The Orientation of Agricultural Experiment Station Research With Reference to the Distribution of Income*

PAUL W. BARKLEY**

The purpose of this article is to report results of an investigation of the performance of 12 selected Agricultural Experiment Stations. The inquiry is intended to give some clues regarding the relationship between research activities conducted by the Stations and incomes enjoyed by the clienteles of these institutions. Relationships of this type appear to be of growing importance as the Agricultural Experiment Stations strive to adjust to changing patterns of social and economic activities in the United States. Stated in terms of a researchable question, this paper reports the results of a modest effort to research the question, "Have the Agricultural Experiment Stations of the United States produced research results weighted more heavily to wealthy rather than poor agricultural areas?"

By almost any measure, the performance of the Agricultural Experiment Stations in the United States must be regarded as successful. They have contributed heavily to the technological revolution in agriculture. This revolution has increased the productivity of farm workers so demonstrably that now less than 5 percent of the nation's population resides on farms, and only 20 percent of these farms are needed to produce more than 80 percent of the nation's food. The technological advances produced in large part by the Experiment Stations have had the general effect of lowering food

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**Professor of Agricultural Economics, Washington State University, Pullman, Washington. Thanks are due to J. G. Hattersley and Joanne Buteau for painstakingly examining the thousands of documents used in this study.

prices for the entire population. This must be regarded as an improvement in the welfare of society. An effect which is not so pervasively favorable is that forced on the agricultural industry. As technology has become available, it has hastened the division of the farm population into rich and poor--into those able to remain in farming and those unable to do so. Those with sufficient capital and skill have been able to acquire land and machinery; those with a lack of either capital or skill have been forced to restructure their economic lives. In sum, the technological advances produced by the Agricultural Experiment Stations have exerted a selective force on the clienteles of these Stations.

It is an object of legitimate concern to wonder if the Experiment Stations have favored those segments of the farm population which have been able to utilize the results of organized technological research and have tended to overlook those segments unable to respond. In other terms, have the Stations researched questions concerning wealthy, commercial farming areas at the expense of researching questions concerning low-income, low-capacity areas or low-income groups such as agricultural laborers within the industry? There would be built-in pressures for a Station to follow such a practice. Since wealthy farm areas would be more inclined to adopt new practices than would poor ones, Stations might favor these areas so as to use adoption rates as a tangible indication of success.[1] Similarly, one might argue that applied research of the type most often conducted by the Experiment Stations is conducted in response to felt and well-articulated needs. The wealthy areas are,

[1] This was pointed out by Beal and Bohlen as early as 1957. See G. M. Beal and J. M. Bohlen, The Diffusion Process, Iowa Agricultural Experiment Station, Special Report No. 18 (Ames, 1957).

for a variety of understandable reasons, capable of producing more pressure for research than are the poor ones. Questions raised by these paragraphs are not easily answered. Some clues to eventual understanding may be gained, however, by relating research activities of these Experiment Stations to income levels in areas studied by individual scientists.

Investigative Methods

The most available record of the research performance of an Agricultural Experiment Station is its published documents. These appear in many forms and vary widely from institution to institution. Most often the publications of a single Experiment Station will include (1) a bulletin series, (2) a technical (or research) bulletin series, and (3) a number of other, less-used types of publications. For present purposes, it is presumed that most major research efforts ultimately result in a published document in at least one of these series. Further, it is assumed that more intensive research efforts will likely yield more than one item in the published record--perhaps a single document in each of the above classifications. When this occurs, it is felt that the Station is placing more emphasis on this particular research program. These published documents, appearing in the continuing series of publications of the Experiment Stations, formed the basic unit of observation in the research. Each individual publication was given equal weight.[2]

Literally thousands of documents have been published by the Experiment Stations since public dissemination of research results began in the early

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[2] One reviewer of an early draft of this paper expressed concern for measures used and suggested the analysis be carried out with reference to Scientific Man-Years assigned to do research in various fields. This recommendation was discarded because SMY's measure inputs rather than performance.

years of this century. To limit the data-gathering process to manageable size, it was arbitrarily decided to examine the published record of 12 Experiment Stations in each of three decades--the 1920's, the 1940's, and the 1960's.

The 12 states were chosen so that three would come from each of the four major geographic regions--Northeast, South, North Central, and West. Within each region, the state with the highest percentage increase in per capita income from 1950 to 1965, the state with the lowest percentage increase in per capita income during the same period, and the state with the largest number of practicing agricultural economists[3] in the mid-1960's were selected for study (Table 1).

