* imports into Mexico in 1990, 20.9 percent came from the United States, 14.3 percent came from the European Community, 52.2 percent came from New Zealand, and the remaining 12.5 percent came from various other countries. In the same year, 34.3 percent of Mexican *butteroil* imports came from the United States, 38.4 percent came from New Zealand, and the remainder came from the European Community. In 1990, 1.6 percent of total U.S. butter and butteroil production was exported to Mexico. During the 1980s, one-third of Mexican butterfat imports have come from the United States, one-half from the EC, and the remainder from New Zealand.

Other Dairy Products

The National Dairy Promotion and Research Board reports that about 7 million quarts of ice cream and 12,000 metric tons of yogurt were imported into Mexico from the United States in 1990 (National Dairy Promotion and Research Board 1991). According to the same source, this represents well over 90 percent of all such imports into Mexico. Although this does not represent a huge market for U.S. processors, it is suggestive of a potential future market.

DAIRY POLICIES IN OTHER COUNTRIES

The EC and the United States are major exporters of dairy products to Mexico, as we saw in the previous section. Other countries (e.g., New Zealand and probably also Argentina, Uruguay, and Brazil) can produce milk more cheaply than can the United States or most EC member states, but they do not at present produce the volume necessary to be major traders. Thus, the dairy policies adopted by the EC and the United States are crucial to Mexico.

Both the EC and the United States support the price of milk to local producers above world equilibrium price levels. In fact, EC price supports for milk in the early 1980s were set so high that in 1984 a marketing quota program was implemented to slow down the accumulation of government stocks of butter and nonfat dry milk. Except for parts of 1988-89, the EC has offered countries like Mexico surplus bulk dairy products (primarily butter, butteroil, and nonfat dry milk) at prices well below world price levels.

The United States also accumulates substantial surpluses of dairy products as a result of its price support and import control programs. The United States then attempts to export the accumulated surpluses through a variety of export programs. To remain competitive with the EC, the United States must also subsidize exports. Several subsidy programs are available: P.L. 480, the Export Credit Guarantee Programs (GSM-102 and GSM-103), the Dairy Export Incentive Program authorized by the 1985 agricultural legislation, and programs which make direct sales out of Commodity Credit Corporation (CCC) stocks accumulated as a result of USDA's price support activities. The 1985 and

1990 farm bills, in fact, mandated that USDA make direct sales of 150,000 tons of dairy products per year. To do so, of course, the USDA must offer these products at prices competitive with other countries (mainly the EC's) sales.

Direct sales by USDA to Mexico since 1980 are shown in Table 2 along with the per unit value of these sales and an estimate of the U.S. price of the appropriate dairy product. Here we see that these sales were made at about 1/2 the U.S. price level, except in 1988-89 when world surpluses had shrunk to near pipe-line levels. We can assume that the implied U.S. subsidies were near the EC subsidy levels for all of the years shown in Table 2.

IMPACT OF TRADE LIBERALIZATION IN DAIRY

It seems quite clear that if the United States were to unilaterally open up its markets to foreign producers, U.S. milk prices and milk production would fall significantly as would its exports of dairy products. As Table 3 shows, U.S. prices for the major dairy products have been well above world price levels for most years during the 1980s. The exception was in 1988-89 when world stocks of butter and nonfat dry milk were quite low. Even then, U.S. butter and cheese prices were substantially above world price levels. Clearly the dairy price support program in the United States, together with its import quotas and duties on dairy products, are effective in protecting the U.S. dairy industry from foreign competition. Thus, if the North American Free Trade Agreement means removal of all forms of protection in dairy by the United States, Canada, and Mexico, U.S. milk and dairy product prices would fall making whatever surplus we may have cheaper to Mexico. But lower U.S. prices would mean lower U.S. production and slightly increased domestic demand so that there might well be *no* U.S. surpluses for export to Mexico. Indeed, we might even expect the United States to import some bulk dairy products as U.S. trade barriers fall. Canada would face a similar dilemma, albeit to a greater extent due to the relatively higher producer subsidy level in Canada as compared to the United States.

The more likely scenario is that United States and Canadian dairy policy would change very little under a North American Free Trade Agreement. Both countries potentially could gain from exporting additional value-added dairy products to Mexico as the latter's import barriers come down. However, since Mexico's import barriers have already come down, and one would expect them to stay down, it would appear the Free Trade Agreement will have little additional impact as far as dairy is concerned, and until Mexican per capita incomes increase (see next section).

SUMMARY OF PROSPECTS FOR U.S. DAIRY PRODUCTS EXPORTS

Mexico appears to be able to produce milk quite efficiently. Recent trade liberalization and economic policies will only enhance its ability to do so in the future. If

Mexican dairy farmers are able to obtain the concentrates and other inputs necessary to sustain an expanded national herd, one might expect increased milk production in the future. This possibility would clearly be enhanced by a free trade agreement that leads to reduced feed grain prices for Mexican producers. Certainly Mexico has the cheap labor supply which increased milk production would require. Even though emphasis seems to be on increasing the efficiency and viability of the *dual-purpose* dairies, the greatest increases in milk production per unit of scarce resources will come from expanding the *confined* system herds. Information indicates however, a continuing if not widening gap between milk consumption and milk production in Mexico into the future. This is based on short-to-medium term capacity, population and income growth, and government social policy. Thus, the prospects for increased imports of dairy products, and dairy animals and genetic material from the United States are quite good. Similarly, the demand for dairy equipment, technical consultants, and dairy nutrition specialists should be strong.

The rate of growth in Mexican per capita incomes will likely be the most critical factor on the demand side of the market. Here the issue is not only by how much will incomes increase, but also by how much will demand for dairy products increase as incomes increase. In a recent study using 1977 survey data from 11,561 Mexican households from 11 different statistical areas, Heien et al. (1989) estimate the income elasticity of demand for dairy products in Mexico to exceed unity. This is about 5-6 times higher than income elasticities estimated for the United States. Thus, if the policies Mexico is pursuing result in significant income increases, there will likely be a great demand for almost all types of U.S. dairy products.

Given the high cost of transporting and storing soft manufactured dairy products, and given the thin market for these products in Mexico at the present time, it does not appear likely that U.S. exporters will be able to develop a sizable market in Mexico for such products until Mexican per capita incomes increase dramatically. Per capita incomes in Mexico fell between 1983 and 1988, increased slightly in 1989-90, and are expected to rise more quickly in the 1990s. Thus, there is some prospect for increased sales of ice cream and yogurt, for example, in Mexico in the future.

The prospects for substantial exports of cheese to Mexico do not appear great. The demand for specialty or aged cheeses in Mexico is not now substantial nor is it likely to increase in importance in the near future, again unless per capita incomes in Mexico increase substantially or consumer tastes change. Similarly, we see limited opportunities for increased imports of butter into Mexico. Even modest increases in Mexican per capita incomes (currently about one-tenth of per capita income in the United States), or modest decreases in the retail price of butter in Mexico, will do little to change the demand for a product that is less important in the traditional Mexican diet than it is in the North American diet.

As demand for higher quality manufactured dairy products in Mexico increases in response to expected future increases in Mexican income levels, Mexican processors would need access to larger supplies of a standard quality of milk. This may force many

small Mexican milk producers out of business, since the quality of their milk is not dependable and the cost of assembling this milk is high relative to that of the larger producers. Large producers (on both sides of the border) would benefit. Schulthies and Schwart (1991) see this as a significant potential impact of the North American Free Trade Agreement, and a boon to Texas milk producers as well. They go on to speculate that even if Mexico does not officially raise milk safety and quality standards, market pressures will force this to happen.

Decreased demand for and supply of the traspatio production would also increase pressure on the commercial system. Increased health awareness, government policy, and urban and industrial land pressure could lead to a decline in the traspatio system.

The best prospects for dairy product exports to Mexico into the foreseeable future, however, will most likely continue to be nonfat dry milk and butteroil for use in reconstituting fluid milk or to be sold in dry form. The demand for these products will likely continue to be strong by virtue of the fact that when reconstituted they yield a reasonably low-priced form of fluid milk with which to make up the shortfall in local production. The Mexican government aims to expand the provision of milk to the nation's poor at low cost, and this population continues to grow rapidly. Further, import restrictions on these products are now minimal (at the present time, import licenses are required for nonfat dry milk but not butteroil, and there are no import duties on either product). In addition, the lack of transportation facilities and refrigerated storage, in the market system as well as in homes, dictate continued reliance on powdered milk. This, together with the fact that given the basic resources available and the expected growth in population over the next 10 years or so, it is not likely that Mexican milk production will keep up with Mexican milk demand.

The market share statistics presented indicate considerable potential for expansion of U.S. dairy exports to Mexico. Competing in this market is another story, however. Given our current dairy price support policies, it is impossible for the United States to compete with New Zealand. New Zealand, however, does not produce the volume necessary to supply the entire Mexican market. Thus, the United States must be able to compete with other countries for this market. Here the problem is primarily the European Community. If the EC is not convinced (through GATT, through the North American Free Trade Agreement negotiations, or otherwise) to reduce its export subsidies on dairy products, it will be increasingly difficult for the United States to increase, or perhaps even maintain, present levels of exports of nonfat dry milk and butteroil to Mexico. The North American Free Trade Agreement, in and of itself, will not resolve this problem.

There are other factors that also need to be considered, as Schulthies and Schwart (1991) point out. These could hamper expansion of the Mexican dairy industry, and/or increase costs of production or imports. For example, transportation facilities in Mexico (rail as well as highway) are apparently poor and deteriorating. Further, there are restrictions that prevent U.S. truckers from operating in the Mexican interior. Lack of adequate transportation facilities together with inferior refrigeration facilities then, may be the most severe restriction to increased dairy product imports into Mexico.

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Table 1. Domestic Milk Production, Imports of Dairy Products, and Apparent Consumption of Milk in Mexico, 1960-1990

		Imports				Apparent Consumption	
Year	Domestic Milk Production	Fresh Milk	Evaporated and Condensed	Cheese	Butter	Nonfat Dry Milk	Total[a/]	Per Capita
	million liters		metric tons				million liters	
1960	1,867	0	50	351	29	11,120	1,873	49
1961	1,941	0	0	43	8	12,870	1,944	49
1962	2,019	0	10	77	0	23,970	2,024	49
1963	2,169	0	0	277	262	28,360	2,184	51
1964	2,672	0	0	73	1,438	23,460	2,715	62
1965	3,508	0	150	74	13	15,580	3,512	78
1966	2,846	0	0	132	224	17,430	2,856	61
1967	3,392	0	6,510	323	406	23,800	2,423	71
1968	3,490	0	40	160	430	21,900	3,507	71
1969	3,626	0	0	329	1,413	28,790	3,671	72
1970	4,483	2	12,348	835	3,552	35,792	4,617	87
1971	4,694	2	12,961	591	3,312	49,125	4,821	88
1972	4,915	367	15,687	755	2,508	52,621	5,029	90
1973	5,225	613	14,558	491	5,503	45,887	5,413	94
1974	5,550	1,429	15,137	1,237	8,092	92,385	5,822	98
1975	5,809	1,137	16,153	1,342	3,051	20,855	5,937	97
1976	5,907	546	14,610	2,357	8,718	53,602	6,195	98
1977	6,181	316	11,760	1,975	14,403	65,521	6,611	102
1978	6,510	1,040	11,357	2,779	13,832	59,605	6,929	105
1979	6,642	1,310	28,042	1,666	18,899	67,689	7,223	106
1980	6,742	3,345	111,441	2,329	25,152	237,326	7,697	111
1981	6,856	8,636	139,012	2,875	26,671	129,647	7,897	111
1982	6,924	3,831	59,991	1,974	18,949	71,331	7,577	104
1983	6,768	5,489	4,993	4,338	17,453	177,306	7,308	98
1984	6,860	10,330	3,069	2,713	19,339	112,057	7,426	97
1985	7,173	12,302	6,367	7,611	26,706	197,779	7,993	102
1986	6,373	13,126	5,750	10,341	16,647	170,966	6,944	87
1987	6,201	6,064	5,274	13,958	18,757	178,341	6,848	83
1988	6,159	12,153	1,206	6,510	22,235	182,744	6,840	81
1989	5,577	59,643	607	7,898	30,206	239,952	6,532	76
1990	6,142	32,493	2,800	10,364	27,103	287,886	7,022	80

[a] Apparent consumption measured in milk equivalents assuming 1070 metric tons equal 1 million liters of milk (1 liter of milk equals 2.06 pounds of milk) and the following kilograms of raw milk are required to produce one kilogram of the associated manufactured dairy product: 1 kilogram for fresh milk, 2.2 kilograms for evaporated and condensed milk, 8.0 kilograms for cheese, 28.1 kilograms for butter, and 0.2 kilograms for nonfat dry milk.

Source: United Nations and Consejo Nacional Agropecuario 1990.

