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## AGRICULTURAL ECONOMICS RESEARCH AND EXTENSION NEEDS OF SMALL-SCALE, LIMITED-RESOURCE FARMERS

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A traditional approach to defining problems or needs is to compare a situation (what is) with objectives or valuations (what ought to be). A more elaborate version of this approach introduces some dynamics into the scheme by projecting current trends to determine how the expected situation some time in the future compares with what we would like the situation to be. One difficulty in such an approach is deciding what dimensions of the situation are important.

In considering the problems of small farms, do we primarily examine income and the measures of wellbeing — or emphasize the structure of agriculture and its implications for our society? Must we consider the extent to which concern for conservation of soil and energy resources is related to size of farms? Should we complicate the picture even more, as is often argued, by including the non-market-goods dimensions [18]? Some researchers would merely use a change in the number of small farms as indicative of a problem, but this is only symptomatic of more basic factors at work.

Though the title of this article might suggest that research and extension needs are obvious, understanding of such needs is not taken for granted. First, changes in the economy which impinge on small farms are examined. Second, an attempt is made to document the present situation with respect to research and extension efforts. Finally categories of knowledge gaps with respect to small farms are suggested.

### THE SMALL FARM SITUATION

Despite much effort, attempts to define "small farm" have led primarily to frustration. A farm obviously can be small in terms of sales, family income, acreage, or assets controlled. Furthermore, there are differences among types of farms and geographic regions. Although the gross farm sales criterion is the one most commonly used, it can easily be misleading because of variation in input requirements and the extent to which inputs are produced on the farm or purchased.

Almost regardless of the measure used, there are many small farms and in most states a majority of the farms are small. For example, in 1974 approximately 70 percent of the farms in the United States had less than \$20,000 gross sales. In six states in the South or Appalachia more than 80 percent of the farms grossed less than \$20,000. Profile information generated by ESCS from census data indicate well over two-thirds of the families on these farms were at the moderate income level or below [8].

A Missouri survey of more than 8,000 small-farm operators in 1977 indicated that a large proportion had low total family income [22]. Even when either husband or wife was working off-farm, over half of the families had less than \$10,000 total family income. The Missouri data also contradicted some other commonly held ideas. For example, it is often suggested that operators of small farms are elderly and about ready to retire from farming, are working off-farm and not dependent on farm income, and generally can be expected to exit from agriculture if left alone. To the contrary, the Missouri information indicated an average age of operator of 48 years, 40 percent with essentially no off-farm income and 83 percent expecting to expand or maintain farm production at the same level.

### CHANGES AFFECTING SMALL FARMS

Why the recent interest in "small" farms? Since the days of Thomas Jefferson interest and concern have been expressed for the "family farm." The preambles to the most important pieces of agricultural legislation have typically suggested the need to preserve and enhance the family farm. But the "small farm problem" has been stressed only during the past decade or so. Perhaps the major reason for this recent emphasis is simply the heterogeneity now characteristic of U.S. farms.

During the early decades of this century there were a few large farms but most "family

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farms" were similar in size and the problems were common to most farms. When the Country Life Commission rendered its report in the early 1900s, the recommendation for improving the situation in rural America had relevance to most of the people and most of the farms. Such is no longer the case. Those farms with sales over \$100,000 (approximately 6 percent of the farms) now account for more than half of all gross sales and have few problems in common with the small farms where most of the rural people live. The reasons for this increased heterogeneity are several in number, but some of the more important ones are related to technology, markets, input prices, and government policies.

### Technology

Much has been written about technological advance in agriculture and no attempt is made here to document the change. A fact that should be recognized is that the change has not been neutral with respect to farm size [2, 15]. Small-farm operators often do not and in some instances cannot adopt the new technologies. Even when they do adopt a new technology they are often among the late adopters. Factors inhibiting adoption of technology on small farms include lack of knowledge, limited resources, fear of risk, limited managerial ability, as well as inability to justify economically the adoption of certain types of technology on small units.

### Markets

Although listed as a separate factor, changes in the markets for farm products are to a great extent also a result of technological change. Developments in transportation and storage and the advent of mass retailing were in many instances associated with new or improved technology. Also involved in market changes were changes in retailing patterns, integration of segments in the production-marketing system, and public regulation of marketing activities. Though in some instances technology was the moving force, in others the changes were in response to such varied factors as consumer preferences, energy costs, or developments in international markets.

