

# Responding to the Technological Challenges of Small-Scale Agriculture

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Eighteenth in a series of  
perspectives on employing  
technology to solve the  
pressing problems of society.

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The 1970s may be remembered as the decade when mounting evidence made it impossible to ignore potential disasters in the areas of energy, food, natural resources, education and other concerns of worldwide dimension.

The 1980s could be the decade that will be remembered as the time when appropriate tools were resolutely put to work to solve those serious problems.

Technology is one word for those tools. In this series of papers, William C. Norris, chairman of Control Data, reflects on how to find, develop and apply technology and its many uses in our society.

This address was first given on November 17, 1981 in Beltsville, Maryland at the Special Symposium on Research for Small Farms. The symposium was sponsored by the Beltsville Agricultural Research Center, USDA.

# Responding to the Technological Challenges of Small-Scale Agriculture

A key element in the improvement of small-scale farming is broad-based cooperation. Therefore, my remarks will primarily focus on what is being done by Control Data—in cooperation with many other organizations—to improve small scale farming. I hasten to repeat that broad-based cooperation is essential, indeed mandatory, to achieve that objective, because the resources required are far beyond those of a single organization or government alone.

I will first describe the underlying rationale of the cooperative program and then review implementation, which essentially has two main parts, one under the aegis of Control Data and the other carried on by a consortium called Rural Venture, Inc.

## RATIONALE

The rationale is simply that with proper selection and application of existing and emerging technologies, and with adequate ongoing R&D, small farms and small scale food processing operations can reduce the cost of food, make a significant contribution to food production, do it in more environmentally protective ways, and provide a decent living for the operators. These objectives cannot be accomplished overnight, but there is enough existing technology to get meaningful results in a few years and, with adequate and continuing support, reach significance on a national scale in ten to fifteen years.

Further that Control Data can help achieve these objectives in a number of ways: first, by catalyzing more research and development applicable to small scale agriculture; second, by assembling existing and emerging technologies in a readily accessible computer data base; and, third, by offering high quality, easily available and affordable education and training to small-scale farmers in planning, management and the application of new technologies. In the process, Control Data will eventually earn a reasonable profit from investments in these and related efforts.

At this point, I should mention that I use the words “technology,” “how-to” and “knowledge” interchangeably. I believe “how to” communicates best, but it is at times a bit awkward to use.

## SUPPORTING EVIDENCE

The perception that small-scale farming has great potential is not the prevailing view. Most experts agree that social benefits would be derived by improving the lot of the small farmer, but few believe

smaller farm units would produce attractive economic benefits or become significant contributors to the food chain.

Although not yet widely perceived, there is a growing body of evidence that the so-called experts are wrong; and better solutions to many of the basic problems plaguing the nation's food chain *can* be realized by means of the small family farm rather than through large, capital-intensive, fossil fuel-based operations.

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Too often, the efficiencies of large-scale, fossil-fuel, capital-intensive agriculture have been accomplished without adequate regard to the loss of jobs, damage to the environment, the effect on human health, and other factors, including the depletion of future production capacity by utilizing practices equivalent to mining the soil. Practically, then, the “efficiencies” have been achieved at added cost to society, and are really subsidies to big agribusiness. Often, the government and universities have been the vehicles providing such subsidies to large scale agriculture. One good example is the channelling of most government agriculture R&D funds into programs which benefit large but not small-scale production. There is no broad indictment implied of the community of large farmers; rather, the emphasis is on the need for constructive changes in large-scale practices and on the importance of the smaller operation.

The USDA this summer released a report entitled *Economies of Size in U.S. Field Crop Farming*, which concludes that “Farms reach efficiency at small or modest sizes” . . . and that “Many commercial farms now exceed the size necessary to achieve all available cost efficiencies.” The study further states that “Since medium-size commercial farms with gross incomes from \$41,000 to \$76,000 achieve most technical cost efficiencies, society benefits little in terms of lower real food costs from further increases in farm size.”

Again, the main theme of our rationale is that available technology, if properly packaged and disseminated, and future research, if vigorously and intelligently pursued, will lead to profitable and viable small family farm operations without benefit of subsidies. The very existence of substantial numbers of currently available appropriate technologies holds the promise of many more being developed.