Table 2. Direct Sales of Dairy Products by USDA out of CCC Stocks, 1980-91

Year	Product	Metric tons	Unit Price per ton	U.S. Price per ton
1980	Nonfat dry milk	40,042	$1,035	$1,949
1981	Nonfat dry milk	60,015	1,225	2,052
1982	Cheese	3	1,000	3,049
1983	Nonfat dry milk	60,015	848	2,055
1984	Nonfat dry milk	20,000	770	2,004
1985	Nonfat dry milk	15,000	741	1,852
1986	Nonfat dry milk	41,100	783	1,777
1987	Nonfat dry milk	50,000	860	1,748
1988	Nonfat dry milk	30,000	1,260	1,769
	Butteroil	4,900	1,748[a]	2,921
1989	Butteroil	6,764	2,538[a]	2,820
1990	Butteroil	1,950	2,029[a]	2,251
1991	Butteroil	9,855	2,173[a]	2,630

[a]Per unit price of butter equivalent to butteroil.

Source: Tabulations provided by Foreign Agricultural Service/USDA and U.S. Department of Agriculture, World Dairy Situation. Circular Series. (Various issues).

Table 3. Ratios of U.S. Wholesale Prices to World Prices of Selected Dairy Products, 1982-90[a]

Year	Butter	Cheese	Nonfat dry milk
1982	1.61	1.74	2.49
1983	1.90	2.12	2.56
1984	2.48	2.51	2.99
1985	3.07	2.35	2.93
1986	3.11	2.55	2.54
1987	3.17	2.47	1.92
1988	2.18	1.65	1.09
1989	1.53	1.56	1.26
1990	1.65	1.77	1.55

[a] World prices are prices at Northern European ports. They are reported as a range for two periods of the year--spring and fall. The ratios shown here are the annual average U.S. price as reported by National Agriculture Statistical Service, USDA, divided by the simple average of the midpoints of the ranges given for the world price.

Source: U.S. Department of Agriculture. World Dairy Situation. Foreign Agricultural Service. Circular Series. (various issues).

Chart 1. Total Milk Production and Consumption in Mexico, 1976-1990

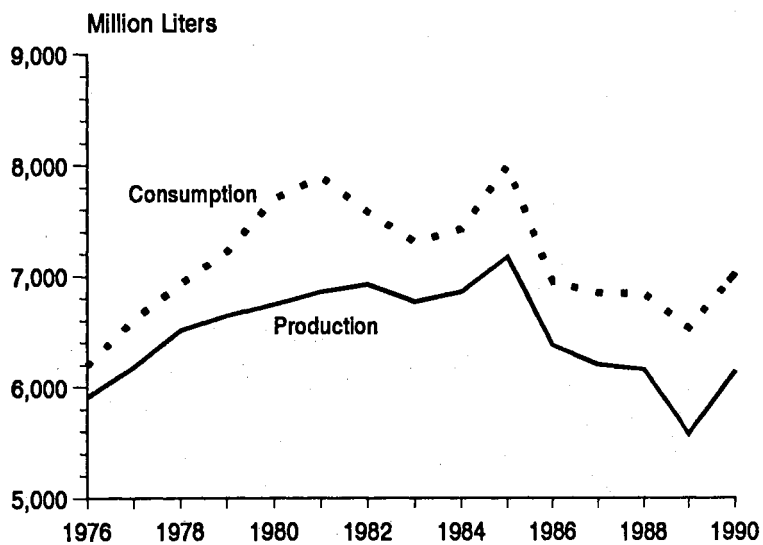


Chart 2. Per Capita Milk Consumption in Mexico, 1976-1990

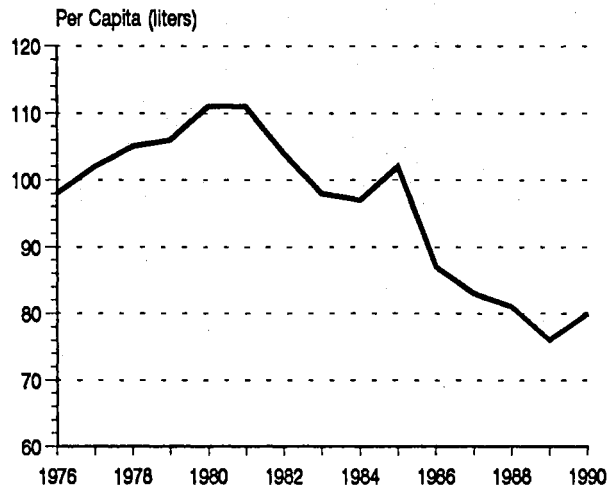
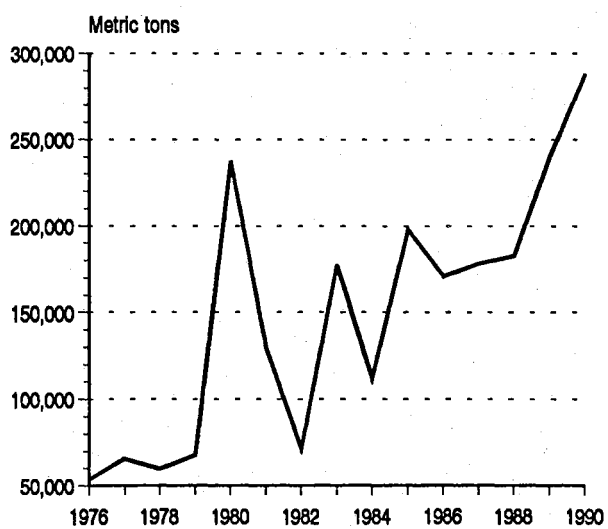


Chart 3. Mexican Imports of Nonfat Dry Milk, 1976-1990



BOVINE SOMATOTROPIN AND EMERGING ISSUES

M. C. Hallberg*

Bovine somatotropin, or BST, is a hormone produced naturally in the pituitary of the cow that apportions nutrients toward milk production. It has long been known that increasing the amount of BST in the cow from external sources can significantly enhance the cow's ability to produce milk. Only recently, however, has an economical source of externally supplied BST become available.

The potential commercial approval and adoption of BST produced by recombinant-DNA technology has been accompanied by a great deal of tension and controversy. Most scientific controversy is confined to scientific journals. Not this one! There has been a great deal of debate about BST in the media and among farm commodity groups, environmentalists, consumer groups, agrarian sentimentalists, and even legislators. There have been disagreements over the likely output-increasing effects of BST. There has been much concern over the safety to consumers of milk and dairy products made from milk produced from cows administered BST. There are those who feel widespread adoption of BST will lead to the premature death of the small dairy farmer, and/or to severe pressures being exerted on the survivability of the rural community. Some are greatly concerned that BST will lead to large concentrations of dairy cows in feedlot-type operations with accompanying serious, if not insurmountable, environmental problems.

The scientific community, and the land-grant system in particular, has been slow to react, or has not found the most effective vehicle with which to react to the BST controversy. What scientists are good at is viewing an issue in the context of the whole and from the perspective of their particular specialty. When this opportunity is denied them, their ability to communicate findings effectively is greatly diminished. It was in large part for this reason that scientists from several different disciplines were asked to summarize, as objectively as possible, what science has to say about the issues surrounding the use of BST, and to outline what is yet to be discovered or is only speculative about the effects of this technology. These contributions have been published in a book recently released by Westview Press (Hallberg 1992).

The book covers four major areas: (1) the policy and ethical issues surrounding BST; (2) the dairy cow's performance under BST treatment: her milk response rate, and her susceptibility to diseases, health, and other problems; (3) the on-farm problems and opportunities likely to be attendant BST use: expected adoption rates, the economics of BST use on the farm, additional pressures BST will place on dairy farm managers, and consequences of BST use on profitability of the dairy farm enterprise; and (4) the market impacts of widespread adoption of BST by dairy farmers: consumer reactions to milk and dairy products produced from BST-administered cows, expected long run market price

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impacts, consequences for resource use in agriculture and for the structure of the dairy farm sector, and international considerations.

BST is, in many respects, the first major biotechnology test case. How we as a society deal with this one foretells much about how we will deal with those to follow. Alternative choices are clearly available, ranging from unlimited commercial availability to a complete ban of the technology. Regardless of the choice made, disagreements will likely rage on. Nevertheless, a choice must be made, and we must insist that the choice society makes is an informed one based on the facts as we can know them at the moment rather than on uninformed hunches or untruths. This is the spirit in which the book was produced. If the authors, including me, have positions on BST adoption, we expect those positions to be counted along with those of everyone else in society. It was not our aim to endorse BST nor to condemn this technology.

Many more issues are covered in the book than I have time to deal with in this session. I will focus most of my attention on the economic issues which I take to be of more interest to this group. I do want to make a few comments about cow responses to BST and about the importance of management in connection with the use of BST. I will also summarize what we might expect in terms of market price impacts, impacts on farm incomes, and impacts on resource use. Finally, I will try to put the major issues in perspective by reviewing with you a few common myths that frequently surface in general discussions about BST.

COW RESPONSE TO BST

BST use has been demonstrated to produce increases in milk output per cow of up to 40 percent. The consensus of most research results currently available, however, is that, on average, milk yield increases of 10-20 percent over the entire lactation are more reasonable expectations. Similarly BST can be expected to lead to increases in feed efficiency of 5-10 percent over an entire lactation (Hallberg 1992, Chapter 3).

Similar gains have been observed for all breeds. Heat-stressed cows also respond positively to BST but at slightly lower rates. There is apparently a greater response to BST in late lactation, and a lower and more variable response in early lactation. Responses to BST appear to be maintained over multiple lactations, although there is some evidence that feed efficiency gains may fall slightly in the second and third lactations.

Users of BST would do well to keep in mind that several inputs are needed to produce any output. This is, of course, just as true in milk production as in corn production or any other type of productive activity. We can think of milk production per cow as being dependent on several inputs including feed concentrates, forage, technology, and management. The management factor promises to be very critical for getting the maximum gains out of BST.

Dr. Patton and Professor Heald address this management issue head-on in the book (Hallberg 1992, Chapter 4), and several other authors also touch on this issue. These discussions deserve very close attention by dairy farmers and those working with dairy farmers. Patton and Heald begin by reminding us that BST directs nutrients from the body tissues toward the mammary gland. The physiological reactions that ensue are very complex and not yet fully understood. A key factor, though, will be to manage concentrate and dry-matter intake so as to maintain body condition as well as to maintain milk production. Monitoring body condition and dry-matter intake will, in their view, be essential for economical results. Proper record keeping will, in turn, be a key to facilitating this activity.

But good management skills do not stop here. Breed of cow and genetic potential do not appear to be factors determining the level of BST response. Still, different herds and different cows within a herd respond differently to BST. In other words, response rates for individual cows cannot be anticipated with certainty. Good record keeping will be essential to make this determination for any individual cow administered BST. Records will be needed to determine which cows to treat, how to feed the treated cows, when to treat individual cows (early, mid, or late lactation; after or before confirmed pregnancy, or during or after a treatable disease), how to manage the dry cow chosen for BST treatment, how to deal with heat stress and cow comfort, and how best to use BST as a marketing tool.

MARKET IMPACTS OF BST ADOPTION

One of the key issues in BST adoption is what can we expect in terms of the impact on market prices. To get at this issue, let us assume that there is no government price support program and no government purchases except for an amount needed to meet mandatory food donation obligations. Let us also assume that BST has been approved for commercial use, and that, for the nation as a whole, milk output per cow has, on average, increased by 10 percent as a result of widespread use of BST. Under these conditions we estimate that farm-level prices will in the long run fall by an average of 8 percent, overall marketings of milk will increase by about 2 percent, and the number of dairy cows needed to produce the amount of milk needed to satisfy demand will be reduced by 7 percent (Hallberg 1992, Chapter 10). There will be some variation in marketings by regions, due primarily to the different regional fluid milk requirements. Marketings in the Northeast will increase somewhat more than 2 percent, while marketings in the Southern Plains will change little and those in the West Coast region will actually decrease slightly.

Over the long run, i.e., after all market adjustments to introduction of this new technology have occurred, overall marketings of milk will only increase by 2 percent--not by 10 percent. This is because some dairy cows (and, no doubt, producers) will be driven out by the lower prices. Producer prices will fall by a larger percentage than marketings increase because of the nature of the demand relations for milk and dairy

products. Since producer prices will fall by a larger percentage then milk marketings increase, total milk revenue received by farmers will fall. Dairy producers in the United States will be required to share a smaller total revenue pie.

The next important question is whether the increase in feed efficiency brought about by BST use will offset the reduction in total producer revenue. Dr. Greaser studied this issue in some detail (Hallberg 1992, Chapter 8). He projected that, under the conditions assumed above, net returns per cow will decrease by an average of 42 percent (74 percent in the Northwest region to 28 percent in the Southern Plains and 33 percent in the Northeast). Thus dairy producers in the United States will be required to share not only a smaller gross revenue pie, but a smaller net revenue pie as well.

The projected 7 percent decline in number of cows means that veal calves and utility dairy cows sent to market will decline by a like percentage. Since the dairy industry supplies only about 25 percent of the nation's utility beef, this would have little impact on beef prices. But the dairy industry supplies about 80 percent of the veal, so we could expect a stronger impact of BST adoption on the veal market.

Full adoption of BST will lead to increases of slightly less than 2 percent in corn and soybean acres required for the nation as a whole, and to reductions of 6.8 and 6.4 percent, respectively for hay and silage acreage. Full adoption of BST will have only marginal impact on labor requirements by the nation's dairy farmers.

Full adoption of BST will not have much impact on pollution nationwide, although it could be a factor in certain locations if there are, as some fear, increased concentrations of dairy cattle in confinement systems.

