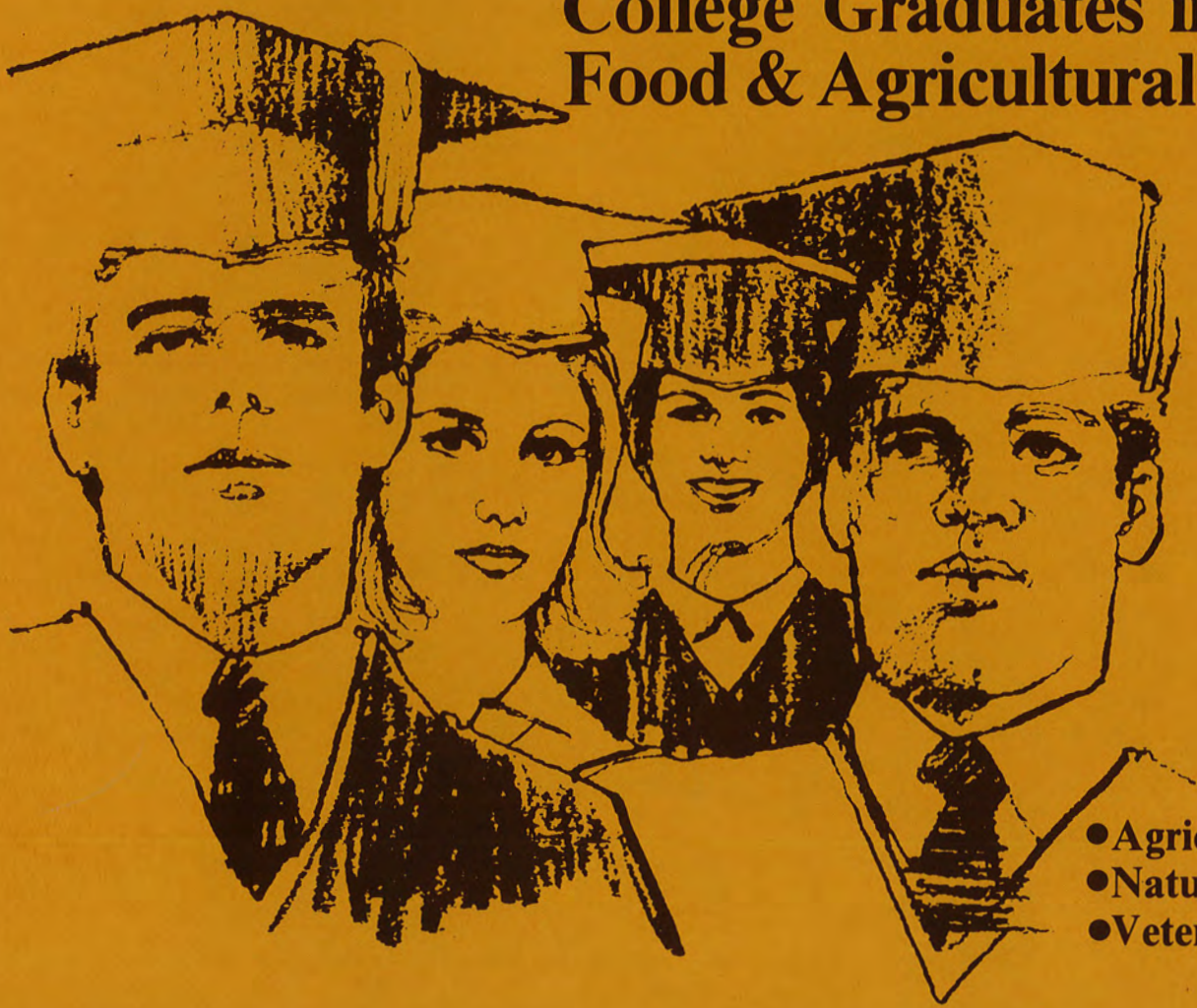
Supply & Demand

College Graduates in the Food & Agricultural Sciences



- Agriculture
- Natural Resources
- Veterinary Medicine

A 1980 National Assessment...Condensed Report

This report was prepared by Allan D. Goecker, assistant dean, School of Agriculture, Purdue University. It is an edited and condensed summary of an U.S. Department of Agriculture study entitled, *Graduates of Higher Education in the Food and Agricultural Sciences,* which was coordinated by Kyle Jane Coulter and reported in the July, 1980, USDA Miscellaneous Publication Number 1385 edited by Coulter and Marge Stanton.

Also acknowledged are the contributions of the panel of experts who participated in the study and made suggestions regarding this publication. The panel consisted of: Stephen R. Chapman, Clemson University; J. Robert Cooke, Cornell University; Edward W. Glazener, North Carolina State University; Richard H. Merritt, Rutgers University; and Winston E. Pullen, University of Maine. Goecker was also a panel member.

This condensed report was prepared for the Agriculture and Natural Resources Resident Instruction Committee on Organization and Policy of the National Association of State Universities and Land-Grant Colleges.

Supply & Demand

College Graduates in the Food & Agricultural Sciences

"If the United States is to continue as the lead nation in confronting problems associated with increasing global population and decreasing agricultural and natural resources, it must possess the requisite human capital—individuals with higher education in the food and agricultural sciences."

"Graduates of Higher Education in the Food and Agricultural Sciences," U.S. Department of Agriculture, Miscellaneous Publication Number 1385, July, 1980.