Further evidence can be found in past experience, current practices, experiments, and emerging technologies relevant to small-scale operations. One of the most significant has been the development of small farm models which have demonstrated substantial production gains by integration of limited acreage high-value crops and small-scale animal agriculture, notably sheep and hogs. Corresponding models are in the process of being developed for dairy goats and beef cattle. I will provide additional information about the sheep model later.

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“...only about 25 percent of U.S. farmland is managed with appropriate soil practices”

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Additional and alarming evidence is found in the area of soil conservation. After more than 40 years of a national soil conservation program, only about 25% of U.S. farmland is managed with appropriate soil erosion practices. However, with intercropping and minimum tillage practices – which are most feasible in small-scale operations – our increasingly dangerous problem of soil run-off can be substantially lessened (estimated reductions of 50 percent by the year 2000) and total yield increased. In addition to reducing erosion, selected intercropping of from two to eight plant varieties has increased some small farm incomes in the Eastern U.S. by 50 percent.

I should also note at this point that the benefits of more intensive agriculture are clearly visible in countries like Denmark, the Netherlands, Korea and Japan – all of which have a preponderance of small farms – where higher yields per acre are being obtained for many crops.

Other evidence testifying to the viability of small-scale agriculture can be found in solar technologies, irrigation methods, wind generation, small-scale machinery and controlled environment crop growing.

A number of solar technologies, either in-hand or emerging, make small-scale grain drying and storage more efficient than present fossil fuel-intensive methods. Other solar applications are providing sources of power for irrigation and adequate heating for animal buildings, even in Northern climates.

By the mid-1980s, the nation will face a major water crisis. Water tables are declining rapidly in many areas, drying wells and dramatically raising the cost of pumping water. In this context, it is encourag-

ing to learn that tests of a small-scale sprinkler irrigation system currently nearing completion indicate a 15 percent savings in energy and as much as a 20 percent savings in water.

Wind generators in the range of 10-25 kw are also under development, will soon be cost-effective, and represent a significant step toward farm energy self-sufficiency.

Machinery for small-scale farming is becoming more readily available. Included in this category are tractors, tillage implements, harvesters and more efficient human-propelled tools.

And, not to be overlooked, small-scale controlled environment agriculture is becoming viable. By controlling the principal environmental factors which effect plant life – such as light, heat, atmosphere, nutrients, and so on – much higher production can be obtained per unit of space.

Perhaps the most convincing evidence, however, is what I saw more than fifty years ago as a boy growing up on a farm in Nebraska. At that time, most of the farms were around 160 acres in size and raised both crops and livestock. Each farm had a high degree of self-sufficiency because organic fertilizers and horsepower were used. The net result was that farmers and nearby small towns prospered. But the degree of self-sufficiency decreased dramatically with the introduction of fossil-fuel, capital-intensive and less integrated methods. Profitability declined along with the self-sufficiency because a substantial part of the proceeds was shared with agribusiness. That, of course, triggered consolidation into larger farms which set off an exodus of people from the land and struck the death knell for many small towns in rural America. I need not go on with the litany of woe. It is well known.

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“...sufficient ‘know-how’ is available to significantly enhance the productivity of small family farms and small-scale food processors”

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Many more small-scale technologies, currently available or under development, could be mentioned. Suffice to say, the examples reviewed demonstrate the point that sufficient “know-how” is available to significantly enhance the productivity of small family farms and small-scale food processors. With further focused R&D, increased viability over a wider range of conditions can be even more firmly established.

## IMPLEMENTATION METHODS

That completes the description of the rationale. Control Data's methods and tools to assist in implementing the approach include: the assembly of a computer data base of appropriate technologies; preparation of the necessary education and training materials; catalyzation of further research and development relative to small-scale technologies; establishment of agriculture and business service centers to distribute technology, education and training and other services to people operating small farms and related small businesses; and, of course, participation in Rural Venture.

*Computer Data Base:* The computer data base, which we call AGTECH, includes practical, how-to information about crop and livestock production; alternate energy sources such as wind, solar and biomass; methods for achieving more efficient use of water in irrigation; and so on. Technologies have been obtained from many sources, the most significant from Brigham Young University, which for many years has been an ardent developer and practitioner of small plot agriculture.