IMPACT OF BST ON RETAIL PRICES

The potential impact of BST on retail milk prices is a much less clear issue. Research findings on the transmission of farm-level price changes to the retail level are mixed. Research based on several years of price trends suggests that reductions in farm-level prices will be reflected at the retail level with little or no delay. More recent research based on data for the past two or three years suggests that a significant time lag occurs before farm-level price changes are reflected at the retail level, and that the lag is shorter when farm prices are increasing than when decreasing. Currently, the best explanation for this phenomenon appears to be that the 1989-91 period represents an aberration rather than a change in the structure of the dairy marketing-processing sector. Certainly, the 1989-91 period was one of unusual price and supply variability in the dairy industry.

SUMMARY

Perhaps the best way to summarize is by addressing a few "BST myths". I hope that by bringing these "myths" to this discussion I can provoke further discussion at this or later sessions.

Myth One--BST use will result in a 40 percent increase in milk output per cow.

This is very doubtful! At best, we might expect something closer to an average of a ten percent increase, and then only after a strong majority of the dairy farmers in the country adopt BST. As is always the case, the most innovative farmers will be the first to adopt. There will likely be a considerable delay (years) before a majority of our dairy farmers adopt BST. Even a 10-percent increase in output per cow in the long run may be overly optimistic for the nation as a whole. Further, there are many factors involved in the cow's response to BST that simply cannot be evaluated in the laboratory. These we will only learn as the technology is actually transferred to the field and put into practice. Remember the promises of the so-called Green Revolution. While it certainly did lead to crop yield increases in many of the developing countries of the world, actual results were considerably less specular than laboratory results.

Myth Two--All that dairy farmers will need to do is inject their cows with BST, and then sit back and reap the benefits.

Not so! Management is always one of the more important ingredients in the production process. A case can be made that managing the dairy operation when BST is used will be even more important that it is now. It is likely that only the superior managers will be able to take full advantage of this technology.

Myth Three--BST will lead to <u>increased</u> profits to individual dairy farmers.

True enough in the short run and for the early adopters. In the longer term, however, when a majority of dairy farmers have adopted BST and the market adjusts to the increased efficiency and rightward shift in the aggregate supply schedule implied by BST use, market prices will fall as a new market equilibrium is reached. I cannot imagine any scenario under which BST use will, in the longer term, lead to a rise in profits per hundredweight of milk produced or per cow. Certainly, government price support policy has a lot to do with the price farmers receive for milk. It would be unreasonable to expect a complete dismantling of the price support program for dairy just because BST is introduced. It would be equally unreasonable, though, to expect the support price to stay at pre-BST levels after BST is approved for commercial use and adopted by a majority of producers.

Myth Four--BST is size neutral.

True, if we adopt the usual definition of "size neutrality" that economists like to talk about--i.e., no differential effects of BST use on different-sized dairy farms. But I certainly expect (can almost guarantee, in fact) that in the longer term, milk prices and per unit profit rates will fall. This means that the farm family now barely getting by with a 40-cow dairy herd will not be able to generate enough income from that 40-cow herd to maintain their standard of living after the majority of our dairy farmers have adopted BST and the market finds a new, lower equilibrium price. Smaller dairy farmers will either be forced to get out of dairy production and into something else, or add to their herd in order to keep their volume up so that their family's standard of living is maintained.

Myth Five--BST is a unique type of technology that will lead to larger concentrations of dairy cows on fewer dairy farms.

I am often amazed at how short are memories. Take a look at Chart 1. Milk production per cow has increased from about 5,240 pounds per year in 1950 to over 14,600 pounds per cow per year in 1990. All this has happened, by the way, at the same time that there has been a strong downtrend in the ratio of milk prices to concentrate prices (see again Chart 1). How has this been possible? Dairy farms that stayed in business adopted cost reducing technology and got bigger. Those that could not manage larger herds, or could not acquire larger herds, got out. This, we can be reasonably assured, will continue to happen with or without BST.

These may sound like fighting words to some of us. Nevertheless, these are the facts. We had over 650,000 farms with 10 or more milk cows in 1950, but only 150,000 farms with 10 or milk more cows in 1987 (Chart 2). Of those farms with 10 or more milk cows, only 2.6 percent had 50 or more milk cows in 1950 but 45.1 percent had 50 or more milk cows in 1987 (Chart 3).

These data by no means make the phenomenon of fewer and larger farms any more palatable. However, one should not be overly critical of BST technology on the grounds that it is a unique technology that will lead to larger and fewer dairy farms. This is a phenomenon that has been going on since the industrial revolution. It is a phenomenon that will go on, I feel quite sure, even if we ban BST! One might will ask why now should we become so terribly concerned about this phenomenon--why did we not raise the issue when corn silage was introduced or special feed additives or mechanical milk-handling equipment or artificial insemination or any number of other types of technological developments available to dairy farmers.

Myth Six--BST use will lead to even greater dairy surpluses than in the recent past, and to even greater expenditures by the federal government to take these surpluses off the market.

When milk prices fall, as we can surely expect them to do in the longer term in the absence of efforts by the federal government to prop them up, consumer demand for

dairy products can be expected to increase at least somewhat. This, together with the fact that lower milk prices will result in lower supplies than otherwise would be the case, will mean that the market will clear without excessive surpluses at the lower price level. Thus, there is no reason to expect a flood of surplus products if the market is not distorted by irresponsible government price support policies.

I should add that there are some unknowns here. Professors Smith and Warland (Hallberg 1992, Chapter 11) point out that on the basis of several surveys of consumer reactions to milk from BST-supplemented cows, there appears to be considerable negative reaction to BST. It is possible that this negative reaction will translate into a reduction, not an increase, in demand for milk and dairy products from BST-supplemented cows. If so, though, this would only change our conclusions about the price impacts of BST--not our conclusions about the accumulation of government surpluses.

Myth Seven--Milk produced from cows administered BST is unsafe to drink.

There is no such evidence to date that this is even remotely true. If this notion persists among some consumers (see MYTH SIX), they will need to be better informed than they are at present. Perhaps here, then, is a new role for some of the dairy promotion check-off funds.

Myth Eight--Different regions can opt for their own solution to the BST issue, irrespective of what other regions choose to do without impacting dairy farmers' incomes or the competitive position of dairy farmers in a specific region.

This is about as far from the truth as one can get. Our results show that if producers in one region of the country were prevented from using BST while all other dairy farmers in the United States adopted the technology, producers in the region of the ban would not only be subject to a price decline commensurate with the decline in prices nationwide, they will lose market share. The situation would be worse for producers in regions with low fluid consumption relative to total regional consumption, since it is more expensive to import fluid milk than it is to import manufactured dairy products.

Myth Nine--Small dairy farms will without question be driven out of business if BST is adopted.

This, of course, is the implication of what I have said up to now. Let me remind you, however, that there are still in this country over 1.25 million farms grossing $20,000 or less annually from the farm operation. This number represents nearly 60 percent of all farms in the United States. A gross income of $20,000 is clearly not enough to provide a farm family a standard of living comparable with that of other families in the United States. Some of these are dairy farmers. Why do they stay in business? They are resilient and do not want to give up the farm life. They stay because they are willing to give up larger incomes possible in other activities, knowing full-well that they are earning a lower return on their investment than are others. There are limited alternatives available

to them either in agriculture or outside of agriculture. They do not have the skills needed for the available alternatives. In sum, there are a variety of reasons why small farmers may stay in business even though the handwriting is on the wall.

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Hallberg, Milton C. (ed). (1992). Bovine Somatotropin & Emerging Issues: An Assessment. Westview Press. Boulder, CO.

Chart 1. Milk Production per Cow and Ratio of Feed Price to Milk Price in the United States, 1950-1990

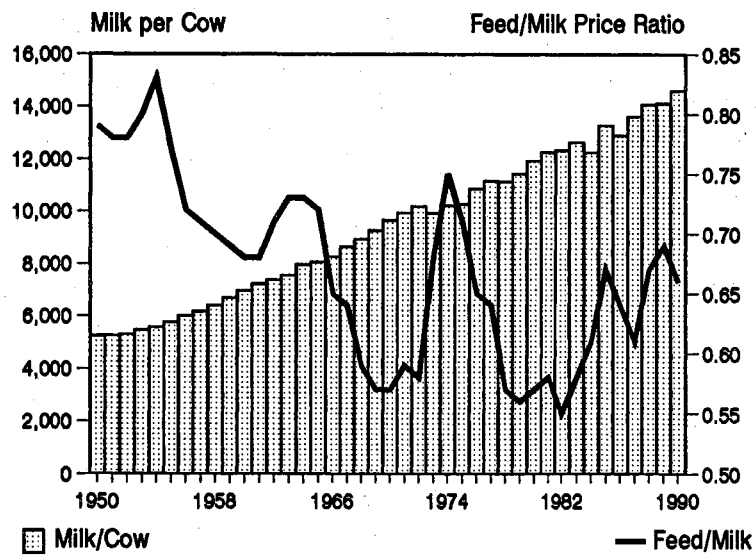


Chart 2. Number of Farms Having 10 or More Milk Cows in the United States, 1949-1987

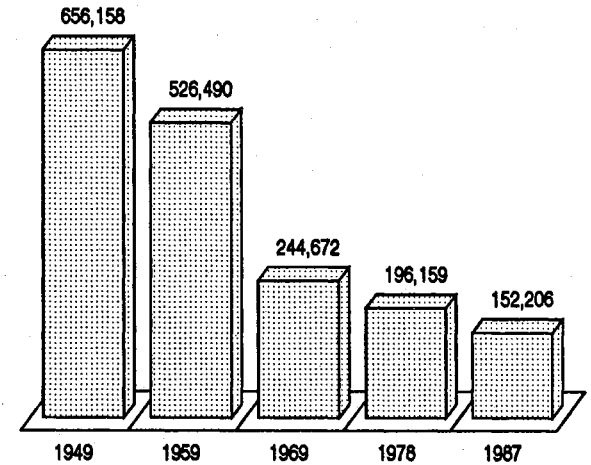
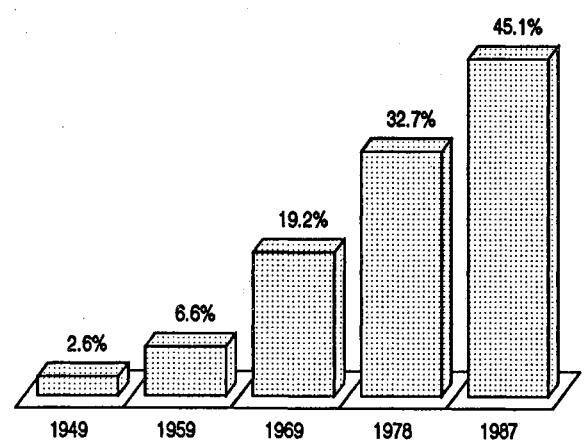


Chart 3. Percentage of Farms* Having 50 or More Milk Cows in the United States, 1949-1987



*With 10 or More Milk Cows

COMMODITY OUTLOOK: DAIRY

Robert D. Yonkers*

Sharply lower milk prices at the end of 1990 made the 1991 dairy outlook the subject of a great deal of speculation a year ago. Although farm prices averaged sharply lower in 1991, other supply and demand factors were more or less steady. It is clear that none of the more extreme forecasts made at the beginning of 1991 were accurate. Dairy producers have been more resilient than the "bears" thought, but low prices took a greater toll than the "bulls" projected.

A QUICK SUMMARY

For 1992, milk prices look to average somewhat higher than last year, perhaps 40 to 60 cents higher. Milk prices should average nearly a $1.00 higher during the first half of the year, compared to year-earlier levels. Milk prices in the fall months should follow the same path as prices during the second half of 1991. Nationally, both milk production and commercial sales of dairy products should increase, on the order of 1 and 1.5 percent respectively. If so, purchases of surplus dairy products by the Commodity Credit Corporation (CCC) will be slightly lower, but still should reach 9 billion pounds milk equivalent, fat basis. Prospects for higher milk prices or supply management of milk production through new, federal dairy legislation are poor.

1991 IN REVIEW

Following the October, 1990 $2.02 drop in the Minnesota-Wisconsin (M-W) price, this basic price mover for the dairy industry continued to drift downward through March of 1991. The M-W price low for the year was $10.20 (adjusted to 3.67 percent butterfat) in March, still 10 cents above the price support level set in the 1990 Farm Bill.

The M-W price at market average butterfat test during the spring flush months of March, April and May this year averaged $10.32. However, the average milk price received by farmers nationally was $11.37 during these months, $1.05 above the M-W. Milk prices in the Northeastern states are historically above this average U.S. price, and during these months were $12.10 in Maryland, $11.54 in New York, $12.30 in Pennsylvania, and $11.73 in Vermont. At these prices, some dairy producers in the

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region found that maintaining cash flow last spring was a problem for the first time in several years.

The same situation was occurring around the country. Milk production in the 21 major dairy states averaged 2.5 percent higher in January and February, 1991 than for the same months in 1990. This rate of year-over-year increase slowed to less than 1 percent by March and April. By May, U.S. milk production was slightly below May of 1990, and these year-over-year decreases have continued each month since (through December, 1991). This change in the direction of milk production was largely a result of milk prices averaging 18 percent below those of the first half of 1990.