The development of mass retailing and the accompanying volume and standardization requirements were of particular significance to the small farm. Changes in the system which resulted from retailers' demands encouraged concentration of production among regions and specialization on individual farms. Trans-

portation lines were lengthened. Volume requirements and production specifications were often such that small-farm operators could not compete. Marketing firms increasingly turned to larger farms or developed an integrated system which bypassed the small farm.

### Input Prices

The prices paid for inputs vary among individual farms and change over time. The variation among farms is related primarily to imperfections in the input markets. Large producers typically can buy inputs at lower prices. Their advantage may be due to simple market power from their size in relation to the supplier's market or to actual lower cost for the supplier in moving a larger volume to an individual producer.

Changes in input prices are the result of changes in basic supply and demand conditions for inputs as well as changes in competitive conditions in the input market. Recent changes in the prices of energy inputs are examples of both types of influence.

As input prices vary among firms or change over time the relative competitive positions of farm firms are affected. The optimum input mix changes and firms may be better off or worse off depending on their relative use of the input involved.

### Government Policies

Although the admonition to "get big or get out" has been heard occasionally, the political rhetoric has more typically extolled the virtues of the "small farm" or the "family farm." Actions, however, have not always paralleled the rhetoric. Rather, the programs developed often have benefitted to a much greater extent those farms that were in the strongest position from the standpoint of assets or volume of production. For example, price and income policies have affected farms and farmers in proportion to their size and volume of production.

Likewise, programs to make capital more accessible or to alleviate tax problems often have had consequences contrary to those expected by individuals or groups desiring to help the small farm. For example, the opportunity to use the cash basis of accounting and the possibility of converting ordinary income into capital gains are particularly helpful to the operator of a very large farm or the non-farmer with high off-farm income [15], but only those small-farm families with high off-farm income would be likely to benefit.

## CURRENT SITUATION — RESEARCH AND EXTENSION

Before the question of research and extension needs is specifically addressed, the current situation must be examined. In other words, what are we doing in research and extension that is oriented toward small farms? First, many research and extension workers would argue that their work is neutral with respect to size of farm. Much of the work no doubt is neutral and some of the work is potentially neutral, but because of lack of knowledge and other forces preventing use or application on small farms, the end results are not neutral. In other instances the work is not relevant to small farms because of the scale of operation required, the resources needed, or the managerial capacity required to use the research or extension output.

No attempt is made here to sort through all of the efforts underway to determine their final consequences. Such a task is obviously impossible. Rather, only those efforts that can be identified as specifically oriented to the small farm are considered. For example, rural development research in general is not included even though it is important and of major bene-

fit to small-farm families. A few projects, such as those stressing human capital, are included if they emphasize the problems of small-farm families.

### Research Activities

A survey of land-grant universities in 1977 indicated 30 or more states had one or more research projects that specifically addressed small-farm issues. An examination of CRIS (Current Research Information System) reports in late 1978 yielded a total of 67 projects directly oriented toward small farms. Another 22 projects were marginal in the sense that some aspect of the project had direct application to small farms or the entire research effort was deemed to have potential implications for small farms. Although this attempt to categorize the research efforts was obviously somewhat subjective, it included an individual examination of all projects which alluded in any way to small farms. Additional details on the research effort indicated by the CRIS reports are provided in Table 1.

Much of the research effort directed toward small farms is conducted in the 1890 land-grant universities. In fact, more than half of

**TABLE 1. TOTAL PUBLICLY FUNDED AGRICULTURAL RESEARCH EFFORT COMPARED WITH RESEARCH ACTIVITY DIRECTLY RELATED TO SMALL FARMS<sup>a</sup>**

| Type of Research  | Number of Projects | Scientist Years | Total Funds (000\$) | Federally Appropriated Funds (000\$) | State and Other Funds (000\$) |
|---|--------------------|-----------------|---------------------|--------------------------------------|-------------------------------|
| Total State and Federal   | 25,730             | 10,983.4        | 1,004,086           | 514,343                              | 489,743                       |
| Total in State Agricultural Experiment Stations                 | 20,725             | 6,556.7         | 594,230             | 117,686                              | 416,544                       |
| Social Science Oriented Small Farm Research: <sup>b</sup>       |                    |                 |                     |                                      |                               |
| 1862 Institutions   | 30                 | 10.2            | 606                 | 322                                  | 284                           |
| 1890 Institutions   | 20                 | 5.3             | 404                 | 397                                  | 7                             |
| Technology Oriented Small Farm Research: <sup>b</sup>           |                    |                 |                     |                                      |                               |
| 1862 Institutions   | 7                  | 3.7             | 215                 | 3                                    | 212                           |
| 1890 Institutions   | 10                 | 7.9             | 331                 | 219                                  | 112                           |
| Total Small Farm Research: <sup>b</sup>                         | 67                 | 27.1            | 1,556               | 941                                  | 615                           |
| Projects Classified as Marginal to Small Farm Research Problems | 22                 | 8.9             | 888                 | 600                                  | 288                           |

