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Economics Research at SDSU

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Economics Newsletter



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Economics Research
at SDSU

by

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Chrm, Dept Research Com

Agricultural research, teaching, and extension or public service are integral components of a land-grant university like SDSU. Agricultural research generates new knowledge for use in the classroom and in extension activities. The content of an agricultural research program often is influenced by topics that emerge from extension requests. Thus, research, teaching, and extension are mutually-supporting. The absence of any one of the three can have negative effects on the other two.

The purpose of this issue of the Newsletter is to indicate (1) evidence on the productivity of U.S. agriculture, (2) the nature and purpose of applied agricultural research, (3) recent evidence on the benefits from agricultural research, (4) the primary beneficiaries of agricultural research, and (5) the nature of the Economics Department's current research program. Abstracts of recent publications resulting from our research program are included so that you can request copies of any you might wish to have.

Agricultural productivity in the U.S.

Agriculture in the U.S. is remarkably productive. One U.S. farmworker now provides food and fiber for nearly 80 people, compared with 26 people in 1960. That is an average of 52 tons of food produced per farmworker.

The current level of productivity in U.S. agriculture reflects a path of continuous growth since the early 1900's (Table 1). Since 1965, however, the rate of increase in productivity has dropped off considerably. For example, total

productivity increased at an annual rate of 1.37 percent between 1965 and 1979, which is only 60 percent of the rate experienced during the prior 15 years.

Table 1. Annual Growth Rates in Selected Measure of Productivity, U.S. Agriculture, 1920-1934 through 1965-1979.

Fifteen-year period	Total farm output			Livestock Production Per Breeding Unit
	Per Unit of all Inputs	Per Farm-Worker	Crop Production Per Acre	
	(percent)			
1920-1934	0.43	0.97	-0.99	1.33
1934-1949	2.16	4.80	2.20	1.44
1950-1964	2.33	5.08	2.75	1.93
1965-1979	1.37	3.89	1.56	0.89

Source: B.R. Eddleman, *Impacts of Reduced Federal Expenditures for Agricultural Research and Education*, (IR-6 Info. Rep. No. 69), National Agricultural Research Planning, Mississippi State, MS, May 1982, p. 18.

This interruption in the path of steadily increasing rates of productivity in U.S. agriculture is disturbing. For one thing, it means that the U.S. is losing some ground in its ability to compete effectively in international markets. For a second thing, it means that the U.S. is losing some ground in being able to produce ever-cheaper food for its own citizens. The historical record on this count is striking. In 1980 the "real" price of food to the U.S. consumer was only about 60 percent as much as it was in the mid-1940's.

What has interrupted the U.S.'s path of steadily increasing rates of agricultural growth? The answer is not simple, but research does show that one explanation is a slow-down in the growth of investments in research, extension, and education. One interregional study shows that the total public funding for agricultural research in the U.S. increased between 1939 and 1967 at an annual rate of 3.9 percent per year, but since 1967 the annual growth rate has dropped off to 1.9 percent per year.

Applied agricultural research

Research involves directed efforts to understand the nature of the world in which we live. "Applied" or "user-oriented" research focuses on the development and application of new technology. This includes attention to issues in plant and animal production, financial planning and farm management, agricultural marketing, and public policy. "Basic" or "science-oriented" research

provides the building blocks or foundation for applied research. The basic research fields answer fundamental scientific questions involved in the development and application of new technology. This includes state-of-the-art research in soil science, botany, zoology, genetics, physiology, and general economics.

In applied economics, research efforts are focused on issues involved in economic decisions being faced by private individuals and public officials. The decision-makers of most direct concern are farmers and ranchers, bankers and other agricultural business people, and state and local government policy-makers. Examples of decisions faced by them are determining the advisability of investing in a particular farm machine, determining the most profitable approach for selling a particular farm commodity, and determining the magnitude of resources that could efficiently be invested in South Dakota's highway system.

The returns to investments in agricultural research

During the past 25 years, scholars have estimated the economic productivity of investments in agricultural research. Vernon Ruttan, in his book, **Agricultural Research Policy** published by the University of Minnesota Press in 1982, draws together the results of 36 such studies. In these studies, the returns to public research--in the forms of higher incomes to producers and lower cost food to consumers--on various crop and livestock commodities covering different time periods in both the U.S. and other countries were estimated. A total of 63 commodity-location-time period situations were studied.