Last year's swings in milk price and production came as the industry was trying to reach a new supply-demand balance after the unusual years of 1988, 1989 and 1990. Total U.S. milk production for 1991 was about the same as in 1990. New York milk production was up about half a percent, Maryland up 3 percent, and Vermont up over 1 percent. Pennsylvania milk production will be up about 2 percent for the year. These increases are even more significant since milk production is down nearly 3 percent in Minnesota. This means Pennsylvania became the fourth leading milk producing state in 1991, while Minnesota fell to fifth.

Commercial sales of dairy products in the U.S. ended 1990 on a sour note after a strong showing earlier in the year. Preliminary data for 1991 indicates that growth in sales did not keep pace with population, as per capita consumption of milk and dairy products slipped slightly. This appears to be largely a function of the recession in the U.S. economy, although exports of dairy products continued to decline from the historically high levels of 1989.

WHAT'S IN STORE FOR 1992

Milk prices have turned downward as they always do during the winter months. How far milk prices fall this spring depends on many factors, including milk production and demand for dairy products. These same factors will determine how high will prices rise by year's end. Will dairy producers hold aggregate milk production constant, or start to increase again? Will the recession end, stimulating demand for dairy products? The rest of 1992 looms with both positive and negative factors for the dairy industry.

As already discussed, milk prices should be higher, especially during the first six months of the year. Also, the industry enters the spring milk flush season with relatively low inventories of dairy products compared with the past two years. At the farm level, the cost of purchasing non-feed inputs is expected to be stable, with only small increases in a few items. Following the trend of recent years, both cull cow and milk cow replacement prices should remain strong through most of the year. And last, but not least, interest rates are at 20-year lows, especially for short-term borrowing.

On the minus side, the drought of 1991 left some areas of the Middle Atlantic states short of forage needs to feed dairy herds until 1992 harvests. While interest rates are low, credit is tight, both for borrowing and with respect to running large accounts-payable with input suppliers. Since pennies per hundredweight add-up, some more bad news is the increase in the CCC assessment associated with the Omnibus Budget Reconciliation Act of 1990. This assessment on all milk marketed by dairy producers increased to 11.25 cents on January 1, 1992, and is likely to rise a few pennies more on May 1 due to monies refunded to those producers who did not increase milk marketings in 1991 over 1990 levels.

The major uncertainties for the dairy industry in 1992 include feed prices, the level of demand for dairy products by consumers, and the level of milk production in the major dairy states. Feed prices are expected to increase slightly, but this is very dependent on weather conditions during the growing season and the demand for exports of U.S. feedgrains and oilseeds. As the U.S. economy recovers from the recession of 1991, demand for dairy products should grow. The key seems to be milk production, which has trailed year-earlier levels for the past eight months. Industry experts expect some increase in milk production in 1992 over 1991, but how much is subject to debate. The only major dairy states to see significant increases in milk production (greater than 1 percent) in 1991 were California and Pennsylvania. Industry experts expect that higher milk prices in the fall of 1991, combined with spring, 1992 prices above those of last year, will stimulate some growth in milk production in more states.

Look for the M-W price in 1992 to gradually slip by over $2.00 from the October, 1991 high of $12.50, to about $10.40 by late spring. Increasing milk prices through the summer and fall should bring the M-W price to near $12.50 before year's end. This should result in a U.S. annual average milk price received by farmers of about $12.70 for 1992, up from $12.25 for 1991. This is well below the 1990 average price, but above the $12.26 of 1988, before the big price increases of 1989 and 1990. For Pennsylvania, the average milk price paid to producers in 1991 was about $13.25; this should improve in 1992 to around the $13.75 mark. However, remember that due to differences in marketing conditions throughout the state, especially the effect of Federal Milk Marketing Orders, milk prices tend to be higher in the southeastern part of the state, and lower in the northern tier and western counties of the state. Also, this is a gross price, before any deductions, which include 15 cents for the dairy promotion and research check-off, the CCC assessment (5 cents in 1991, rising to about 12.5 cents in 1992 on average), and hauling charges (which vary widely across the state).

Table 1. Milk Supply, Use and Price Outlook

	1991	(Percent change)*	1992	(Percent change)*
SUPPLY				
Cow Numbers (thousands)	10,030	-1%	9,930	-1%
Output per Cow (pounds)	14,800	+1%	15,100	+2%
	bil. lbs		bil. lbs	
Production	148.5		150.0	
Farm Use	2.0		2.0	
Marketings	146.5		148.0	
Beg. Commercial Stocks	5.1		4.6	
Imports	2.5		2.5	
TOTAL SUPPLY	154.1		155.1	
UTILIZATION				
Commercial Disappearance	139.5	+.4%	141.5	+1.5%
Ending Commercial Stocks	4.6		4.6	
Net CCC Removals	10.0		9.0	
TOTAL USE	154.1		155.1	
MILK PRICES	$/cwt		$/cwt	
US All Milk (Avg. Test)	$12.25	-11%	$12.70	+3%
M-W Price (3.67% BF)	11.25		11.60	
Support Price (3.67% BF)	10.10		10.10	
Assessment	0.05		0.125	
Milk: Feed Price Ratio	1.56		1.60	

* From year-earlier levels.
Estimates by Robert D. Yonkers, Penn State University, 1/31/92.

COMMODITY OUTLOOK: POULTRY

Milton E. Madison*

The current slow recovery from the 1990-1991 recession will not provide consumers with the confidence to increase their food spending budgets, especially spending at restaurants and for the higher priced items in supermarket display cases. While poultry sales typically are hurt less by tough economic times than other meats, there are some shifts in types of poultry products sold. Higher valued further-processed products, which have been an important part of poultry consumption growth, are often foregone by consumers feeling the pinch of recessionary times. This effect has been evident in both the chicken and turkey markets with slower product movement but has hurt turkey sales the most. Slow movement of further-processed turkey products during last summer and fall caused inventories of turkeys to increase and overload the Thanksgiving market. Continued slow sales have kept turkey prices below break-even levels recently.

Total meat and poultry supplies for 1991 were 3 percent larger than in 1990. Another 3 percent increase is expected for 1992. This will be the eighth straight year of increases in meat availability. While meat supplies are increasing food consumption patterns are shifting, with increases in grain, fruit, nut, and vegetable consumption. Food consumption has changed in the last 20 years according to a USDA survey. Consumption of all food on a per person basis increased eight percent using a price-weighted quantity index. Consumption of crop products increased by 16 percent while meat consumption increased less than one percent.

More food calories are being consumed and diets are shifting away from meat as the main entree. We are eating more breakfast cereal, pizza, pasta, stir-fried meat and vegetables served on rice, salad entrees, tacos, burritos, enchiladas, and fajitas. Vegetable oils, flour and cereal products, fruits, fresh and frozen vegetables, frozen potatoes, peanuts and tree nuts led the way in crop product consumption increases over the last 20 years. Decreases were seen in canned vegetables, dry beans and peas, and coffee. On the meat side consumption decreased for red meat, eggs, whole milk, butter, and lard. Increases were seen for poultry, fish and shellfish, lowfat milk products, cream products, and cheese.

EGGS

Egg production for 1991 was nearly 1 percent larger than in 1990 (Chart 1). Shell egg demand on a per capita basis continued to decline. Total egg consumption dropped by nearly three eggs from 1990 to 1991. A shift in egg consumption is taking place

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between shell eggs and egg products. Processed egg consumption increased by the equivalent of four eggs between 1990 and 1991. When the total egg consumption decline and the shift to processed eggs is combined the result is a decline of seven eggs consumed in the shell form. A slowing in the total egg consumption drop is expected for 1992, (two eggs), but increased use of egg products should continue. Egg producers will have to produce increasing amounts of their eggs for breaking and processing uses or expect more competition for their shell egg markets. A 1 percent increase in egg production will be seen in 1992 with prices lower than in 1991 (Chart 3). Net returns at the wholesale level will fall to four cents per dozen (Chart 2).

BROILERS

Broiler production in 1991 was over 4 percent larger than in 1990 (Chart 4). Prices for 1991 felt the pressure of increased meat supplies and were two cents lower than in 1990 (Chart 6). Slightly higher production costs brought net returns for broilers to five cents per pound in 1991 (Chart 5). Stronger than expected exports in the last half of 1991 helped support broiler prices and another export record was set in 1991. Broiler meat exports have nearly doubled in the last five years. In 1991 exports used six percent of production. The USSR was the leading export market in 1990, but Japan and Hong Kong returned as the primary destination for exports in 1991. A slight decrease in exports is projected for 1992 as conditions in the Soviet Republics will not allow them to continue purchasing as many "Bush legs" as they did in 1991.

Early last fall the breeder flock had been expanded to 5 percent larger than the previous year and may reach nearly 7 percent larger this month. Large production increases will be possible if all these eggs are used to produce birds. Early 1992 prices should give some indication of whether this large potential increase in production will be realized (Chart 6). Low returns early in the year will slow the annual production increase to 4 percent. Prices and returns will be slightly lower than the levels seen in 1991.

TURKEYS

Turkey markets felt the pressure of increased meat supplies and consumer constraint in their peak marketing season, Thanksgiving. Even with fourth quarter production equal to 1990, wholesale prices in 1991 were held ten cents per pound lower than the 1990 Thanksgiving market (Chart 9). Production for 1991 was a little more than two percent larger than in 1990, the smallest production increase since 1984, and prices were two cents per pound lower (Chart 7). With 1991 a small loss year for most producers (Chart 8), prospects for large meat supplies and higher feed costs should keep the brakes on production increases for 1992. Production growth of 3 percent for 1992 is expected with some improvement in prices coming by next Thanksgiving.

Exports are an area that turkey marketers need to pursue. Exports take only two percent of turkey production presently, with Mexico being the destination of over half of all exports.

CONCLUSION

All poultry and egg producers will feel economic pressure to produce and market their products more efficiently in 1992. Food spending budgets will be tight. Consumers are putting less emphasis on meat in their meals. With meat supplies at a record high, new product forms, new sales areas (exports), and new efficiencies will be important if poultry companies hope to maintain profitability in the 1990s.

EGGS

Production

Wholesale Level Net Returns

Wholesale Prices

Chart 1
Egg Production

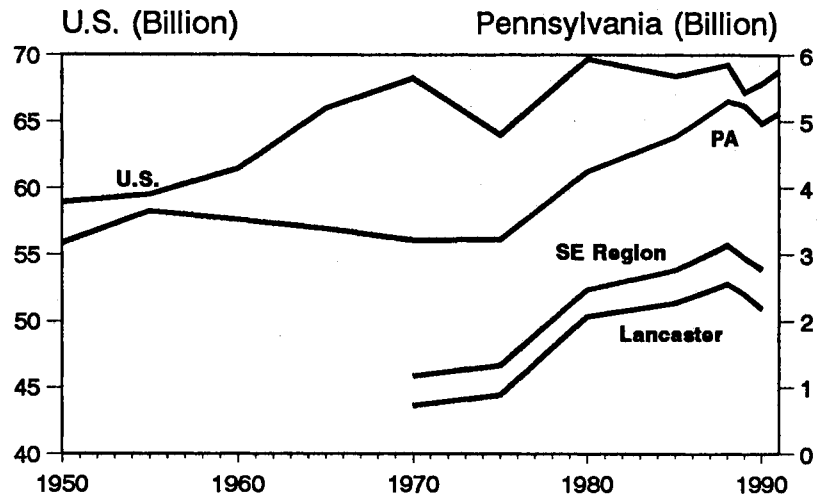
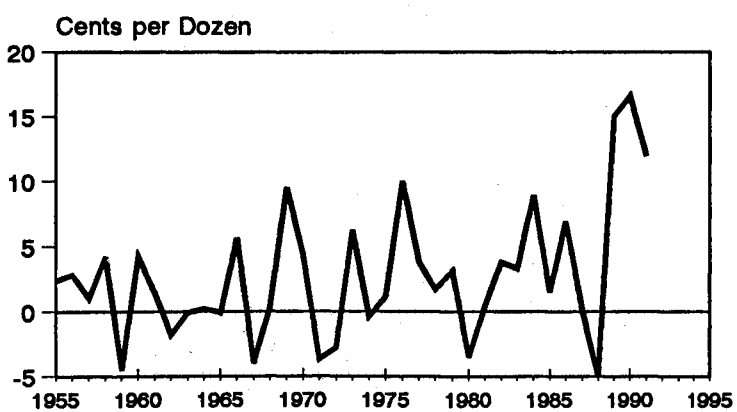
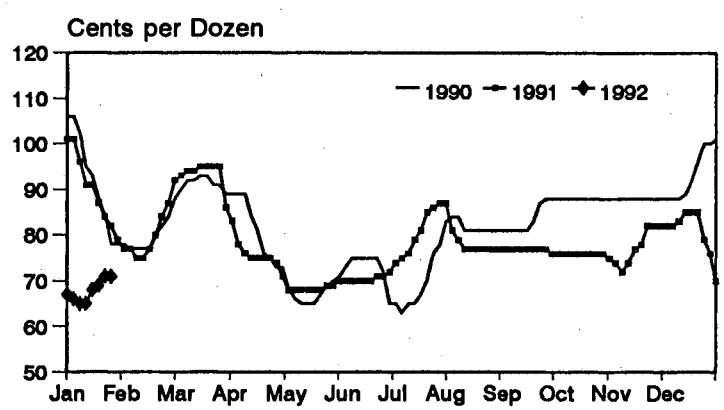