Table 1.--States selected for examination

Geographic	High increase in per capita income	Low increase in per capita income	Largest number of agricultural economists
Northeast	Vermont	New York	Pennsylvania[a]
South	Arkansas	North Carolina	Virginia
North Central	Minnesota	Ohio	Illinois
West	New Mexico	Montana	California

[a]Pennsylvania has fewer agricultural economists than does New York but was selected because New York qualified for inclusion on other grounds.

[3]As indicated in the handbook of the American Farm Economic Association, Journal of Farm Economics, Vol. 48, No. 4, Part II (November, 1966). In early stages of the examination, it was hoped that this delineation would make an interesting subset for agricultural economists. At later stages the subset proved to be inconsequential, so this portion of the comparison was dropped.

Each publication of the Experiment Station of each state was examined to determine purpose, authorship, and geographic orientation.[4] Geographic orientation was made with reference to counties. When counties were not named in the document, one of three methods was used to establish a county basis. These were:

1. Converting a named geographic region into counties by selecting as nearly as possible those counties which comprised the area in question. For example, a research done in the Salinas Valley in California was presumed to be related to Monterey County.
2. If a bulletin dealt with a specific crop, the major producing counties which, when aggregated, produced 75 percent of the state's total production of that crop were named as the geographic area of study.
3. Bulletins dealing with pervasive topics (for example, "How to Build a Farm Shed" or "The Annual Report of the XYZ Agricultural Experiment Station") were considered statewide in geographic orientation.

Particular difficulties arose in making county determinations in cases such as item 1 above. It is readily recognized that other observers may have made other determinations when given the same sets of information.

The relationship between an individual document and income levels was established by examining median farm income and average per capita income in the counties included in a document's area of study. These relationships were established after the counties of each state in the study had been arranged

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[4] Over 6,000 documents were examined during this effort. It is highly likely that some Stations published more items than we were able to locate. The documents examined were those carried by and ultimately placed on the shelves of the Washington State University Library.

in quartiles with reference to incomes reported in the Census of Population[5] and in Sales Management[6]. Those counties in the highest income quartile were given a numerical index of one; those in the second highest income quartile, an index of two; those in the third, an index of three; and those in the lowest income quartile of counties, an index of four. The counties in each publication's study area were then related to their income quartiles and an average index of income orientation was calculated. That is, a bulletin dealing with three counties, of which two were in income quartile two and one in income quartile three, would be given an average index of $\frac{2 + 2 + 3}{3} = 2.33$. An index of 2.50 is considered to be income neutral. An index above 2.50 is weighted toward low-income counties, and an index of less than 2.50 indicates a weighting in the direction of high incomes.

The income data are not entirely satisfactory. The Census of Population reports median family incomes of the rural farm population on a county basis. These data, however, are not available for years prior to 1959. The Census data, then, are for a year just prior to the beginning of a sampled decade (the 1960's), thus representing the entire decade somewhat less adequately than would a mid-decade year. Nonetheless, because it is the income of farmers that is most interesting, each bulletin published in each of the three decades studied was related to the 1959 median farm income. Relating 1920 publications to 1959 incomes is a questionable practice. In order for such an analysis to be valid, it is necessary to adhere to the overly gallant assumption that

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[5]U.S. Bureau of the Census, U.S. Census of Population: 1960. Vol. I, Characteristics of Population, Part 1, United States Summary, General Social and Economic Characteristics, 1964.

[6]"Sales Management, Survey of Buying Power," Sales Management, 19:21-23, Sept. 1929; 56:12-21, May 1946; 92:227-229, June 1964.

income rankings among counties have remained unchanged since 1920. This is demonstrably untrue--particularly when one considers such events as the highly selective natural resource policies of the Bureau of Reclamation and the Tennessee Valley Authority, which have been geared toward local development, and the selective nature of some federal price and income-support programs. These have undoubtedly changed the relative rankings of county income figures in the past three decades.

To compensate for these difficulties, other income measures were sought. The only single series available on a continuing basis since the decade of the 1920's is the series maintained by Sales Management. The series was introduced in 1928 and has appeared annually with some modification since that time. Sales Management reports average per capita income on a county basis, but distinctions are not made between farm and nonfarm populations. The various documents published in the 1920's were related to county income quartiles based on 1928 data. Those published in the decade of the 1940's were related to 1945 incomes, and those documents of the 1960's were related to 1964.[7]

Neither of the series described above is entirely adequate. The Census series suffers for being a one-shot effort and for that effort's being related to the wrong year. The Sales Management series suffers for being a formula-created average for the whole population rather than the more desirable and appropriate average (or median) farm income.