*Education And Training:* Education and training required to efficiently teach farmers how to use the technologies is primarily accomplished through the use of the PLATO computer-based education system. It is a part of Control Data's largest program which is addressing the worldwide need for better, more available and less costly education. The only practical way to make significant progress in addressing this massive and urgent need is through the use of technology such as television, audio/video tapes, and telephone and satellite transmission coordinated in a network learning system with computer-based education.

For 19 years Control Data has been engaged in developing such a system, called PLATO computer-based education. The effort included scores of cooperative projects with the government, universities, large companies, small organizations and individuals. PLATO lessons are stored in a computer and are accessed through television-like terminals operated by students at their own pace by using typewriter-like keyboards and touching the terminal screen. Lesson information is displayed in the form of numbers, text, drawings and animated graphics. There is continuous interaction — a give and take — on a personal, one-to-one basis, supplemented with video recordings and texts, thereby creating an effective learning experience which cannot be practically achieved by any other method on a broad basis.

As a result of this substantial effort, a wide range of high quality PLATO instruction is available, including courses for business, industry and agriculture; academic and vocational courses for high school and college students, and both remedial and continuing education courses for out-of-school adults. Especially important to the advance-

ment of small-scale agriculture are the basic skills and high school skills curricula, because many persons living in poverty-stricken rural areas, especially in developing countries, are functionally illiterate.

*Basic Skills:* Control Data has been co-developing the basic skills curriculum for many years. These lessons help those who are educationally disadvantaged to advance from third-grade to eighth-grade equivalency in reading, language and math. And this advancement can take place in much less time than that required for traditional teaching methods. Lesson materials for 0-3 grades are currently being designed.

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Impressive results are being obtained. For example, in the city of Baltimore, 24 functionally illiterate adults advanced almost one full grade level in reading after only 22 hours of instruction — 20 of them on PLATO. Another group of 200 high school students in the state of Florida advanced an average of one grade level after only 14 hours of computer terminal time — and these were failing students threatened with the prospect of not graduating because of the state’s minimum competency requirements.

*High School Skills:* The PLATO-based high school skills curriculum is called the general education learning system, which consists of courses in reading, mathematics, writing, science and social studies. The five subjects correspond to the five years of the GED examination, the main criterion of adequate skill levels in this country.

Finally, with respect to PLATO, it is important to emphasize that the computer is critical if small-scale agriculture is to succeed in reaching its goals. Without the computer, the needed technologies could not be efficiently assembled and distributed — and providing the required education and training would be too costly.

*Research and Development:* To help catalyze needed research and development, Control Data for a number of years has been making significant grants to universities and research institutes to help support cooperative development of small-scale technologies. In addition — acting on the belief that demonstrating success would encourage research and development by others — Control Data has provided direct assistance in the incorporation of small-scale technologies in farm projects. The technologies used in these efforts are, of course, listed in the AGTECH Computer Base.



In addition to the R&D grants to universities and research institutes, Control Data is investing in the development of small-scale controlled environment agriculture and small-scale food processing – and in small companies developing products needed by small farmers. Let me briefly review the nature of the controlled environment research and then describe just one of the products being developed by a small company.

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“The development of controlled environment agriculture has important implications for virtually all parts of the world...”

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*Controlled Environment Agriculture:* The development of controlled environment agriculture has important implications for virtually all parts of the world, and Control Data is making a major investment to develop different types of small-scale technologies that are highly efficient; provide faster growth, higher yields, and higher quality; and are suitable for use in different geographic locations. The technology is being franchised for operation by others.

One type of controlled environment agriculture utilizes waste heat from many different sources. Both natural and artificial lighting are used, and a small computer controls temperature, carbon dioxide and so on. Another type, which we call Multiponics, is totally enclosed and utilizes only artificial light. Operation of the first small business franchise will commence early in 1982.

*Wind Power:* The product to be mentioned is a 10 kw wind generator developed and marketed by the Jacobs Electric Co. This is a highly reliable unit which can be used anywhere in the world. Fifteen and 25 kw models are under development.

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“In addition to providing access to the agricultural data base and delivering the PLATO courses, the centers also provide assistance in preparation of farm business plans and help in analyzing actual financial and production results”

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*Ag Centers:* The next part of the implementation strategy to describe is what we call Agriculture and Business Services Centers. In addition to providing access to the agricultural data base and delivering the PLATO courses, the centers also provide assistance in preparation of farm business plans and help in analyzing actual financial and production results. For persons in small business, a wide range of high quality courses are also available: How to Establish and Manage a Small Business, Accounting, Selling, Purchasing, Government Regulations and many other subjects important to successfully operating a small business. A number of courses have been tailored to the needs of women entrepreneurs.