In only three of the 63 situations were the annual internal rates of return to research investment less than 10 percent. In 25 situations, the returns ranged from 10 to 40 percent, and in 35 situations (more than one-half of the total situations studied) returns exceeded 40 percent. One study showed returns of more than \$18 per dollar invested in agricultural research in South Dakota.

These rates of return are "high" by almost any point of comparison. To interpret them, the familiar "law of di-

minishing returns" is used. A common application of the law involves the use of fertilizer. As more and more fertilizer is applied, yields continue to increase, but by successively smaller increments at each higher level of fertilizer used. A farmer is well-advised to continue adding fertilizer until the value of his added yield is driven down to the cost of the added fertilizer. To apply less fertilizer would be to forgo profit from potentially greater yields.

What are the implications, then, of an historical record that shows past investments in agricultural research to have yielded unusually high returns? One implication is to affirm the wisdom of those in the past who have decided to allocate funds to agricultural research. Further, the fact that the returns from added expenditures for research have been substantially greater than the added expenditures for the research, implies that higher levels of investment in agricultural research would be economically beneficial.

Why, in the face of this economic evidence, are pressures for greater investments in agricultural research relatively weak? Possible answers are an unawareness by the general public of the very substantial returns realized from investments in agricultural research, the negative psychological impacts of agricultural commodity surpluses and low farm prices, and the popularity of competing goals such as national defense. Another possibility concerns special circumstances surrounding the beneficiaries of agricultural research, a point to which we now turn.

Who benefits from agricultural research

Different people have different opinions about who benefits from publically-supported agricultural research. My own conclusion is that the largest weight of evidence supports the perspective advanced by Theodore W. Schultz, the 1979 Nobel Prize-Winner in Economics and a native of South Dakota, and the earlier mentioned Vernon Ruttan. In short, they believe that U. S. agriculture is competitive and that the main long-term beneficiaries of publically-supported agricultural research are food consumers.

Their reasoning is as follows. In general, the demand for food in a high-

income country like the U.S. is rather inelastic. Even if the price of food does go down, individuals like you and me will not increase our food purchases very much. Further, because of our relatively slow population growth rate, the demand for food in the U.S. is expanding very little over time. In a market characterized by inelastic demand and by slow growth in demand--such as this--most of the gains from technical change are ultimately passed on to consumers in the form of lower product prices.

The time-path of benefits from agricultural research associated with this reasoning is as follows. Technological advance resulting from agricultural research usually enables lower per-unit costs of production. Early-adopters of technical advances usually derive some economic benefit from their adoption of new techniques because of lower production costs. As time goes on, however, the competitive pressures of the market eat away at the extra profits of early adopters. Commodity prices drop, and the gains from the technical advance that initially belonged to producers are transferred to consumers. Thus, most of the longer-term benefits from agricultural research are realized in the form of cheaper market-baskets of food for the consumer. The money saved from lower-cost food is available for other types of purchases to increase people's standard of living.

Although the aggregate spill-over of research gains from producers to food consumers is very substantial, the amount of spill-over associated with the purchase of individual market-baskets of groceries is both small and unidentified as to source. Therefore, unless food prices are rising, individual consumers are not generally motivated to exert pressure for expanded investments in agricultural research.

A second type of spill-over involves the results of research funded in one state being used in other states. Ruttan shows evidence of between 30 and 50 percent of the total productivity change from agricultural research being realized outside the state in which the research was undertaken. As a result of this geographic spill-over, individual states do not have incentive to provide the level of support for research that would be justified if (1) all the benefits were returned in-state or (2) the

funding decisions were made at a regional or a national level.

What do these findings concerning the beneficiaries of research imply to South Dakotans? The farmers and ranchers of South Dakota have incentive, as producers, to support agricultural research for the extra profits that they can earn during the early stages of adopting technological advances. Further, by being able to adopt new technology, they can remain competitive with producers in other states and nations. The farmers and ranchers of South Dakota and all other citizens of the State--as consumers--have a responsibility to support the funding of agricultural research. Since the ultimate fruits of agricultural research are available to everyone free of any user-cost, the funds to support the research (as with any public good) have to be paid on public account. To the extent that there is a willingness to do so, the competitive position of U.S. agriculture in international markets and the possibilities for a continued rise in the living standards for Americans are both going to be aided.