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[7]The 1928 Sales Management estimates of per capita income were calculated using an unpublished formula intended to yield "actual current income from all sources." The 1945 estimates are described as reflecting "net effective buying power" and include nonmoney incomes of farmers and individual proprietors. They are also reduced by an estimated amount of income tax paid to the federal government. The 1964 estimates are modified from the 1946 series to include imputed rental values of owner-occupied homes.

After average indexes of income orientation had been calculated for each publication, the publications were classified into three "type of bulletin" categories and 10 subject matter categories. The distribution of bulletins among these categories, like the definition of study areas, was a highly subjective process. If a bulletin or other document could not be placed in one of the subject matter categories by reference to its title, the affiliation of its senior author was used to make the determination. For example, "The Effects of Bees on Orchard Yields" could be placed under either "bees" or "orchards." Author affiliation was used to resolve this type of dilemma. The analysis proceeded using averages of all indexes appearing in each bulletin type and subject matter classification.

Some Qualifications

Because of data problems, and because most publications do not carry with them a built-in indicator of the intended clientele, some reservations should be made about the results of the research. It is legitimate to inquire if an academic department, such as animal husbandry, can make conscious choices about helping the rich or the poor. Insofar as research work is done regionally, and insofar as poverty is most often arrayed unequally across geographic territories, the answer seems to be "yes." If dairy operators in a particular section of a state suffer from chronic low incomes, an animal husbandry department, by researching the strictly animal husbandry problems of this area, can direct aid to the poorer segments of the population. On the other hand, continued efforts at perfecting high-yield varieties of wheat for the Palouse Hills region of Washington provide a not-too-subtle example of a research commitment made to aid a generally wealthy agricultural region.

Questions can also be raised about the use of median county incomes as a measure of poverty. Measures of central tendency may obscure relevant problems regarding the distribution of income in a given county. For example, a study dealing with marginal farming at the rural/urban fringe could be directed toward low-income farm people but would appear to be directed toward the wealthy when Sales Management data are used as the basis of comparisons. Similarly, bulletins describing efforts to increase cotton production in the Mississippi delta region may appear in this analysis as weighted toward low-income agricultural areas, but major beneficiaries would likely be among the higher income segments of the farm population. The same may be said for many bulletins reporting labor-saving technologies.

These weaknesses are serious, and future researches should attempt to eliminate some of the distortions created by them. It appears desirable, however, to proceed, even in the face of these difficulties, to generate some indications about the relationship between research activities and the incomes of farm people.

Results

Results of the aforementioned classification scheme appear in Table 2. The distribution of bulletins by type shows that research bulletins, which are most often written for one's professional peers, made up a small but growing percentage of the total publications package. The bulletin series diminished considerably in importance over time but was replaced by the perhaps more selective types of publications that appear here as "other" publications. In the subject matter categories, publications in economics and sociology increased significantly as a portion of all publications, perhaps revealing

Table 2.--Number and percent of bulletins by category

Category	1920's		1940's		1960's	
	Number	Percent	Number	Percent	Number	Percent
Type of publication						
Bulletins	1,199	64.6	1,094	64.7	1,064	44.4
Research bulletins	249	13.4	238	14.1	533	22.2
Other	409	22.0	358	21.2	801	33.4
Subject matter						
Economics and sociology	213	11.4	337	19.9	622	25.9
Animal husbandry	390	21.0	258	15.3	312	13.0
Horticulture	313	16.9	192	11.4	215	9.0
Field crops	518	27.9	492	29.1	649	27.1
Forestry	32	1.7	24	1.4	54	2.3
Home economics	53	2.9	85	5.0	97	4.0
Entomology	138	7.4	135	8.0	171	7.1
Soils and resources	104	5.6	83	4.9	149	6.2
Farm mechanics	65	3.5	54	3.2	76	3.2
Administration	31	1.7	30	1.8	55	2.3

an increased interest in human and social problems. The compensating adjustment came through decreases in publications coming from animal husbandry and horticulture. Impressive trends are not found in the remaining categories.