An expanded version of the agriculture and business services center enables small businesses to physically occupy office, laboratory and manufacturing space at the center and to share other facilities and services such as a library, model shop, drafting, accounting, purchasing and computer services. Economies of scale make it possible to provide occupants of the center with needed facilities and services of much higher quality for considerably lower cost than any of them would be capable of acquiring alone. Benefits are also obtained from the enhanced environment for peer interchange.

Every rural community needs an ag center of some type. Within the next 18 months or so, as the agriculture technology data base grows and more PLATO courses are completed, ag centers operated under license agreements will become attractive small business opportunities. The smallest version can be started with an initial investment of less than \$15,000, which is sufficient for the purchase of a small computer, selected education and training course materials, and access to the agriculture technology data base via telephone.

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“Control Data has joined with other organizations to form Rural Venture, Inc.”

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#### RURAL VENTURE

In order to greatly expand the scale and range of small-scale agricultural activities addressed, Control Data has joined with other organizations to form Rural Venture, Inc. The participants in this for-profit consortium include corporations, farm cooperatives, a foundation, church organizations and individuals. A complete listing of the stockholders appears below:

## RURAL VENTURE SHAREHOLDERS

### *Corporations*

Concord Inc.  
Control Data Corporation  
Hubbard Milling Co.  
Super Valu

### *Agricultural Cooperatives*

CENEX  
Land O' Lakes

### *Foundations*

Delta Foundation

### *Religious Groups*

Archdiocese of Saint Paul  
and Minneapolis

Diocese of Crookston, Inc.

Diocese of New Ulm  
Diocese of St. Cloud  
Diocese of Winona

### *Health Service Organizations*

Health Central

### *Individuals*

Elmer L. Andersen  
Mr. & Mrs. Bayard Coggeshall  
T. J. Coolidge, Jr.  
Irene H. Whitney

### *Other Organizations*

Institute of Cultural Affairs

Rural Venture engages in rural development. Its main thrust is to increase the productivity and profitability of small farms; to assist in the start-up and profitable growth of small business in rural communities; to help achieve significant advances in education and training, health care, housing, and communications; and, in the process, to create jobs and vastly improve the economic base of depressed rural areas.

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"The Agriculture Technology Data Base has been growing rapidly... there are now some 11,000 listings."

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## PROGRESS

Next, I will review the progress being made in building the ag technology base and in Rural Venture's business. The agriculture technology data base has been growing rapidly and there are now some 11,000 listings. Many are organized by farm enterprise. As an example, one listing describes technology for sheep production and management — a corresponding practical and intensive PLATO course teaches its applications. The course, entitled "Sheep Production and Management," was developed cooperatively by the Winrock International Livestock Research and Training Center, The Rockefeller Brothers Fund, The Pipestone Minnesota area Vocational Technical Institute, and Control Data. It provides the basic knowledge required to efficiently run a sheep operation.

We have had many favorable reports about the effectiveness of the

sheep production and management course. For example, I recently received a letter from a freelance writer who had just completed the course. She wrote: "I am tremendously impressed by the course as a whole. An enormous amount of information has been packaged in an easily digestible and absorbable form. I have enjoyed myself very much – and learned a great deal. However, I have a suggestion to offer. The lead sentence in Module 3 – Pre-Lambing Management – needs to be changed. The sentence reads, 'Once you and your sheep have successfully completed the breeding season, your ewes should all be pregnant.' To avoid the laughter and the tired farmer/sheep jokes, the words 'you and' should be deleted."

Another entry in the data base similar to the sheep production reference describes swine production. Within the next ten months, goat and dairy production will be completed, with cattle to follow about a year later.

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Education and training courses on many subjects are available, and more are in process of preparation. A partial listing is shown on the slide.

*Pine City:* Rural Venture is also making excellent progress. The first project managed by that organization is headquartered at Pine City, Minnesota. The project, financed by Control Data, started in the spring of 1979 with an objective of assisting a group of 18 small farmers. Today it is part of a larger six-county Rural Venture project in east-central Minnesota.

Participants came to the Pine City program with farming experience ranging from none to ten years; many of them had failed to achieve more than limited success before the program started.