Chart 2
Wholesale Level Net Returns: Eggs



Source: USDA-ERS

Chart 3
Prices for Large Eggs
New York City Grade A White Cartoned



Source: USDA-AMS Egg Market News Report

BROILERS

Production

Wholesale Level Net Returns

Wholesale Prices

Chart 4
Broiler Production

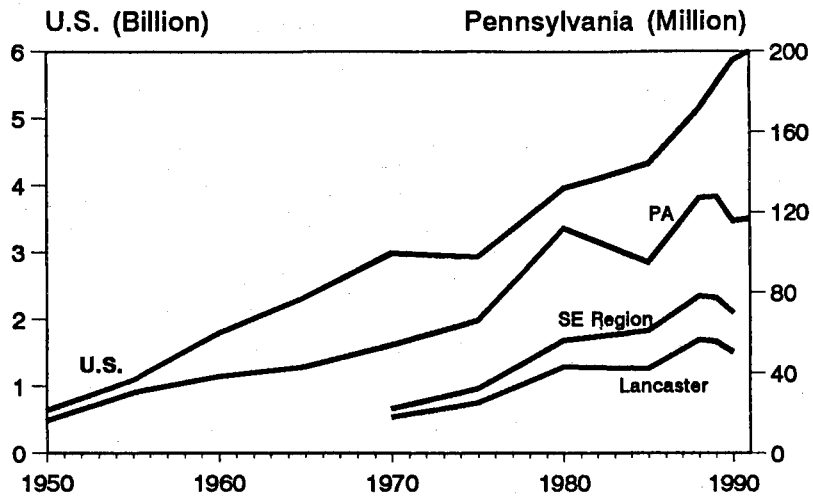
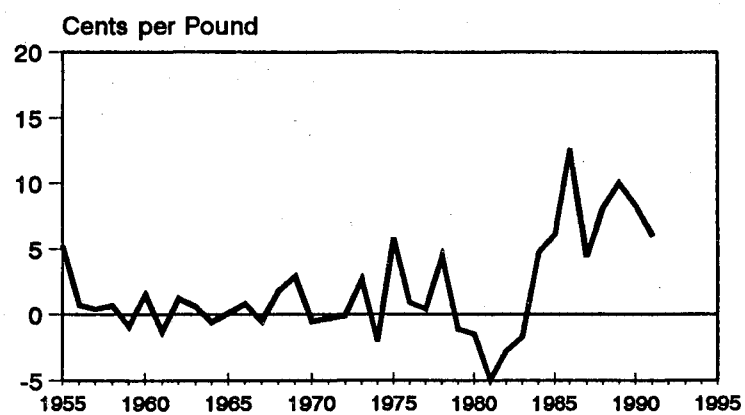
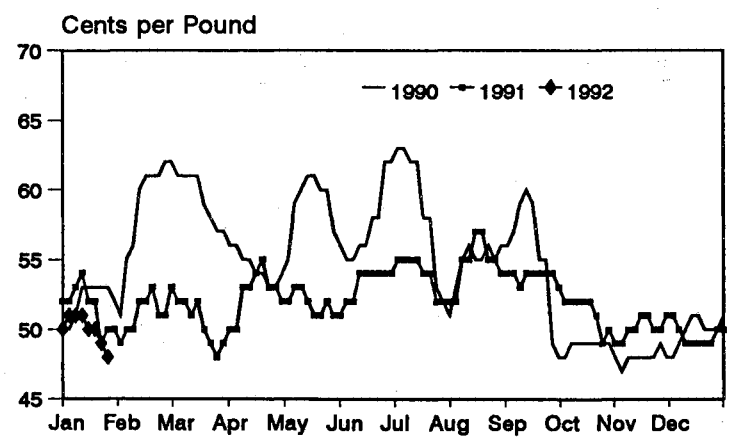


Chart 5
Wholesale Level Net Returns: Broilers



Source: USDA-ERS

Chart 6
Wholesale Broiler Prices
12-City Weighted Average



Source: USDA-AMS Poultry Market News Report

TURKEYS

Production

Wholesale Level Net Returns

Wholesale Prices

Chart 7
Turkey Production

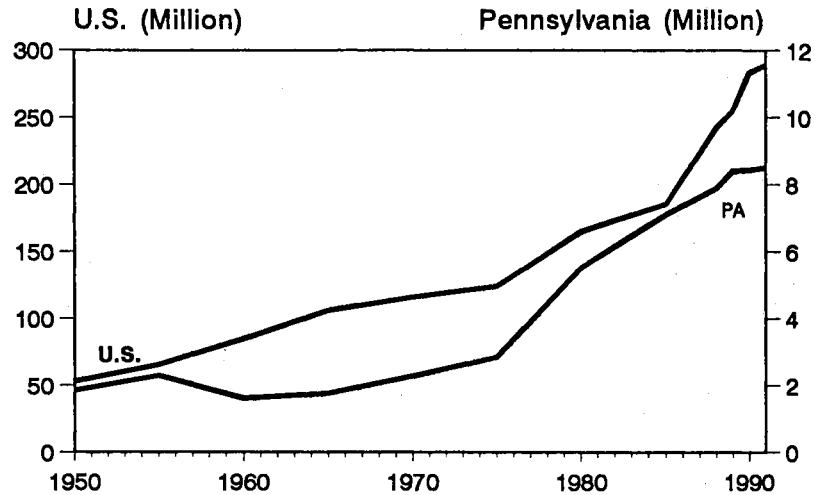
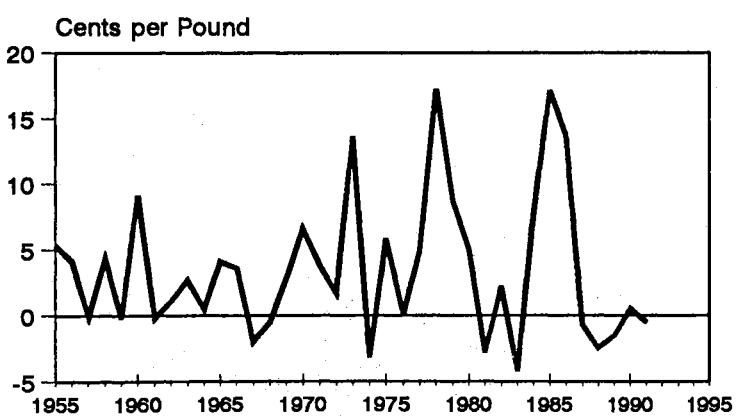
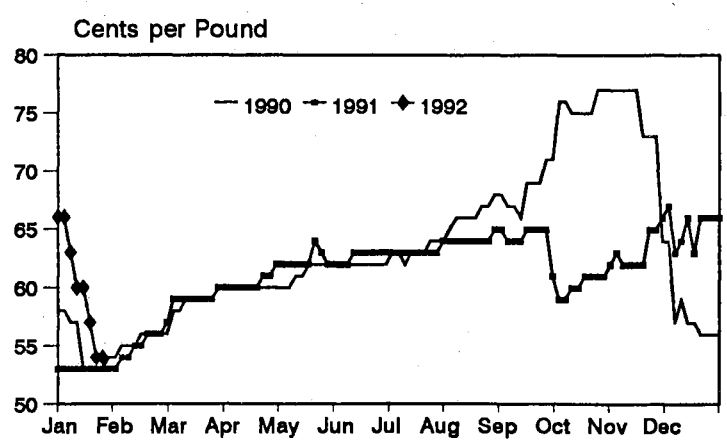


Chart 8
Wholesale Level Net Returns: Turkeys



Source: USDA-ERS

Chart 9
Wholesale Turkey Prices
8-16 Pound Hens - Eastern Region



Source: USDA-AMS Poultry Market News Report

AN UNCERTAIN YEAR AHEAD FOR GRAINS AND LIVESTOCK

H. Louis Moore*

The 1991 national corn crop at 7.47 billion bushels was down only 6 percent from the 1990 crop and yielded about 109 bushels per acre. Drought was not a major factor in the 1991 season except in Pennsylvania and several surrounding states. The drought of 1991 in Pennsylvania resulted in crop production that was only marginally better than resulted during the 1988 drought. Pennsylvania's corn production at 66.5 million bushels in 1991 was only 7.3 million bushels higher than the 1988 crop. Yields per acre for corn were 70 bushels in 1991 compared to 65 in 1988.

During the remainder of the feeding season there will be more grain and hay shipped by sellers here and in surrounding states into Pennsylvania to sustain our dairy and livestock herds until harvest of the 1992 crop is underway.

Weather uncertainty is already playing a role in pricing of 1992 grain crops. In some sessions December 1992 corn on the futures market has traded at a premium to 1991 crop corn because of early drought rumors and concerns. The USDA will require smaller acreage set-asides in 1992 indicating that planted acreage of corn and soybeans will increase. The carryover of corn on August 31, 1992 is estimated at about 1 billion bushels, the second lowest in the past 16 years. Corn prices are likely to be quite volatile during the planting and growing season. Wheat prices have been booming because of increased exports, reduced acreage and strong domestic demand for flour. Pennsylvania wheat growers should profit handsomely from sales of leftover 1991 wheat and wheat from the 1992 crop.

Livestock enterprises have generally been more profitable than grain enterprises in the last decade but 1992 will be a marginal year for livestock enterprises. The potential for higher feed prices, record meat supplies and a sluggish economy are factors pinching producer margins in 1992.

Beef production is expected to increase 1 percent in 1992 after increasing 1 percent in 1991. All of the production increase in beef is coming from increased weights of animals sold rather than an increase in slaughter numbers. Pork is leading all meats in production increases in 1992. Pork output is expected to increase 8 percent during the year. Hog production was profitable in 1989 and 1990. This led to the current expansion in marketings. For most of the year producer returns will not cover all production costs. The hog industry is rapidly changing from an enterprise made up of many small producers marketing hogs and other farm commodities. Increasingly hog production is made up of larger specialized producers contracting with feed and marketing firms. In

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*Professor of Agricultural Economics

1991 about 12 percent of the hog producers marketed 68 percent of all hogs in the U.S. In the last decade we have seen about half of the hog producers go out of business.

Broiler production will increase about 4 percent this year while turkey production will be up at least 3 percent. Production of poultry seems to increase every year. In the 1988 to 1990 period each consumer had available about 210 pounds of meat. In 1991 it increased 5 pounds to 216, a new record. Led by pork, consumption of meat will increase to about 223 pounds in 1992, 7 pounds above last year's record. However, livestock enterprises for many producers will not be profitable in 1992. Economic recovery after mid-year will help demand but the supply of meat is too burdensome to return the industry to profitability in 1992.

CONSUMER HORTICULTURE: A PEOPLE/PLANT INDUSTRY

Alvi O. Voigt*

People/plant interaction is a phrase used here to signify the many ways in which plants affect human beings. Besides providing the usual rewards of food and beauty, plants contribute to our lives and the environment in many other relatively unheralded ways. Attempts to measure environmental effects have begun. NASA-sponsored research has shown indoor plants remove pollutants from the air. It has also been shown that plants clean the outside air, water, and soil of pollutants, they produce oxygen, and they may help reverse the greenhouse effect.

From a social standpoint, plants provide personal rewards for work and opportunities to develop individual and group skills. Plants also provide a topic of conversation, a pride of possession, and even an aspect of subtle competition.

Psychologically, plants appear to reduce stress, improve self-image, teach long-term values, and provide links between the past and the present. A quarter century ago the Dichter Motivational Institute identified three motivations for gardening. These are: enjoyment; a sense of achievement; and mental and physical therapy.

Charles Lewis of the Morton Arboretum said, "Plants are non-threatening, non-restrictive, non-discriminating. They are predictable...such as an oak tree and a rose. They generate neighborliness, a sense of community ("we did it together"). Rather than a feeling of helplessness there's a chance to make a difference. What satisfactions are derived from gardening? Peacefulness, tranquility. Not boredom but creativity. Behavioral changes from mental fatigue and irritableness; gardening is an opportunity to work out tensions. There's a sense of creativity, social well-being, self-esteem, respect, pride."

Continuing, Lewis also said, "Society has found horticulture. With the people/plant concept, horticulture can discover new and vital dimensions in society. The questions concerning people/plant interactions will be answered because the pressures of human needs demand answers. To what degree will horticulture participate in the search? Can we enlarge the area of our horticultural concerns to include inherent human benefits?"

GARDENING MOTIVATIONS

The most recent studies of motivations for vegetable gardening were conducted by the Gallup Organization for the National Gardening Association (NGA) in 1982, 1983, and

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1984 (Table 1). People's motivations to raise vegetables changed even during the span of this brief study period. There was movement away from saving money towards the desire for fresh vegetables and better tasting/quality food. Fun and enjoyment of vegetable gardening became a more important motivation than saving money. The relaxation/hobby motivation had almost equalled saving money. The NGA/Gallup study suggested that home vegetable gardening can be positioned to appeal to consumers with a wide variety of needs.