<sup>a</sup>Total research effort is from SEA/CR published data for fiscal 1977 while small farm research fund data is from CRIS forms for fiscal 1977.

<sup>b</sup>All CRIS forms in any way identifying small farms as subject of inquiry were examined and only those judged to be of direct relevance to small farms were included. Only projects at 1862 and 1890 Land Grant institutions were included.

the federal funds going into small-farm research is being expended by the 1890 institutions. The fact that federal research funding for these universities is of relatively recent origin indicates that the small-farm research effort has only recently received this additional impetus. Moreover, most of the research effort is in the southern states.

A breakdown of the 67 research projects by topic of emphasis is provided in Table 2.

TABLE 2. SMALL-FARM RESEARCH PROJECTS IN LAND GRANT INSTITUTIONS BY AREA OF EMPHASIS, 1977<sup>a</sup>

| Research Area                 | Total Funds |       | SY    |       |
|-------------------------------|-------------|-------|-------|-------|
|                               | (\$)        | (%)   | (No.) | (%)   |
| Typology (16) <sup>b</sup>    | 264,877     | 17.0  | 3.3   | 12.2  |
| Enterprise Combination (12)   | 284,537     | 18.3  | 5.9   | 21.8  |
| Marketing (9)                 | 179,469     | 11.5  | 2.4   | 8.8   |
| Technology (17)               | 546,107     | 35.0  | 11.6  | 42.8  |
| Other Areas (13) <sup>c</sup> | 281,245     | 18.2  | 3.9   | 14.4  |
| Total (67)                    | 1,556,235   | 100.0 | 27.1  | 100.0 |

<sup>a</sup>Information taken from CRIS forms with only those projects included which were directly related to small farms.

<sup>b</sup>Figure in parentheses indicates number of projects.

<sup>c</sup>Other areas include finance (3), transportation (1), government programs (2), off-farm employment (2), human capital (3), social dimensions (1), and community impacts (1).

Nearly one-fourth of the projects are typology studies and another one-fifth are attempts to determine the optimal size and combination of enterprises on small farms.

The National Rural Center is also in the process of examining research activities related to small farms in an attempt to identify research needs. Eight task forces have been organized and have prepared reports on the current state of knowledge, knowledge gaps, and research needs. Topics covered by the task forces include societal goals and values, production efficiency and technology, marketing, energy, taxation, off-farm income, structural change and information needs, and government policies. These topics in themselves are a fairly good catalog of research needs with respect to small farms.

### Extension Activities

Extension programs in agricultural economics have obvious relevance to the educational needs of small-farm operators. Foremost among these programs would be those in

farm management, marketing, and rural development. Although programs in these areas have typically been available, small-farm operators have not usually participated [13]. The addition of paraprofessionals to work with small-farm operators in Missouri was partly in response to research findings that indicated these farmers were not being served by the regular extension programs [7].

More than 20 states now have paraprofessional programs. The paraprofessionals or education assistants are employed to work intensively with part-time and limited-resource farmers. A Virginia study of small-farm extension programs indicated there were 178 paraprofessionals working in 30 counties of the 13 states in the Southern Federal Extension Region plus Missouri [13]. Evaluations of such programs in Texas and Missouri indicate success in improving incomes on small farms [6, 21]. In addition to the states with paraprofessional programs, a number of states have recently developed other types of programs specifically for small-farm operators. In 1978 there were 54 professional agents working primarily with such farmers in the 13-state Southern Region.

### RESEARCH AND EXTENSION NEEDS

As research and extension needs are examined it becomes apparent that we are handicapped somewhat by lack of understanding or agreement as to societal goals related to the structure of agriculture and specifically small farms. Consequently the delineation of problems and hence the determination of research and education needs are very difficult and somewhat inexact. In discussing needs we are assuming that problems do exist, that the problems would not solve themselves, and that research results and extension activities would alleviate the problems.