The farms involved vary between five and 140 acres in size; the land is marginal and is located in an area considered by the government to be economically depressed. In addition to helping prepare farm business plans and consulting on the operation of the farms, Rural Venture is also drawing upon Control Data training services tailored to the needs of each individual.

At the beginning of the program, all participants were part-time farmers. By the spring of 1980, several had progressed enough to quit their off-farm jobs and support themselves as full-time farmers.

*Princeton:* A second Control Data financed project in Princeton, Minnesota, involves a group of 15 beginning farmers. It began in 1980 and is now also part of Rural Venture's area-wide program in Minnesota.

The main objective in Princeton is to establish successful operations which can be widely replicated. The farms are 80 to 140 acres in size and the land somewhat better than in the Pine City project. Also, unlike the Pine City participants, most of the Princeton farmers are new to the land.

Construction of solar-tempered, earth-sheltered homes and a variety of farm buildings is well underway. About a third are completed, and the first crop and livestock operations were launched last spring. Rural Venture managers are living in the Princeton area and working with the farmers in every phase of the program.

*Alaska:* Two other Rural Venture projects are located in Northwest Alaska near the villages of Ambler and Selawik. Both within the Arctic Circle. Ambler has 200 inhabitants; Selawik 600.

The objective of the Ambler project, which started three years ago, is to establish an integrated small farm operation combining vegetable and small grain growing with livestock production. Thirty-five acres of tundra have been cleared thus far. Wheat, barley and a variety of vegetables — including cabbage and potatoes — have been successfully grown this year. The farm is operated by an enterprising Eskimo and his wife.

The objective of the project at Selawik is similar to the one at Ambler. The farm is presently operated by the village as a community effort, but will eventually be divided among a number of individuals.

*New England:* The focus of another Rural Venture contract, with the New England Regional Development Commission, is improved and expanded sheep production in a six-state area. The application of the latest technologies in sheep production will improve net income for both small farmers and related businesses. During the first year of the program, 25 farmers along the Connecticut River Valley are participating. Plans are being formulated to increase that number to 60.

*Virginia:* Recently, Rural Venture also completed a nine-month contract with the Virginia State Private Industry Council to develop a plan by which private jobs would be created in a ten county area during the next five years. The three primary components are agricultural development, small business development, and employment preparation training. The major emphasis is on agriculture; specifically, diversified

small-scale operations. The objective is to provide services to several hundred small-scale farmers over five years, such that they can derive a decent income from full-time farming.

*Jamaica:* The last Rural Venture project I will mention is being established in Jamaica. With the election of a new government in October of 1980, there has been a turning away from the socialism of the previous regime to an emphasis on private enterprise for meeting the country's needs. The new Prime Minister, Edward Seaga, was the first foreign Chief of State to visit President Reagan. One outcome of the meeting was the establishment of the U.S. business committee on Jamaica to help improve economic performance, which had seriously deteriorated under the previous government. For example, the unemployment rate exceeded 30 percent.

There is a consensus within the committee and in Jamaica that agriculture is a primary area for aggressive development. A plan is being prepared to assist in the achievement of this goal – and the plan is reckoning with the large numbers of small and medium scale farms in Jamaica – some 150,000. While the plan is not yet complete, it is evident that there is a consensus for proceeding with a project to vastly improve small-scale agriculture. A Rural Venture consortium is being formed in Jamaica which will work with Rural Venture here in the U.S. in applying small-scale farm technology to Jamaica's needs. Such broad-based cooperation among Jamaica and U.S. organizations is both a powerful and equitable approach.

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#### ECONOMIC AND HUMAN IMPLICATIONS

Even though achievements in advancing small-scale farming by Control Data, Rural Venture and other organizations to date are modest compared to what *can* be done, they do demonstrate clearly the great potential of small-scale operations. However, progress *must* be accelerated in order to meet a number of major and pressing economic and social needs in a more timely manner – both here and overseas, especially in developing countries. Let me spend a few minutes reviewing some of those needs and the relevance of small-scale agriculture. First by looking broadly at some of the realities of U.S. agriculture, then considering rural poverty. After that, I will focus on developing countries.

*U.S. Agriculture:* Large-scale U.S. agriculture is often extolled by such statistics as:

- During 1980, one farm worker produced enough food for himself and some 60 other people.
- During the seventies, one-third of total agriculture production was exported. This ratio of export to production has never been achieved by any other country.