The annual NGA/Gallup survey also contained evidence indicating a decline in vegetable gardening, beginning about 1983, when there was a decrease in the number of U.S. households with vegetable gardens, a decrease in size of vegetable gardens, and a decrease in expenditures on vegetable gardening supplies.

Conjecture with respect to the NGA/Gallup vegetable gardening survey results suggests saving money became less important because of the decline in food prices at that time. Vegetable gardens were getting smaller in size, suggesting either less interest in producing as much food or the more efficient use of garden space. Public interest in health, nutrition, fitness, and food that is free from additives and chemical residues were becoming more important issues.

Verification of declining interest in home vegetable gardening has surfaced in the yearly analyses of sales by the bedding plant industry. Popularity of tomato and other vegetable plants dropped precipitously from being the third best-seller (by 17 percent of respondents) in 1981-82 to only ½ percent in 1989. Additional evidence provided by USDA indicates that while vegetable bedding plants averaged 28 percent of all bedding plants during the 1979-1981 period, they accounted for only 8.2 percent in 1987-89. Essentially, vegetable plant sales had plateaued while flowering bedding plants sales were booming.

PERSPECTIVES WITHIN THE NATION

So, what was happening with respect to people/plant interactions more generally...beyond the narrow aspect of home vegetable gardening? The mix of lawn and garden retail sales changed from 1985 to 1989 are provided in Table 2. National vegetable gardening sales were $950 million in 1985, and $1,026 million sales in 1989. This is actually a decline when adjusted for inflation (15.2 percent between 1985 and 1989). Total lawn and garden retail sales increased 35.4 percent, from $12,026 million to $16,285 million, which is clearly an increase in real money terms.

Lawn care, the most important activity, had the largest absolute dollar increase of $1,764 million. This was followed by flower gardening at $598 million, landscaping at $480 million, insect control at $399 million, flower bulbs at $195 million, and ornamental gardening at $120 million. Other lawn and garden activities had smaller absolute changes in dollar sales.

One activity, consumers raising their own transplants, actually declined over the 1985-89 period. This may be indicative consumer inability and/or unwillingness to grow their own transplants when, indeed, the commercial bedding plant and perennial growers have provided perhaps better quality, greater variety, and wider availability--coupled with competitive prices. The more popular transplants are mature already-flowering plants that can be enjoyed immediately.

In attempting to judge the dollar size of gardening in our society, the reader is cautioned that NGA estimates cover only U.S. households, and, the remaining nonhousehold market--consisting of lawn and garden usage by commercial, governmental, institutional, and other nonhousehold entities--is an extremely large additional market that, so far, has escaped measurement.

PEOPLE/PLANT PERSPECTIVES IN PENNSYLVANIA

The Pennsylvania combined greenhouse/nursery industry has become an increasingly important source of cash receipts for Pennsylvania production agriculture. In 1979-81 greenhouse/nursery average was 5.1 percent of all livestock and crop cash receipts; in 1986-88 its share averaged 8.9 percent, (Chart 1 and Table 3). Indeed, the share is expected to become even greater as ornamentals are not restricted by stomach capacity, and the past and future growth are allied with gardening, a dominant outdoor leisure activity in our society.

The specialized greenhouse or floriculture portion of the industry has almost tripled in wholesale sales, going from $30.7 million in 1976 to $88.3 million in 1989 (Table 4). Domestically-produced cut flower sales have changed but little, due to increased imports. Sales of foliage or green plants, where the green plant market boom of the 1970s has settled into a somewhat mature, mostly-replacement and maintenance market, have not even kept up with inflation. Potted flowering plant sales increased by 246 percent, while sales of bedding plants increased by almost 900 percent between 1976 and 1989. Similar growth is expected to continue.

Sales by Pennsylvania's nursery and landscaping portion of the industry have more than tripled, going from $143.7 million in 1975 to $438.5 million in 1989 (Chart 2). Chart 2 also shows the number of establishments to have increased by 61 percent, illustrating the attractiveness for new entrants. The number of hired workers more than doubled, and salaries and wages increased by 352 percent.

Data for Pennsylvania's retail florists and garden centers are shown on Charts 3 and 4. Increases in retail flower shop sales (46.9 percent) were slightly above the average in all retail trade for Pennsylvania (44.7 percent), whereas growth in Pennsylvania garden center sales (111.7 percent) was 2.5 times that of all Pennsylvania's retail trade. Additionally, the number of Pennsylvania flower shops increased by 12.5 percent (vs. all retail trade establishments at 3.6 percent) and the average sales per shop in 1987 was

$190,401 (vs. $146,121 in 1982). In contrast, new garden center establishments increased by 31.6 percent, and the average garden center sales in 1987 were $514,834 (vs. $319,884 in 1982). Obviously, important differences exist between retail flower shops and garden centers which reflect societal demand and basic people/plant relationships.

SOME FINAL THOUGHTS

With gardening being the nation's number one outdoor leisure activity, quality control and consumer education will lead to favorable sales growth and profitability in the gardening market. Obvious opportunities exist for gardening entrepreneurs who are market-oriented. Marketing strategies should include identifying their market niche; considering integrating forward to retailing for better business control and customer education; orienting to those markets with customers who have better-than-average incomes; developing a good reputation; and by being a savvy marketer by listening and catering to customers' wishes.

Evidence from available sources indicates that consumer horticulture, a people/plant interactive industry, has experienced strong growth in the last decade or so, and is likely to enjoy strong growth in the future as well.

Table 1. Motivation for Home Vegetable Gardening

Reason	1982	1983	1984
Fresh vegetables	26%	33%	30%
Better tasting/quality food	24	21	25
For fun/enjoyment	18	18	22
Produce for canning/freezing	18	14	19
Save money	**27**	**18**	**15**
Relaxation/hobby	11	11	14
More healthful food	8	6	8
Exercise	6	3	5
A family activity	2	2	2

Source: National Gardening Survey, National Gardening Association, Burlington, VT. (Note: totals above add to more than 100% due to multiple responses)

Table 2. Lawn and Garden Retail Sales, by U.S. Households, 1985 and 1989

	1985	1989	Percent Changes
	--- millions ---		
Lawn care	$ 3,896	$ 5,660	45.3%
Landscaping	2,125	2,605	22.6
Flower gardening	1,259	1,857	47.5
Insect control	653	1,052	61.1
Vegetable gardening	950	1,026	8.0
Tree care	795	886	11.4
Shrub care	699	844	20.7
Indoor houseplants	706	822	16.4
Flower bulbs	275	470	70.9
Fruit trees	271	287	5.9
Ornamental gardening	146	266	82.2
Container gardening	NA	240	-
Raising transplants	208	139	-33.2
Growing berries	41	73	78.0
Herb gardening	NA	58	-
Total	$12,026	$16,285	35.4
CPI (1982-84 = 100)	107.6	124.0	15.2

Source: National Gardening Key Results of the 1989-1990 National Gardening Survey.

Table 3. Cash Receipts (millions of dollars) from Sale of Agricultural Products from Pennsylvania Farms, 1979-81 and 1986-88

	1979-81	1986-88
All commodities	$2,683	$3,214
Livestock products	1,947	2,299
Crops	736	915
-Greenhouse/Nursery	137	285
% of all commodities	5.1%	8.9%

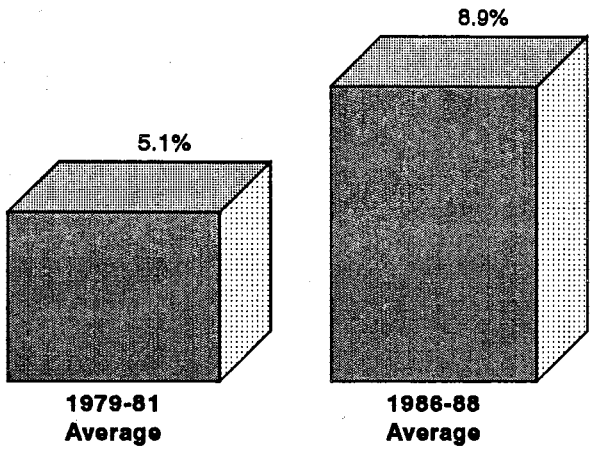
Source: Pennsylvania Agricultural Statistics Service

Table 4. Changes in Wholesale Value in Pennsylvania for the Four Floriculture Categories, 1976-1989

	1976		1989		1976-1989
	Wsle Value (X 1000)	Share %	Wsle Value (X 1000)	Share % †	Value Changes
Cut flowers	$14,200	46%	$14,513	16%	+ 2%
Pot plants	7,346	24	25,437	29	+346
Bedding plants	4,101	13	40,960	46	+999
Foliage plants	5,066	16	7,430	8	+ 47
Totals	$30,713	99%	$88,340	99%	+288%

† The U.S. shares in 1989 were: Cut flowers 20%; pot plants 22%; bedding plants 37%; and foliage 20%. Source: Floriculture Crops, USDA.

Chart 1. Greenhouse/Nursery Share of Cash Receipts on Pennsylvania Farms



Source: Pennsylvania Agricultural Statistics Service

Chart 2. Growth of Pennsylvania Nursery and Landscaping Enterprises Between 1975-89

	1975	1989
# of Establishments	2,883	4,648
Hired Workers	11,922	25,308
Unpaid Family	2,438	3,143
Salaries, Wages Paid (million)	$42.241	$190.923
Total Sales (million)	$143.700	$438.528

Source: Pennsylvania Agricultural Statistics Service

Chart 3. Retail Sales of Flower Shops, Pennsylvania, 1982 and 1987

	1982	1987
Sales (Million)	$167.2	$245.6
Shops	1147	1290
Average Shop Size	$146,121	$190,401
Sales Per Employee	$31,216	$38,098
Sales Per Capita	$14.10	$20.57

Source: Census of Retail Trade, U.S. Commerce Dept.

Chart 4. Retail Sales of Garden Centers, Pennsylvania, 1982 and 1987

	1982	1987
Sales (Million)	$118.4	$250.7
Shops	370	487
Average Shop Size	$319,884	$514,834
Sales Per Employee	$68,414	$81,193
Sales Per Capita	$9.96	$21.01

Source: Census of Retail Trade, U.S. Commerce Dept.

PENNSYLVANIA'S POTATOES, MUSHROOMS, FRUITS, AND VEGETABLES

Thomas Brewer*

POTATOES

Value of Pennsylvania Production (1990) $39.4 Million

As recently as 1960 per capita utilization of table-stock (fresh) potatoes stood at 84 lbs. with only 7-8 lbs. of frozen potato products used each year. Per capita consumption of fresh potatoes declined rapidly and frozen use increased just as rapidly from then until the mid 1970s (Table 1). Since that time there have been no discernable trends in table-stock consumption and only slow growth in use of frozen potato products. Some believe that the micro-wave and other technological and nutritional developments will lead to a rediscovery of the fresh potato for home prepared meals. Consumption of frozen potato products (primarily french fries) has paralleled growth of the fast food market. Expansion of the fast food market is slowing. However, frozen french fries have been a major factor in the growing export market in recent years and much of this trade has been with E. Asian, other Pacific and Carribean countries.

Pennsylvania's share of U.S. potato production has been declining for some time (Chart 1). Most of the reduction in Northeast production since 1980, as well as the increase in total U.S. production can be attributed to increased output in the Northwest (Chart 2). Through the mid 1970s, per capita consumption of fresh potatoes was decreasing and frozen potato product usage was increasing. At the same time improved storage and transportation technology along with growth in consumer incomes enabled other regions to begin serving Northeast table-stock markets. Chip consumption has been relatively stable and the chipping industry has provided an important market for Pennsylvania grown potatoes.

Since 1980, Pennsylvania acreage and production have both leveled off (Table 2). The table-stock market will continue to be important, but improved storing, grading and marketing will be required if the state's growers are going to continue being successful in serving this segment of the market. The chipping industry will continue to be important too, but the state's growers must improve quality to compete with suppliers from other regions. More efficient production (higher yields/acre) would improve the competitive position of the industry in Pennsylvania. Development of acceptable methods of controlling insects and diseases are essential to improving Pennsylvania yields and maintaining the industry.

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*Associate Professor of Agricultural Economics

MUSHROOMS

Value of Pennsylvania Sales (1989-90) $256 Million

Per capita mushroom usage has almost tripled since 1970 (Table 3). Until the mid 1980s, usage increased steadily. Since 1984, total per capita mushroom use has not changed appreciably, though fresh usage may have increased a little at the expense of processed. As a part of the 1990 Farm Bill, the industry gained enabling legislation for establishment of a federal marketing order to collect funds for advertising and promotion. If a marketing order is issued and a successful promotional program developed, we may see increasing demand and higher prices for mushrooms. It will quite likely be 1993 before it would have much impact.

Most mushrooms produced in the U.S. are Agaricus (the common button mushroom). Exotic mushrooms (Shiitake, Oyster and other) are but a small percentage of total production. However, production of exotic mushrooms is expanding.

Pennsylvania, long the center of U.S. mushroom production has declined in importance over the years even though the states' output continues to grow (Table 4). Twenty years ago Pennsylvania produced more than 60% of all U.S. mushrooms, but by the late 1980s that percentage had declined to about 45%. In the early 1970s, Pennsylvania sold about three quarters of its mushrooms to processors and for the most part they were canned. The remaining fourth of the crop was sold on the fresh market. By the latter part of the 1980s, sales to processors were about the same as in the early 1970s but fresh sales had experienced a five fold increase (Chart 3). Total Pennsylvania production has more than doubled since the early 1970s.