Economics research at SDSU

The Economics Department is currently undertaking 11 research projects funded by the South Dakota Agricultural Experiment Station. These projects are designed to increase the profitability of farming and ranching in South Dakota, enhance rural employment opportunities, and aid decision-making about use of public financial and other resources. The research projects are distributed about evenly among the areas of (1) agricultural marketing, (2) farm and ranch management, and (3) energy and rural water resource development. One project also involves a study of state and local government finances. Some examples of the issues being studied in each of the three general areas are as follows.

The research in **agricultural marketing** involves studies to suggest possible strategies for producers to realize higher farm product prices and net income. Consideration is given to alternative marketing outlets such as terminal markets and direct on-farm sales, as well as futures contracts. Possible future grain handling systems to accommodate changes in grain handling

and transportation technologies, market flows, and transportation systems and the economic impact of highway investment decisions on agricultural and other groups of people in the State are also being studied.

The research in **farm and ranch management** is focused on managing (1) production costs and (2) the acquisition of capital resources such as farm machinery and land. It includes studies to determine the expected costs and returns from the adoption of new farm technology, e.g., reduced pressure center pivot irrigation machines and reduced tillage practices. Machinery systems that are economically suited to farms of various sizes and in different regions of the state are being examined. The economic feasibility of different types of farmers buying additional land in various parts of the state also is being studied.

The research in **energy and rural water resource development** involves three subtopics. In energy development, we are examining the economic feasibility

of producing fuel alcohol from grain and other crops. In the area of energy use and irrigation development, a main concern is determining the impacts of rising energy prices on (1) the relative economic advantage of reduced pressure versus traditional high pressure irrigation and (2) the profitability of energy-intensive irrigated production relative to the profitability of dryland production. In the area of rural water systems, the economic impact of water provided through the systems on the value of livestock produced is being studied.

Abstracts of recent publications available on request from the Economics Department are shown in the Appendix. If you would like copies of any of the publications, or have any suggestions of high priority topics for economic research, please let us know. Our current research budget is limited. Nevertheless, we are interested in ideas for future research projects so that, when resources permit, we can be prepared to move in directions judged to be of high priority by people in the State.

APPENDIX
RECENT PUBLICATIONS, SDSU ECONOMICS DEPARTMENT

Note: If you would like copies of any of these publications, please write (Econ. Dept., SDSU, Box 504A, Brookings, SD 57007) and let us know which ones.

AGRICULTURAL MARKETING

Achieving higher farm product prices and net income

1. **Profile with Potential**, by Larry L. Janssen and Kevin Weischedel. South Dakota Farm and Home Research, Vol. 33, No. 2, 1982, 5pp.
Provides a profile of a typical South Dakota hog producer, information on the market channels most commonly used in the State, and factors limiting the expansion of South Dakota's pork production operations.
2. **Alternative Marketing Strategies for Corn and Soybeans**, by Art Sogn, A. Clyde Vollmers, and Fred Baatz. Bulletin 677. Brookings: S.D. Agric. Exper. Sta., Oct. 1981, 23 pp.
Which marketing strategy for corn and soybeans generates the most revenue? Which is the most profitable? Which is least risky? Which is least costly? These are questions explored in this bulletin. The overall theme is that, through skillful marketing, farmers can exercise some control over the price they receive.
3. **Goose Marketing and Production, Characteristics and Problems of South Dakota's Goose Industry**, by Richard Shane and Leonard Benning. Bulletin 673. Brookings: S.D. Agric. Exper. Sta., Jan. 1981, 19pp.
Describes the structure of production and marketing in South Dakota's goose industry. Enterprise budgets and marketing alternatives are provided. Break-even prices for geese are discussed.