Indeed, these statistics touting the productivity of American agriculture are impressive, but they are only part of the current picture. A broader look shows:

- U.S. agriculture has anemic profitability, even though propped up by government subsidies.
- Yields of major food crops have plateaued.
- As noted earlier, yield per acre is higher in many countries where small farms are preponderant.
- And, as previously mentioned, the adverse consequences of large-scale, fossil-fuel, capital-intensive agriculture with respect to jobs, damage to the environment, human health and other aspects are rarely factored in.

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Leaving aside the matters of profitability and adverse effects for the moment, it is apparent that growth in agricultural production to meet rising world food demand and to help correct massive U.S. foreign trade deficits will require increased levels of crop yields and/or increased amounts of land, energy and water. With the prevailing system of agriculture, neither is likely to happen, at least not during the next ten to 15 years.

To begin with, expansion in our land resources will not occur to any great extent because of a number of factors. One is urban sprawl, which removes from cultivation one to two million acres per year. And as noted, soil erosion is steadily decreasing the productivity of some of even the best farmland. Utilizing presently uncultivated marginal

land has potential, but it can't be fully realized by large-scale fossil-fuel intensive methods. The greatest potential for improving productivity of marginal land by small-scale agriculture is in the large, arid regions of the Western United States, the uncultivated land of Alaska, and the under-utilized acreages on Indian reservations.

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"... it takes at least ten years for a new agricultural technology to move from the research laboratory to the farm"

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Water is another limited resource. The United States has a finite amount of ground water -- in a number of important agricultural areas, it has either been depleted or will be within the next ten years at present rates of consumption. As for energy, its availability and rising cost have also become limiting factors.

With further research, crop yields will no doubt be increased through genetic improvements, greater photosynthetic efficiency, enhancement of nitrogen fixing capabilities and other methods. But the promise of these emerging technologies must be viewed with the reality that it takes at least ten years for a new agricultural technology to move from the research laboratory to the farm.

Considering resource limitations, the time required to get new agricultural technology from the research stage into the field, the need for increased profitability, the adverse effects too often present with large-scale agriculture, and on the positive side the know-how presently available to significantly enhance the productivity of small family farms, the answer has to be a vast increase in small-scale agriculture.

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"Forty percent of our nation's poor live in rural communities..."

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*Rural Poverty:* Expansion of small-scale agriculture is also needed to better address rural poverty in the United States. Forty percent of our nation's poor live in rural communities, more than a fourth of them in inadequate housing. Health care facilities are also often inadequate, especially in isolated areas. Some of the poorest are found on Indian reservations.



Unemployment is a virtually intractable problem in many rural areas because of little or no industry and scarcity of capital, technical and management resources. Expanding and increasing the efficiency of small-scale agriculture can provide the means for creating new jobs both on the farm and off. Recent studies show that for every job created on the farm, two more will be generated in nearby small towns.

Indian reservations can greatly enhance employment and economic advancement for tribal members with small-scale agriculture. In fact, Rural Venture is in the initial stage of developing small-scale agriculture programs with a number of tribes.

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“There are more than one billion small farmers in the developing world, yet per capita food production is declining in all developing regions except in Asia”

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*Developing Countries:* The most urgent need for more efficient small scale agriculture, however, is in developing countries. There are more than one billion small farmers in the developing world, yet per capita food production is declining in all developing regions except in Asia. Without great improvement in small-scale agriculture, there is little hope for significant economic progress, because the initial progress achieved with the large-scale “green revolution” agriculture of the last half century has slowed sharply in recent years.

The Rural Venture project in Jamaica described earlier will be a stepping stone for a broader-based effort in other developing countries. While further research and development with respect to small-scale technology is needed, substantial production gains can be made in developing countries by improving the process for teaching the use of existing technologies. This can be accomplished effectively and economically with computer-based education. Success in Jamaica will accelerate adoption by other countries.

#### NATIONAL PROGRAM

In order to accelerate the advancement of small-scale food production in the U.S., a national program is needed – based on new legislation and policy changes. It isn't practical to enumerate all of the elements in such a program, so I will only mention a few of the most important.