Pennsylvania's heavy dependence on the processing market during the 1970s, when about 70% of the state's production was canned, left the industry particularly vulnerable to competition from imported processed mushrooms. Pennsylvania growers were not well organized to serve the rapidly growing fresh market. In recent years though, the Pennsylvania part of the industry has shifted and now sells about 60% of its output for fresh use. Nationally about 75% of the crop is sold fresh.

A lack-luster economy coupled with increased production could signal lower prices for the industry. An advertising and promotion program that might be established under a Federal Marketing Order can not be expected to be up and running in time to have any appreciable impact on prices for a year or two.

FRUIT

Value of Pennsylvania Fruit Production (1989) $92.5 Million

Per capita consumption of fruit (citrus and non-citrus) has increased from about 180 lbs. per year during the early 1970s to 210 lbs. in the period from 1985 to 1989. Two thirds (20 lbs.) of that 30 lb. increase has been due to increased consumption of non-citrus fruits. Among the non-citrus fruits, fresh purchases account for nearly all of the increase. Except for grapes, sour cherries, and apples, the fresh market is of primary importance to Pennsylvania's fruit industry. Per capita use of dried and frozen non-citrus fruits has remained fairly stable while consumption of canned product has been declining.

The processing market is very important to Pennsylvania's grape and apple growers (Table 5). Most other Pennsylvania fruit is marketed through fresh market channels.

In terms of either tonnage or value, apples are easily the most important of Pennsylvania's fruit crops. Peaches and grapes come next and are followed by pears, cherries (tart and sweet), strawberries, cane-berries, and nectarines in no particular order (Table 6 and Charts 4 and 5). A significant proportion of Pennsylvania-grown fruit, sold for fresh market use, passes through direct marketing outlets.

Pennsylvania usually ranks from 4th to 6th among the states in apple production. It follows Washington, New York and Michigan as do California and Virginia which, depending on the year's crop, may rank ahead of or behind Pennsylvania. Apple sauce manufacturers are a major user of Pennsylvania's apples. In 1983 (the last year for which data is available) the Eastern region, centered around Adams County, Pennsylvania, and stretching from New York to Virginia, produced nearly 60% of the apple sauce produced in the United States. Substantial quantities of juice are also processed in the East, primarily from apples that are not satisfactory for the fresh market. Canned pie filling, frozen apple slices and vinegar manufacturing are among other important uses of Pennsylvania produced apples.

1991 was a good production and price year for Pennsylvania's tree fruit growers. The crops were larger than generally expected and that fact when coupled with a 'manageable' national crop and the timing of harvest in competing production areas led to rather good prices and a strong market for Pennsylvania Apple growers. A mid-april freeze in Central Europe reduced the world's concentrated apple juice supply and led to higher prices for juice apples. The peach marketing season, after starting out strong, slackened and movement and prices of peaches and nectarines suffered. The grape crop in Pennsylvania was large and sugar content was high. Prices were a little weak but revenue per acre was quite good.

VEGETABLES

Value of Pennsylvania Vegetable Production (1990) $45.6 Million

Per capita use of vegetables in the United States has been increasing for the last decade (Table 7). Most of the growth can be attributed to increasing fresh vegetable purchases but some is due to purchasing of more vegetables in the frozen form. Per capita fresh and frozen purchases have more than offset the decline in the use of canned vegetables.

Pennsylvania's location, near to market, makes it possible for growers to share in the growth of the fresh vegetable market even if for only a short period of time each season. A substantial portion of fresh vegetable sales take place through some type of direct marketing outlet (roadside stands, farmer's markets, etc.). However, centralized packing and marketing of vegetables for fresh market is beginning to increase in importance. As a result, more and more growers are now able to serve the larger volume traditional wholesale markets. Total sales of fresh market Pennsylvania vegetables have a dollar value of three to five times that of vegetables sold for processing.

Pennsylvania's production of the so-called principal vegetables[1] has been decreasing for several decades. A strong downward trend in production of tomatoes for processing has not been offset by the rather rapid growth in production of sweet corn and tomatoes for fresh market. Besides tomatoes and sweet corn for fresh market there has been greater interest in, and increased production of a number of other fresh market vegetables in recent years.

The tonnage of the principal vegetables produced in Pennsylvania is only 50-60% of the volume produced in the late 1960s and early 1970s (Chart 6). The values of the Pennsylvania's processing and fresh-market vegetable crops were about equal in 1970 even though processing tonnage was four times as great as that for fresh market (Table 8). By contrast, in 1990, tonnage of fresh market vegetables was about 1.25 times that of vegetables for processing but the value of the fresh market crop of principal vegetables was more than three times that of the processing crop.

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[1]Fresh-market (sweet corn and tomatoes); processing-market (snap beans, sweet corn, and tomatoes).

Table 1. Potatoes, All: U.S. Per Capita Utilization, 1970-89

Year	Total	Fresh	Freezing	Chips and Shoestring	Dehydrating	Canning
	Pounds per capita, farm-weight					
1970	119.3	62.3	25.6	17.4	12.0	2.0
1975	121.6	52.6	36.8	15.5	14.7	2.0
1980	115.9	51.1	36.9	16.7	9.4	1.9
1981	112.7	45.7	37.8	16.8	10.5	1.8
1982	114.9	46.8	39.1	17.2	10.1	1.9
1983	118.1	49.7	38.7	17.9	9.7	1.9
1984	119.2	48.8	40.5	18.1	10.0	1.8
1985	121.3	46.7	44.0	17.7	11.0	1.9
1986	126.0	49.4	45.9	18.2	10.5	1.8
1987	124.0	48.9	45.7	17.7	10.4	1.8
1988	127.3	51.4	43.9	17.3	10.0	1.9
1989	126.2	49.8	46.1	17.8	10.5	2.0

Source: Economic Research Service, USDA.

Table 2. Potatoes: Harvested Acres and Production (U.S. and PA) 1970-90

	1,000 Acres		1,000 cwt.	
	U.S.	PA	U.S.	PA
1970	1,421	35	325,716	8,280
1975	1,259	29	321,978	6,815
1980	1,148	22	303,905	4,180
1981	1,232	21	340,623	4,500
1982	1,267	21	355,131	4,935
1983	1,241	22	333,726	4,300
1984	1,298	22	362,039	5,160
1985	1,359	22	406,609	5,720
1986	1,220	22	361,743	5,160
1987	1,293	22	389,320	4,730
1988	1,259	21	356,438	3,690
1989	1,282	21	320,444	4,715
1990	1,359	23	393,204	5,400

Source: Crop Production, NASS, USDA.

Table 3. Mushrooms: U.S. Per Capita Utilization, 1970-89

Crop Year	Fresh	Processing	Total
	----------Pounds per capita, (farm weight)----------		
1970	0.3	1.0	1.3
1975	0.7	1.3	2.0
1980	1.2	1.7	2.9
1981	1.4	1.5	2.9
1982	1.4	1.8	3.2
1983	1.6	1.6	3.2
1984	1.8	1.9	3.7
1985	1.8	1.8	3.6
1986	1.9	1.8	3.7
1987	1.9	1.8	3.7
1988	2.0	1.6	3.6
1989	2.1	1.4	3.5

Source: Economic Research Service, USDA.

Table 4. Mushrooms: Production by Type of Sale, 1970-89

Crop Year[1]	U. S.			Pennsylvania			PA as % of U.S.
	Fresh	Processed	Total[2]	Fresh	Processed	Total	
	----------Millions of pounds----------						
1970	58	149	207	32	96	128	62
1975	142	168	310	65	114	179	58
1980	275	195	470	88	150	238	51
1981	319	198	517	120	153	273	53
1982	337	154	491	129	117	246	50
1983	388	173	562	155	125	280	50
1984	420	176	596	160	116	276	46
1985	427	161	588	156	100	256	44
1986	457	157	614	183	98	281	46
1987	469	163	632	185	100	285	45
1988	485	183	668	176	118	294	44
1989	512	203	715	193	140	333	47

[1] Crop year begins July 1 and ends June 30 the following year. Thus 1989 is from July 1, 1989 through June 30, 1990.

[2] Total production, fresh market and processing estimates are primarily agaricus, but also include exotics and specialties through 1986. Statistics after 1986 are for agaricus only.

Source: Mushrooms, NASS, USDA.

Table 5. Utilization of Pennsylvania's Grape, Apple and Peach Crops, 1970-89

Year	Grapes		Apples			Peaches	
	Fresh	Proc.	Fresh	Proc.	% Proc.	Fresh	Proc.
	millions of pounds						
1970	4	86	195	315	62	74	10
1975	3	93	228	275	55	83	7
1980	4	108	208	362	64	95	10
1981	4	118	152	247	62	60	5
1982	4	90	183	341	65	83	7
1983	2	122	175	325	65	83	12
1984	3	116	207	368	64	79	7
1985	2	98	210	375	64	34	4
1986	2	118	136	484	78	93	7
1987	2	123	157	303	66	78	7
1988	2	114	138	382	73	73	7
1989	2	118	120	200	63	62	3

Table 6. Production of Apples, Peaches, Grapes, Pears, Cherries and Strawberries in Pennsylvania 1970-89

Year	Apples	Peaches	Grapes	Pears	Tart Cherries	Sweet Cherries	Straw-berries
	Millions of lbs.						
1970	540	84	90	8	16	1.2	4.7
1975	550	110	96	9	12	1.7	4.8
1980	570	105	112	7	6	1.4	6.2
1981	400	65	122	6	8	.6	6.8
1982	525	90	94	9	6	1.2	7.6
1983	500	94	125	5	8	1.6	7.2
1984	575	85	120	7	9	1.8	5.1
1985	585	40	119	7	6	1.0	5.1
1986	620	100	124	11	12	2.1	6.1
1987	460	85	131	11	5	1.4	7.2
1988	520	85	126	10	9	2.4	8.2
1989	320	65	120	11	6	1.3	8.5

Source: Various annual summaries, Pennsylvania Crop Reporting Service, now the Pennsylvania Agricultural Statistics service. (Some production figures have been rounded to nearest whole number for ease in presentation.)

Table 7. Total U.S. Per Capita Utilization of Commercially Produced Vegetables, 1970-89

Year	Total Fresh and Processed	Vegetables		
		Fresh[1]	Canned[2]	Frozen[3]
	----------Pounds per person, farm-weight----------			
1970	175.3	70.6	91.4	13.3
1975	176.2	73.5	88.9	13.8
1980	185.5	80.5	90.6	14.4
1981	174.0	79.3	80.0	14.7
1982	174.7	82.3	78.9	13.5
1983	176.6	82.5	79.6	14.5
1984	190.3	87.6	85.2	17.5
1985	192.7	88.0	87.5	17.2
1986	198.7	95.3	87.6	15.8
1987	202.3	98.5	87.0	16.8
1988	200.6	100.3	82.8	17.5
1989	198.7	99.6	82.2	16.9

[1] Includes asparagus, broccoli, carrots, cauliflower, celery, sweet corn, lettuce, onions, tomatoes, and honeydews.

[2] Includes asparagus, snap beans, carrots, sweet corn, green peas, pickles, and tomatoes.

[3] Includes asparagus, snap beans, broccoli, carrots, cauliflower, sweet corn, green peas.

Source: Economic Research Service, USDA.

Table 8. Production and Utilization of Principal Vegetables,[1] Pennsylvania 1970-90

Year	Fresh	Processing	Total
	----------Thousand of cwt.----------		
1970	972	3758	4730
1975	1130	2792	3922
1980	1229	1274	2503
1981	1445	2111	3556
1982	1498	2278	3776
1983	1219	1985	3204
1984	1926	1814	3740
1985	1819	1724	3543
1986	1406	1224	2630
1987	1653	1004	2657
1988	1550	1199	2749
1989	2254	1194	3448
1990	1503	1219	2722

[1] Fresh-market (sweet corn and tomatoes); processing-market (snap beans, sweet corn and tomatoes).