Agricultural economics research and extension needs might well be categorized as having either a macro or micro orientation. Many of the problems and accompanying knowledge gaps are related to aggregate issues whereas others apply to the individual farm operator. Public decisions are being made at various levels, with or without adequate information, and with or without consideration given to the impact on small farms. Similarly, the small-farm operator by decision or indecision has impact on his own wellbeing and much of the time the information base is inadequate.

The temptation is to suggest that general agricultural economics research and extension programs suffice. If this line of defense fades, the academic community might argue that knowledge of small-farm characteristics to

guide public policy combined with studies of optimal combination of enterprises for the various types of small farms will take care of most of the problems. The distribution of research effort currently underway indicates this view is prevalent. The rest of this article is devoted to identification of other topics deemed worthy of attention in research and extension efforts.

### Macro-type Small-Farm Issues

Very little is known about how small farms fit into society's goals with respect to structure of agriculture. This question is particularly basic to any further consideration of small-farm problems. What are the socioeconomic benefits and costs of small farms? It is a rather sad commentary on the disciplines of agricultural economics and rural sociology that this question can be addressed only by reference to a California study of the 1940s [3].

A number of questions arise with respect to the economic feasibility of small farms with the changes in the markets for agricultural products (domestic and foreign) and the dynamic nature of supply with changes in technology and input prices. Again, the literature is not current and great dependence is placed on what economic theory tells us about economies of scale and on the relatively few empirical studies available [1, 9]. To what extent do economies of size operate for various types of farms, what are the bases for the economies (production, buying, or selling), and are there opportunities for small farms to overcome competitive disadvantages?

Research in the biological, physical, and engineering sciences to develop "appropriate" technology for the small farm does not fall within the domain of the economist. However, investigations of the impact of technology and studies of the organization and the feasibility of production techniques and systems of production do require the contributions of the social scientist. Only in recent years have we seriously examined these questions and much remains to be done [14, 16]. The economist also has a role to play in projecting the impact of changing relative input prices on production technology.

In a series of Small Farm Conferences sponsored by the USDA, Action, and the Community Services Administration during 1978, marketing was one of the most often cited problems. Many traditional markets, particularly for fruits, vegetables, poultry, and dairy products, are no longer available to small-farm operators, and in other situations the needed institutions, facilities, or financial arrangements have not been developed. Direct marketing efforts have been expanding in

many parts of the U.S. but only recently has some guidance from agricultural economics research and extension become available. The impact of regulatory programs on small-farm access to markets is another neglected area.

The flow of capital into and out of agriculture and rural areas and its impact on the structure of agriculture have not been analyzed adequately. Information is needed on the costs and benefits associated with government assuming more risk in providing capital to small-farm operators, particularly those without previous farming experience and those with limited security, but also established small-farm operators who would like to explore the introduction of enterprises which are new to the area. Also lacking is information about the impact of loans and grants to communities for extending roads, utilities, and other community services to rural areas on the prevalence of small-farm operators as well as their quality of life.

Research is needed in a number of other areas where public actions affect small farms, including government policies related to energy, land use, taxation, and agricultural price support programs. There is also a need for knowledge of the distributive impact of general economic policies and rural development programs on farms of various sizes and types. Specific policy issues, of which the "160-acre limitation" in public water projects and rules involved in estate taxes are just two examples, are much in need of analysis.

As agricultural economists we have been involved in the design and analysis of agricultural programs and rural development programs. However, neither type of program is specifically related to the small-farm operator as a farmer. The question may be the extent to which programs can be devised that will truly redistribute income or even services. Can economists devise such schemes or will the benefits inevitably go to the larger, more knowledgeable, more powerful?

Some researchers have argued that the appropriate unit of analysis is the family, or individual, not the farm [10]. In terms of emphasis this is probably true, but the family cannot appropriately be separated from the farm in many instances. Thus rural development activities may be of crucial importance to the family living on a small farm, but not a sufficient condition. Moreover, improvements on small farms will contribute to development, but will play only a small part.

### Micro-type Small-Farm Issues

Relatively little is known about the goals and objectives of families living on small

farms. This knowledge gap becomes very important when optimization studies are being attempted, as the objective function is unknown. It is one reason agricultural economists have difficulty with the ideas and concepts of those who suggest

"...we can interest ourselves in the perfection of production methods which are biologically sound, build up soil fertility, and produce health, beauty and performance. Productivity will then look after itself" [17].