Improving transportation services

4. **The Restructuring of South Dakota's Railroad System, 1976-1981**, by Charles Lamberton. Bulletin 688. Brookings: SD Agric. Exper. Sta., Apr. 1983.
Describes the physical, financial, and operating restructuring of the State's rail system during a period when one-half of that system was being abandoned. The influence of deregulation and the role of federal, state, and local governments are also analyzed.
5. **Wentworth Cooperative Terminal, Inc. Feasibility Analysis**, by Charles Lamberton. Research Rep. 81-2. Brookings: Econ. Dept., SDSU, May 1981.
Analyzes the economic feasibility of operating a unit-train grain-loading facility at Wentworth, SD by four local cooperative associations.
6. **South Dakota Transportation Outlook for the 1980's**, by Charles Lamberton. Research Rep. 81-1. Brookings: Econ. Dept., SDSU, Apr. 1981.
Describes recent changes and future issues and problems facing rail, highway, and trucking sectors for South Dakota's grain shippers and citizens.
7. **Branchline Economic Feasibility Analyses: Vol.'s I-VI**, by Charles Lamberton and Rail Management Services, Inc., 1980
Evaluations of the economic feasibility of shortline rail operations on each of six line segments in South Dakota. Line segments studied are: Andover to Brampton, ND; Roscoe to Linton, ND; Blunt to Gettysburg; Napa to Platte; Trent to Elk Point; and Mitchell to Rapid City.

FARM AND RANCH MANAGEMENT

8. **A Budgeting Procedure for Use in Farm Planning**, by Herbert Allen. Econ. Pamph. ECO05 Brookings: Econ. Dept., SDSU, Oct. 1982.
This is a short-form procedure for estimating costs and returns in whole farm planning.
9. **The Economics of Irrigated Crop Production in Eastern South Dakota**, by Donald C. Taylor and Richard C. Shane. Research Rep. 82-3. Brookings: Econ. Dept., SDSU, Aug. 1982, 76pp.
Describes the amount of energy involved in the production of various dryland and irrigated crops, and the impacts of rising energy prices on the relative economics of producing different crops and of producing crops under energy-intensive irrigated conditions versus dryland conditions.
10. **An Approach to the Grazing Fee Problem on Indian Land**, by Richard Shane, and others. J. of Farm Mgmt. and Rur. Appraisers, 1982.
Describes a method for determining the grazing fee on land owned by Indian tribes in South Dakota which is leased to ranchers for grazing.
11. **Crop Budgets for Irrigated Agriculture in Central-East Central South Dakota**, by Richard Shane. Research Rep. 82-2. Brookings: Econ. Dept., SDSU, 1982.
Provides average cost of production information for the major irrigated crops in Central-East Central South Dakota for 1982. Space is provided for farmers to make individual changes to meet their specific conditions and to update the costs for succeeding years.
12. **Expected Production Costs for Major Crops for Six Production Areas in South Dakota**, by Wallace Aanderud and Herbert Allen. EMC 864. Brookings: SD Coop. Ext. Ser., 1982, 8 pp.
Shows expected costs and returns for 1983 for alfalfa hay, barley, corn, durum wheat, flax, oats, rye, sorghum, soybeans, spring wheat, and sunflowers for six production regions in eastern South Dakota.
13. **South Dakota Grain Production: Yesterday and Tomorrow**, by Charles Lamberton and J. Michael Alley. Bulletin 676. Brookings: SD Agric. Exp. Sta., Apr. 1981, 25 pp.
Summarizes the production of each of 11 commodities in South Dakota counties and crop reporting districts. Based upon 15 years of production history with production forecasts to 1985.

ENERGY AND RURAL WATER RESOURCE DEVELOPMENT

Energy Development

14. **A Small-Scale Plant: Costs of Making Fuel Alcohol**, by Randy Hoffman and Thomas L. Tobbs. Bulletin 686. Brookings: SD Agric. Exper. Sta., Sept. 1982, 39pp.
Contains estimates of costs for producing 185-proof alcohol, from corn, in small or community-scale fuel alcohol plants. The report is designed for use by farmers and other potential investors in and financiers of fuel alcohol plants.
15. **Framework for Examining the Economic Feasibility of Small-Scale Alcohol Plants**, by Thomas C. Dobbs, Randy Hoffman, and Ardelle Lundeen. Staff Paper 81-3. Brookings: Econ. Dept., SDSU, Aug. 1981, 34pp.
Outlines an approach for determining whether small-scale alcohol plants are feasible in various situations. Cost considerations, as well as fuel and feed by-product marketing considerations, are addressed.