The average indexes of income orientation reported in Table 3 emerge when the published records of the 12 Experiment Stations are compared to the county income quartiles based on median incomes of farmers in 1959 (as determined by the Census Bureau). Of the 39 entries in the table, 14 are greater than 2.50 indicating that research represented by these 14 cells was, on the average, carried out in geographic areas with median farm incomes somewhat below the median farm income for the state as a whole. Four cells are income neutral with indexes equal to 2.50; and the remaining cells have indexes less than 2.50, showing a tendency toward the wealthier sectors of the farm population.

In the top section of the table the "bulletin" series and the "other" series are consistent through all periods in showing average indexes less than 2.50--that is, inclined toward wealth. Reference to Table 2 indicates that these two types of publications include approximately 80 percent of all bulletins published by the sample Experiment Stations.

When subject matter is the frame of reference, results are much less consistent. Forestry and home economics publications show a leaning toward the poor; field crops and entomology are consistently on the wealthy side of the ledger. As one moves through time, there is no general tendency for a subject matter index to either increase or decrease. This may be traced to the problem of using 1959 data as the focal point in this table. One would expect, however, that problems associated with this one-year measure would be minimal in later years.

Table 3.--Indexes of income orientation based on average county net farm income as reported in the Census of Agriculture

Category	1920's	1940's	1960's
Type of publication			
Bulletins	2.47	2.45	2.45
Research bulletins	2.55	2.54	2.52
Other	2.46	2.48	2.37
Subject matter			
Economics and sociology	2.54	2.46	2.48
Animal husbandry	2.56	2.47	2.48
Horticulture	2.54	2.41	2.41
Field crops	2.43	2.44	2.48
Forestry	2.59	2.63	2.72
Home economics	2.64	2.63	2.48
Entomology	2.41	2.50	2.41
Soils and resources	2.41	2.36	2.53
Farm mechanics	2.48	2.54	2.51
Administration	2.50	2.50	2.50

The indexes are generally lower when Sales Management data are used in the analysis. Because of this, greater inclination toward the wealthy areas may be noted in Table 4. In this case, only three of 39 average indexes leaned to the poorer geographic regions, three were income neutral, and 33 showed inclinations to wealthier areas.

Since the Sales Management data provide a slightly more sensible comparison through time, it is useful to note that in only one case (entomology) was the 1960's index less than the index for the decade of the 1940's. This observation lends mild support to the theme stating that the Experiment Stations are responding to the social needs of the day.

In both Table 3 and Table 4, research bulletins carry higher indexes than other classes of publications (with the exception of one instance in Table 4). One interpretation of this would be that scientists, when writing for their professional peers, are more attuned to the problems of the poor and are more expressive of this concern. On the other hand, when writing for popular consumption, the needs of commercial agriculture and the needs of the higher income clientele must be met since these clienteles continue to provide support--financial and political--for the station's activities. This interpretation is a hopeful one for it indicates that scientists have begun to talk to each other about social problems.

Aggregated average indexes for all types of publications are shown by geographic region in Table 5. As before, the comparisons using Census data are somewhat higher than those based on Sales Management calculations. In the former case, five of the 12 individual indexes are weighted toward the poorer areas. In the latter instance, not one index of income orientation is greater than 2.50.

Table 4.--Indexes of income orientation based on average county family expendable income as reported in Sales Management

Category	1920's	1940's	1960's
Type of publication			
Bulletins	2.29	2.38	2.40
Research bulletins	2.42	2.37	2.52
Other	2.38	2.39	2.37
Subject matter			
Economics and sociology	2.32	2.40	2.42
Animal husbandry	2.36	2.33	2.37
Horticulture	2.45	2.42	2.46
Field crops	2.32	2.32	2.38
Forestry	2.58	2.43	2.70
Home economics	2.48	2.46	2.48
Entomology	2.34	2.40	2.39
Soils and resources	2.27	2.45	2.49
Farm mechanics	2.48	2.44	2.46
Administration	2.50	2.50	2.50

Table 5.--Indexes of income orientation for designated geographic areas

Geographic region	1920's	1940's	1960's
	Based on Census income figures		
Northeast	2.53	2.47	2.44
North Central	2.30	2.36	2.37
South	2.61	2.54	2.62
West	2.56	2.50	2.44
	Based on Sales Management data		
Northeast	2.22	2.43	2.42
North Central	2.31	2.35	2.35
South	2.32	2.42	2.47
West	2.46	2.33	2.42