Even for those families who are not necessarily of the persuasion that "Small is Beautiful," the primary objective may not be the maximization of farm or even family income. Living on a small farm perhaps should be viewed as a consumption activity with the costs minimized rather than as a production activity with income maximized. Those small-farm families who do wish to maximize family income typically sell their services to both the farm and nonfarm sectors. Analyses of the family as a firm should take this fact into account.

Studies of the efficiency of small farms or lack thereof are hindered by lack of knowledge about the costs and benefits realized by families on small farms. Why do small farms exist? Is it merely because of the parcelization of land holdings and the difficulty of combining the parcels due to topography? Or to what extent do they fulfill the desire of families to supplement off-farm income, to obtain recreation benefits, or to enjoy aesthetic surroundings? Benefits may be realized from living on small farms such as lower costs of food, housing, water, waste disposal, and taxes. But are these benefits great enough to offset lower returns to the family's resources?

Given the preponderance of small farms in the U.S., and the likelihood they will continue to exist, can research and extension help improve their situation? Enterprise studies as well as evaluations of extension programs suggest the answer is yes. But the studies may need to be broadened and reoriented to take into account the complex nature of the small-farm firm and its multiplicity of objectives. Because resources are limited, the small-farm family must get most of its return from labor and management incomes rather than equity [5]. The question is how.

A recent California study indicates that small farms have a machinery value per acre two to four times that on large farms [4]. Gross sales per acre for some types of small farms is less than half that of large farms. These results suggest that small farms are both over-mechanized and unproductive, but the reasons and remedies are not so obvious. More work needs to be done on alternatives to owning a complete set of machinery like that on larger farms. To what extent can custom work, pur-

chase of used machinery, or joint ownership of machinery help reduce costs? Can machinery of a size appropriate for use on small farms be developed? It has been argued that success in producing technology suitable for small-scale units has been much greater than expected by economists and engineers [19]. In some instances the productivity problem may not be one of technique, but of the timing of its application [11]. In such cases an extension program with intensive personal attention may be necessary.

Marketing problems also beset the individual small farm. Research is needed on alternative procedures which will be effective in reducing input costs and enhancing output prices. To what extent would group or cooperative ownership of resources, specific types of equipment, or marketing facilities be of benefit? Strategies also need to be developed to help the small-farm operator cope with the variability inherent in the prices of agricultural products.

Actually the problems of the small-farm firm in input procurement, financing, production, and marketing are all related. The real research need is for systems analysis. For example, the small dairy farm's problem is not simply to meet health regulations, but also involves forage production, feed handling, milking parlor operations, waste disposal, product handling, and marketing. Changes in any one of these aspects of the small farm's activities will affect the others and this fact should be considered in research planning.

## SUMMARY AND CONCLUSIONS

To some extent we must decide whether we are concerned just about production of food and fiber or are concerned also about the families living on farms and the communities in which they live. The majority of farm families live on small farms. But these small farms are not simply scaled-down versions of large farms. They are different in that they have limited resources, are more dependent on off-farm income, have more difficulty using the technology being developed for production and marketing, and may have different objective functions.

If research and educational institutions are serious about helping the small farm, we need to develop public policies, design systems of production and marketing, develop appropriate technology, and generally create an environment more conducive to their success. Given present conditions, that objective would require work with a small-farm bias.

Research and extension efforts of the type suggested in this article are needed and should

be funded if the benefits from publicly financed research and education activities are to be distributed equitably and the small-farm option kept open. Research to develop more effective approaches to extension of information to small-farm operators is needed along with funding of such programs. Programs involving the use of paraprofessionals to provide technical assistance have proved effective and are being used on a limited basis but are worthy of considerable expansion. Research to provide information on alternative markets, appropriate technology, distributive impacts of public policies affecting agriculture, the interface between farm and off-farm employment, and optimal systems of production and marketing on small farms should receive high priority.

Perhaps the situation has some parallel to that described in a recent article in *Nature*:

"In a democracy the direction of scientific research must in some degree respond to the will of the People. The scientists, who, after all, spend public money, cannot fairly object to the public setting the 'ends' of scientific research. If the public deems a cure for cancer, or solar energy, or the environment, to be important, then that public has a right to support scientific effort aimed at achieving these goals" [20].

Both the Rural Development Act of 1972 and the Food and Agricultural Act of 1977 call for increased efforts in research and extension activities related to small farms. The needs described in this article may suggest some directions these efforts might take.

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