Chart 1.
Potato Production in the U.S. and Pennsylvania, 1970-1990

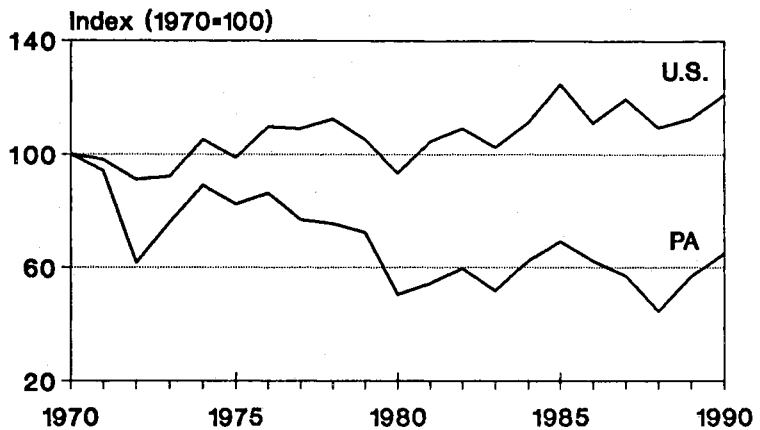


Chart 2.
Northeast and Northwest Fall Potato Production Trends, 1978-1988

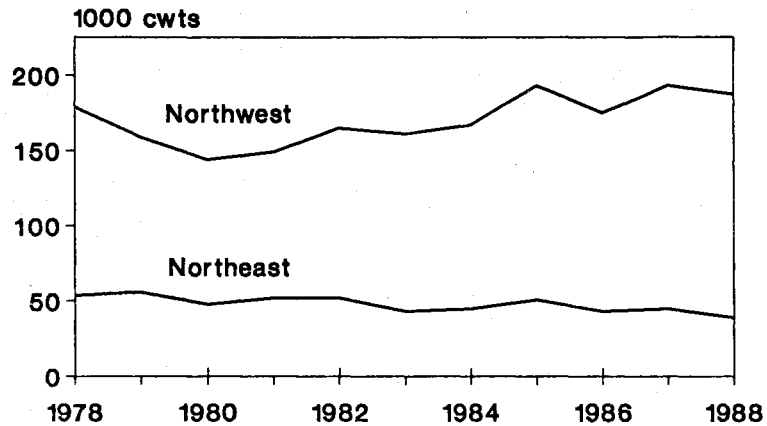


Chart 3.
U.S. Produced Mushroom Utilization and Grower Prices

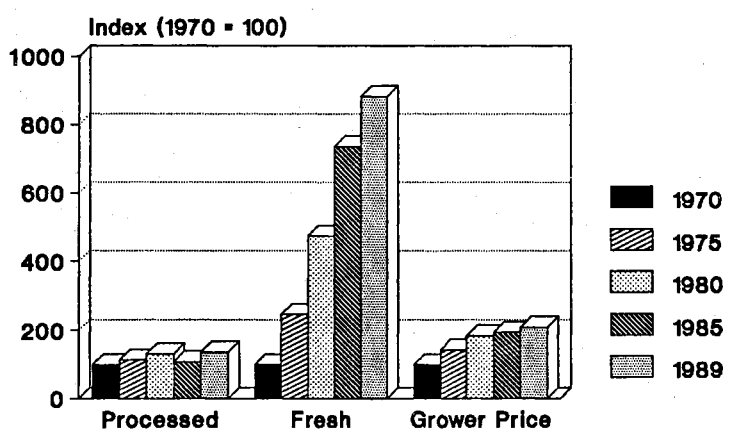


Chart 4.
Pennsylvania Fruit Production Trends 1970-1990

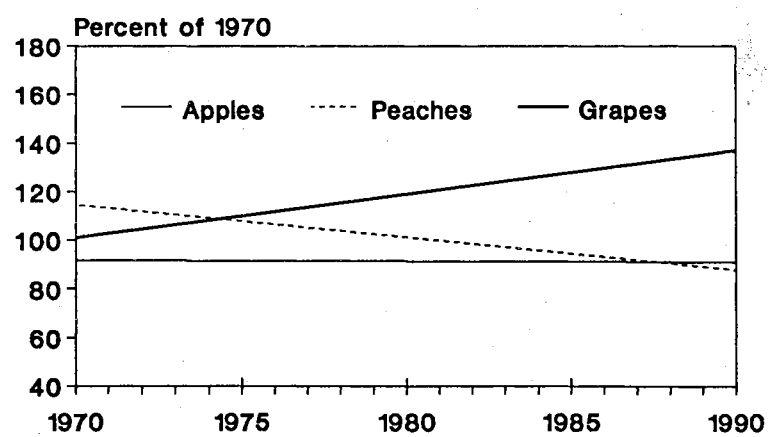


Chart 5.
Pennsylvania Fruit Production Trends 1970-1990

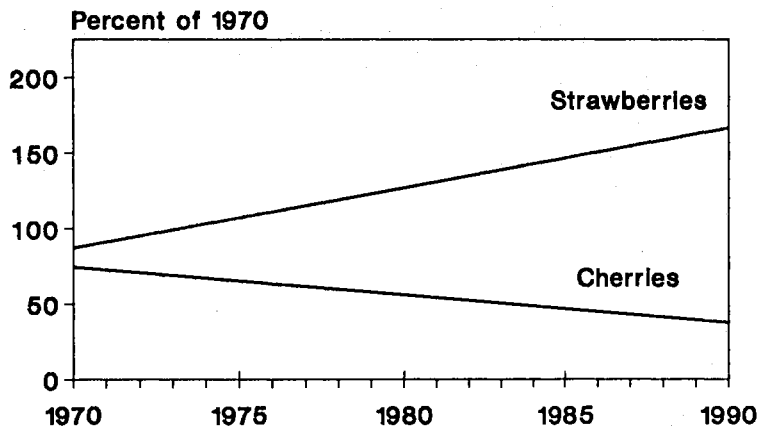
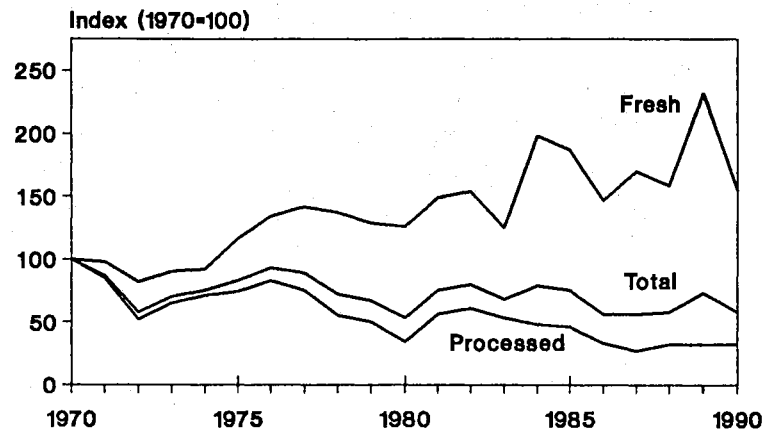


Chart 6.
Production of Major Vegetables in Pennsylvania, 1970-1990



APPENDIX A

Recent Publications in the Agricultural Economics and Rural Sociology Departmental Series (A.E. & R.S.)

Number	Title	Author	Date
195	Marketing Opportunities for Pennsylvania-Grown Poinsettias	R. O. Herrmann A. O. Voigt	March 1988
196	The Costs and Profitability of Selling Fluid Milk and Cream Products in Retail Grocery Stores in Northeastern Pennsylvania	J. J. Kirkland	May 1988
197	Characteristics of Packaged Fluid Milk Sales in Pennsylvania	B. J. Smith R. S. Miller	June 1988 *(not available)*
198	Potential for Storing Chipping Potatoes in Pennsylvania *(also published as Marketing Research Report 6)*	T. A. Brewer R. D. Powell J. W. Dunn J. M. Carson R. H. Cole	March 1989
199	Assessing the Impact of Milk Advertising: A Survey of U.S. and Pennsylvania Adults	R. O. Herrmann R. H. Warland B. J. Smith	April 1988
200	U.S. Agriculture Under Multilateral and Unilateral Trade Liberalization–What the Models Say	D. Baker M. C. Hallberg D. Blandford	December 1988
201	Images of Rural Life: Findings From a Statewide Survey of Pennsylvania Residents	F. K. Willits R. C. Bealer V. L. Timbers	January 1989
202	Characteristics and Practices of Dealers Delivering Milk to Pennsylvania Public Schools	B. J. Smith	February 1989
203	The Structure of the International Trade of Wheat: It's Implications for Model Specification and Trade Liberalization Analysis	R. D. Weaver	February 1989
204	Surplus Capacity and Resource Adjustments in American Agriculture: Conference Proceedings	M. C. Hallberg J. Barndt R. House J. Langley W. H. Meyers	June 1989
205	Improving Data for Rural Sociological Research: A Case Study of Operationalizing the Content Analysis of Farm Magazine Ads	M. G. Dalecki R. C. Bealer	June 1989

Number	Title	Author	Date
206	Agricultural Production Research in The United States: Factors Influencing Research	L. M. Musser A. J. Harp C. E. Sachs W. N. Musser J. S. Shortle	August 1989
207	An Annotated Bibliography of Selected Literature on Reduced Tillage and Related Low Input Production Practices on Relevance for Pennsylvania	F. Higdon R. R. Janke W. N. Musser	September 1989
208	Manuscript Reviewing: A Case Study	R. C. Bealer	Ocrtober 1989 *(not available)*
209	Determinants of Milk Use in the Public Schools of Pennsylvania	B. J. Smith J. J. Kirkland	February 1990
210	Milk Consumption and Consumer Concerns about Fat, Cholesterol, and Calories	B. J. Smith R. O. Herrmann R. H. Warland	February 1990
211	The Importance of Cereal to Fluid Milk Consumption	B. J. Smith R. D. Yonkers	February 1990
212	Conference Proceedings: Pennsylvania's Agricultural Economy: Trends, Issues, and Prospects, 1990	C. Hamlett (ed.)	March 1990
213	*(Never Published)*		
214	Symposium Proceedings: Industry and Academic Perspectives on the Competitive Position of the Northeast Dairy Industry	C. Hamlett B. J. Smith	April 1990
215	Characteristics of Packaged Fluid Milk Sales in Pennsylvania, October 1989	B. J. Smith R. S. Miller	April 1990
216	Reflections on Rural Demography, Rural Society, and Predicting Social Behavior. M. E. John Lecture, 1990. (Author: Calvin L. Beale)	D. M. Crider (ed.)	
217	The Effect of Away-from-Home Eating on the Consumption of Fluid Milk (*also published as Marketing Report #9)*	B. J. Smith	November 1990
218	Conference Proceedings: Pennsylvania's Agricultural Economy: Trends, Issues, and prospects, 1991	J. C. Becker (ed.)	March 1991
219	Environmental Concern of Pennsylvania Citizens: Data from a Statewide Survey	D. Scott F. K. Willits	March 1991

Number	Title	Author	Date
220	Perspective on Economic Growth and the Environment: Data from a Pennsylvania Survey	F. K. Willits D. M. Crider	March 1991
221	Consumers' Shift Toward Lower Fat Dairy Products: 1990 *(also published as Marketing Report #10)*	R. O. Herrmann A. H. Sterngold R. H. Warland	
222	Agricultural Real Estate Activity in Pennsylvania and Surrounding States, 1972-1976	N. B. Gingrich	
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229	Pennsylvania's Agricultural Economy: Competing for Resources and Markets in the 90's	R. O. Herrrmann (ed.)	March 1992
230	The Pennsylvania Food Processing Industry: Importance and Future Issues *(also published as Marketing Report #11)*	J. W. Dunn T. Fuller	January 1992

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University Park, PA 16802

Extension Letters

Dairy Marketing Letter - (monthly), Blair Smith, Department of Ag. Econ. and Rural Soc., 814-865-0469

Farm Economics (bi-monthly), Editor: Blair J. Smith, Prof. of Ag. Econ., 814-865-0469.

Farm Management Reports - (bi-monthly), W. McSweeny, Asst. Prof. of Ag. Econ., 814-865-7656

Flower Marketing Letter - (monthly), Alvi Voigt, Department of Agric. Econ. and Rural Soc., 814-865-2561

Pennsylvania Farm Law Bulletin - (3 times/yr.), John C. Becker, Assoc. Prof. of Ag. Econ., 814-865-7656

Poultry Letter - (quarterly), Milt Madison, Dept. of Agric. Economics and Rural Sociology, 814-865-2561

Recent Titles from Farm Economics

The Misunderstood Mission of Marketing in Agriculture, James G. Beierlein, Associate Professor of Agricultural Economics, January/February 1988.

Open International Markets - Enormous potential but difficult to achieve, Thomas A. Brewer, Associate Professor of Agricultural Economics, March/April 1988.

Big, Bad BST!, Blair J. Smith, Associate Professor of Agricultural Economics, May/June 1988.

Lobbyists Provide Insight in Ag Policy Decision Making, Marshall Cohen, Cohen/Herman Associates, August, Maine.

The Pennsylvania Agricultural Real Estate Market 1972-86, Neil B. Ginrich, Instructor of Agricultural Economics and Rural Sociology, September/October 1988.

Employment Changes in Pennsylvania Food Industries, Theodore E. Fuller, Development Economist, and William R. Gillis, Associate Professor of Agricultural Economics, November/December 1988.

Who's Drinking More (or Less) Milk? Rex H. Warland, Professor of Rural Sociology, Cathy Kassab, Graduate Research Assistant in Rural Sociology, Robert O. Herrmann, Professor of Agricultural Economics, and Blair J. Smith, Associate Professor of Agricultural Economics, January/February 1989.

The Farm Crisis and Pennsylvania, William T. McSweeny, Assistant Professor of Agricultural Economics, March/April 1989.

Egg Producer Attitudes Toward Supply Management, Milton E. Madison and James W. Dunn, Assistant Professors of Agricultural Economics, May/June 1989.

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Europe 1992: What does it mean for United States Agriculture? M. C. Hallberg, Professor of Agricultural Economics, September/October 1989.

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Student Experiences with Milk in Pennsylvania Schools, Blair J. Smith, Assoc. Prof. of Ag. Econ., January/February 1992.

Pennsylvania's "Clean and Green" Act, Act 319 of 1974, John C. Becker, Assoc. Prof. of Ag. Econ., March/April 1992.