*Policy:* One critical change in policy would be some redirection of federal and state research funding to increase efforts devoted to small-scale technology development, particularly with respect to integrated small-scale production and energy generation. At the present time, the

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“...a national program is needed – based on new legislation and policy changes”

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amount of support for small-scale agricultural research is a very small percentage of the total funding for agricultural research. For example, the last report I saw shows that research at U.S.D.A. aimed specifically at small farms represented less than half of one percent of the total for agriculture-related research. The percentage is somewhat better at state agricultural experiment stations, but still inadequate. Fortunately, substantially more research directly applicable to small-scale farming is being performed overseas.

*Legislation:* Part of the new legislation needed to improve the environment for small-scale farming also applies to small business. Since I have written and spoken extensively about new legislative initiatives for small business, I won't repeat them at this time. I will only review those pertaining to small farms, which include the following:

1. Increased availability of low cost loan financing for small farms.
2. Tax incentives for owners to sell land to small farmers.
3. Tax credits for investments in agricultural business and technology centers which provide education, training, and technology to small farmers.
4. Establishment of rural enterprise zones for a twelve year period. The legislation would provide tax incentives and other means to stimulate investment and provide support to help assure successful startup and profitable growth of small farms and small rural-based businesses. Two rural enterprise zone bills are pending in Congress; however, they are too narrowly focused. With an enlarged scope, the rural enterprise zone concept could be very effective.

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“...the costs of such legislative initiatives would prove to be a good investment for taxpayers because they would facilitate job creation”

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It is my belief that the costs of such legislation initiatives would prove to be a good investment for taxpayers because they would facilitate job creation. Although limited in extent, experience thus far indicates that the one time cost in government funding per job created by the Rural Venture type of projects mentioned earlier will probably average

around \$15,000. However, studies show that the average value of a new job to our nation is around \$52,000 *each year*. Considering that a job in the private sector will exist for ten years or more, there is an enormous return from the one time investment.

A national program stimulating the creation of jobs in rural areas through the expansion of smaller scale agriculture which is more productive, environmentally protective and resource conserving is very much in consonance with President Reagan's policies. If the private sector will take the initiative, it is the type of program I believe the administration and state government will support. I have attended meetings with the President to review private sector initiatives, so I am speaking from first-hand experience.

### CONCLUSION

On that note, I will start to conclude. Instead of summarizing what I have been saying, I will further emphasize the benefits of vastly increasing private initiatives to advance small-scale farming.

Uppermost in my mind here at home is the need to provide enough career opportunities for our youth, especially those who are disadvantaged. A small farm can provide an attractive option. We know from experience that there are large numbers of young people who would be elated if such an opportunity were available.

At the other end of the spectrum are families on larger farms who are unable to make enough income to continue indefinitely. Unless a more attractive alternative model is available, they are not going to stay in farming. The small-scale model offers an alternative.

In other words, considering demand and progress in establishing feasibility, a huge domestic market is developing for small farm technologies. The Department of Agriculture, the Agricultural Extension Service and universities will be unable to adequately respond to it because of traditional constraints and shrinking budgets. Those in the private sector who are far sighted will develop, assemble and deliver the technologies and reap attractive profits.

A key element in the process is the ag center described earlier. Next year ten individuals in various parts of the country will be participating with Control Data in the opening of small centers. They will be selected on the basis of a deep personal commitment and willingness to innovate.

After a year of experience in working with these individuals to refine support procedures, the number will be increased to one hundred in 1983. Thereafter, an expansion to some 10,000 centers will occur in about five years.

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"...the seriousness of the situation we face calls for goals we must stretch to meet..."

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Some may consider that to be an overly optimistic goal. However, the seriousness of the situation we face calls for goals we must *stretch* to meet in order to assure maximum progress. America has been the breadbasket of last resort for the world for more than a century. America has provided its citizens with a stable, plentiful and nutritious food supply unparalleled in history. We must take every possible creative step to preserve that legacy.

At the same time, there is the far larger and more critical problem of improving the efficiency of small-scale agriculture in developing countries that must be addressed.

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"...responding to the technological challenges of small-scale agriculture...is vital to the preservation of our American heritage..."

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From my own personal experience on the land – and after fifty years of experience embracing a broad range of technology – I am totally convinced that responding to the technological challenges of small scale agriculture I have outlined here is vital to the preservation of our American heritage and to meet the awesome task of greatly improving agricultural production in the developing world.