Discussion

The land-grant system has been in existence for over 100 years. For a good many of these years, colleges in the system have received considerable support from federal and other sources to conduct research geared toward solving the wide range of problems facing the agricultural industry. Nowhere in the original legislation or in the subsequent legislation can be found a specific admonition to the Experiment Stations to conduct research aimed exclusively at solving the problems of particular portions of the rural population. The laws are neutral after specifying in general terms that the pertinent problems of the industry should be those chosen for scrutiny. For the first several decades of the Experiment Stations' lives, the traditional physical, biological, and organizational problems of agriculture were indeed the most pressing ones; and significant inertia developed in the conduct of research programs geared toward these ends.

More recently, the tenor of problems facing the nation and the agricultural industry has changed. The less-than-ideal distribution of income has emerged as an important theme in oratory and in policy yet there is little evidence to indicate that research programs of the various Stations have changed in response to this exhortation.

The Stations cannot claim either ignorance or lack of time for response. As early as fiscal year 1926-27, H. C. Taylor[8] reported that only 12 of 332 Experiment Station projects in progress in the field of agricultural economics were in any way related to farm income problems. He suggested an immediate taking of stock and redirection of emphasis. One year later he broadened

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[8] Taylor, H. C., "Research in Agricultural Economics," J. Farm Econ. 10: 33-47, January 1928.

the scope of his suggestion by stating that all research in agriculture should be designed to assure farmers a more equitable share of the gains in national income[9]. Similarly, Heady[10] early in his professional career, inquired into the differential impacts of agricultural research on different segments of the industry. He later (1961) insisted that improving farm income must be an important goal of all agricultural research[11]. By the mid-1960's, the American Farm Economics Association was taking notice of rural poverty problems by including a section devoted to this theme in its annual meetings. Additionally, individual agricultural economists were making progress in describing the extent of rural poverty and the difficulties associated with using income transfer programs to reach the rural poor.

One searches in vain for similar indications of changing emphasis at the Experiment Station level. The sections of the Proceedings of the Association of State Universities and Land-Grant Colleges (ASULGC), devoted to the agricultural activities of the member institutions include a constant admonition to change; but the suggested changes are most often retrenchments designed to adjust the activities of the Stations to the demands of a diminishing clientele. There is an obvious penchant for discussing the problems of commercial agriculture. In the several issues of the Proceedings of this

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[9]Taylor, H. C., "The New Farm Economics," J. Farm Econ. 11:357-367, July 1929.

[10]Heady, E. O., "Basic Economic and Welfare Aspects of Farm Technological Advances," J. Farm Econ. 31:293-316, May 1949.

[11]Heady, E. O., "Public Purpose in Agricultural Research and Education," J. Farm Econ. 43:566-581, August 1961.

organization published in the 1960's, only the voice of James T. Bonnen[12] suggests that the problems of low-income people (rural and urban) and of declining rural areas and institutions are more important than the problems of commercial agriculture. It is not only a case of the researchers themselves selecting the wealthier clienteles among which to operate. The administrators of the system--even in the face of intense public sentiment--have singularly failed to incorporate the poverty theme into their discussions regarding direction and role. On the other hand, university-level administrators attending annual meetings of the ASULGC introduce and dwell on the urgency of poverty problems and the roles which universities might play in understanding and solving the problems. The Experiment Stations appear to be existing between a clamoring public and concerned administrations but have, in and of themselves, failed to respond.

In summary, it must be said that this paper reports results of a very tentative nature. Crude methods were used to find the relationship between geographic regions researched and the incomes of families living in these geographic regions. The results show that, in general, the published research available through the Agricultural Experiment Stations was weighted toward the wealthier regions of the states studied. Moreover, there does not seem to be a shift toward researching problems of low-income areas in the more recent years. To be sure, much additional work is needed. More incisive measures of income need to be developed and, more importantly, less aggregated methods of inquiry must be used before this theme can be adequately

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[12] Bonnen, James T., "The Colleges of Agriculture: Old Bottles, New Wine?," Proceedings of the National Association of State Universities and Land-Grant Colleges, 81st Annual Meeting (Columbus, Ohio, 1967), pp. 152 and 153.

researched. It seems imperative that such efforts be made; that the quest continue to determine (1) whether the Agricultural Experiment Station is an institution capable of responding to the varying needs of its clientele, and (2) if it is, what direction should such a response take?