Energy use and irrigation development

16. **The Economics of Irrigated Crop Production in Eastern South Dakota**, by Donald C. Taylor and Richard C. Shane. Research Rep. 82-3. Brookings: Econ Dept., SDSU, Aug. 1982, 76pp.
For abstract, see No. 9 above.
17. **Irrigation Development, Its Potential Impact on South Dakota's Economy**, by Richard Shane and Ralph Brown. Research Rep. 82-1. Brookings: Econ. Dept., SDSU, 1981.
Reports estimates of the economic impacts--directly to farmers and indirectly throughout the South Dakota economy--from several different possible paths of irrigation development in the State.

Rural water systems

18. **Household Impacts of Rural Water Systems: A Case Study**, by Larry Janssen and Ardelle Lundeen. Bulletin 682. Brookings: SD Agric. Exp. Sta., May 1982, 34pp.
Presents impacts of rural water system development on households located in the Brookings-Deuel Rural Water System service territory. Rural water system development was not a major factor in location and housing-related decisions and public service choices of member households.
19. **Operational Characteristics of Rural Water Systems in Five North Central States**, by Paul Gessaman and Terese Janovec. Ames: No. Cen. Reg. Cen. for Rur. Dev., Iowa State Univ., Jan. 1982, 79pp.
Contains descriptive data on rural water systems constructed during 1970-77 in Nebraska, Iowa, Missouri, North Dakota, and South Dakota. An analysis of the operational experience of a selected sample of rural water systems in each state is reported.
20. **Public Impacts of Rural Water Systems: A Case Study**, by Ardelle Lundeen and Larry Janssen. Bulletin 675. Brookings: SD Agric. Exp. Sta., 1980, 19pp.
Presents the effects of a rural water system on public sector expenditures and revenues in the area served by the Brookings-Deuel Rural Water System.

Other "energy and rural water resource development"

21. **Scenic and Recreational River Designation: What Happened to the James?** by Peter Manley and Philip Favero. Bulletin 689. Brookings: SD Agric. Exp. Sta., Mar. 1983, 17pp.
Contains an analysis of South Dakota's process for protecting wild, scenic, and recreational rivers. A case analysis of the attempt to designate the Upper James River as a state scenic and recreational area is used to illustrate the strengths and weaknesses of South Dakota's process for river designation and to determine possible changes that might be made in the investigation process.
22. **Water Use by Rural Manufacturing Firms in South Dakota**, by Randy Hoffman and Thomas L. Dobbs. Bulletin 678. Brookings: SD Agric. Exp. Sta., Nov. 1981, 27pp.
An aid to water planning and industrial development at the local, regional, and State levels in South Dakota. Contains estimates of water requirements for 11 different categories of manufacturing-processing firms. Information on the "per firm" and "per employee" water requirements and the costs of extending municipal water supply facilities to new industrial firms is also presented.

OTHER

23. **The Changing Structure of South Dakota Agriculture**, by Larry Janssen and Mark Edelman. Research Rep. 83-2. Brookings: Econ. Dept., SDSU, Jan. 1983, 90pp.
Examines trends during the past 25 years in South Dakota in farm numbers, farm size, land ownership and tenure, gross farm sales, livestock enterprise specialization and concentration, farm finances, farm and off-farm income. Implications of the trends for family farms, young farmers, rural communities and agricultural policies are presented.
24. **South Dakota Tax Facts for Financing State and Local Government**, by Mark Edelman, EC 746. Brookings: SD Coop. Ext. Ser., Oct. 82.
Presents data showing changes over time in the tax structure used to finance state and local government in South Dakota. Some comparative data in surrounding states are also presented.
25. **Rural Manufacturing Development...What Influences It? A Study of South Dakota in the 1970's**, by Wayne Goeken and Thomas L. Dobbs. Bulletin 683. Brookings: SD Agric. Exp. Sta., May 1982, 31pp.
Presents factors determining success in promoting manufacturing and processing development in South Dakota during the 1970's. Factors which are subject to influence by local development groups are highlighted.

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