The above statement represents the basic purpose of a 1980 national assessment of the relationships between the supply of and the demand for college graduates in the food and agricultural sciences by the United States Department of Agriculture. The most significant results of this study are summarized as follows:

- During the early 1980s, the total average annual demand for college-educated graduates in the United States in the food and agricultural sciences—including agriculture, natural resources, and veterinary medicine—is expected to exceed the available supply by 15 percent.
- An especially short supply of individuals having advanced preparation—master's and doctoral degrees—is expected to be available for the required research efforts in the food and agricultural sciences during the mid-1980s. The more significant shortages are foreseen in agricultural business management, agricultural engineering, animal sciences, food sciences, plant sciences, soil sciences, forest engineering, forest products utilization, and veterinary medicine specialities such as regulatory medicine and pathology.
- Some imbalances in the future supply and demand relationships for baccalaureate degree recipients in the food and agricultural sciences are projected. The most extensive shortages are expected in agricultural engineering, agricultural business management, food sciences, and plant sciences. A continued oversupply of baccalaureate degree recipients is anticipated during the next five years in some natural resources disciplines, including wildlife management and forest recreation. Also, an oversupply of media specialists is expected.
- Although it was not an objective specifically addressed in the USDA study, there is strong related evidence that fewer college graduates in the food and agricultural sciences will have significant work experiences and backgrounds related to their degrees as we approach the mid-1980s. Employers will find it increasingly necessary to adjust toward more graduates without traditional farm or ranch background and other employment experiences related to entry-level jobs.

Total Supply and Demand - Early 1980s

For the United States during 1980-1985, there is projected an average annual demand of 59,780 college graduates in agriculture, natural resources and veterinary medicine. The USDA study defined college graduates as individuals having associate, baccalaureate, master's, doctoral, or initial professional degrees in the food and agricultural sciences.

Total, 1980-1985
Supply 51,976
Demand 59,780

The projected average annual supply of college graduates in the food and agricultural sciences during 1980-1985 totals 51,976. Of this total, 74 percent, or 38,424, are projected to be graduates of colleges of agriculture, natural resources, and veterinary medicine. Some 26 percent, or 13,552, are projected to have related degrees such as economics, microbiology, marketing, mechanical engineering, business, and genetics which compete in the professional employment market in the food and agricultural sciences. Graduates in these areas are generally from colleges other than agriculture, natural resources, and veterinary medicine.

Stated in another manner, the aggregate demand for college graduates in the food and agricultural sciences is projected to exceed supply during 1980-1985 by 15 percent. When the aggregate demand is related to the total supply of graduates anticipated from colleges of agriculture, natural resources, and veterinary medicine, the disparity is 35 percent.

The USDA study identified eight food and agriculture occupational employment clusters and presented the supply and demand relationships for each group. The following occupational employment clusters were defined:

- Scientific and professional specialists
- Manufacturing and processing scientists and engineers
- Sales and service representatives and purchasing agents
- Administrators, managers, and financial advisors
- Educators
- Media specialists
- Agricultural production and management specialists
- Miscellaneous agricultural specialists

The ensuing discussion will focus on the supply/demand relationship for college graduates for each cluster. Also, examples of specific occupations included in each cluster will be presented along with an analytical assessment of the supply and demand data.

Scientific and Professional Specialists

Included in this cluster are the professional occupations which involve high levels of technical agricultural and scientific competency. These occupations generally require the application of mathematics, biology, chemistry, statistics, and social sciences to solving problems, expanding productivity, or increasing efficiency in the areas of food, agriculture, and renewable resources.

A limited number of specific examples of occupations associated with this cluster are: agronomist, animal pathologist, arborist, floriculturist, plant breeder, seed analyst, research technician, silviculturist, landscape architect, atmospheric scientist, food chemist, hematology technologist, dietitian, forest ecologist, soil surveyor, soil conservationist, wood technologist, forester, food inspector, rural sociologist, regional planner, veterinarian, and toxicologist.

The study projects an average annual demand for 14,986 scientific and professional specialists during the early 1980s in the United States. This includes an estimated 1,448 annual openings for veterinarians. An average annual supply of 13,779 graduates who are qualified to assume positions as scientific and professional specialists is expected to be produced, leaving an average annual deficit of 1,207 individuals.

Of the projected annual supply, 3,552 or about 25 percent are expected to earn advanced degrees—master's, doctor of philosophy, and doctor of veterinary medicine.

Scientific and Professional Specialists, 1980-1985
Supply 13,779
Demand 14,986

Analysis

The supply and demand data for scientific and professional specialists indicate an inadequate average annual supply of higher education graduates through 1985.

Specific data indicate that a supply and demand balance for veterinarians may be achieved by the mid-1980s, but annual shortages approximating 8 percent will exist for other scientific and professional specialists.

Supply and demand data were obtained at the baccalaureate degree level as well as for advanced degrees. The more specialized data indicate that there will likely be a sufficient number of baccalaureate graduates to fill the related scientific and professional positions, but there will be significant shortages of master's and doctoral graduates. It appears that fewer than the required number of persons will enter graduate degree programs to prepare for the more specialized scientific and professional positions during the early 1980s unless significant increases in support for graduate study in the food and agricultural sciences are established.

National goals for the 1980s reflect needs for greater productivity in agriculture, more energy-efficient food production and delivery systems, maintenance of environmental quality, and provision of a more nutritious and safe food supply. Consequently, a sustained demand for scientific and professional specialists having the highest levels of training and expertise in the food and agricultural sciences is anticipated.

It is expected that the most significant unmet demand will be for master's and doctoral graduates in agricultural engineering, animal sciences, food sciences, forest management, forest engineering, soil sciences, and plant sciences.

Manufacturing and Processing Scientists and Engineers

This occupational cluster includes the scientific and engineering occupations which are related to the design of facilities, processing, and quality control of products manufactured from raw agricultural and forest inputs.

Some examples of occupations included in this cluster are: dairy bacteriologist, entomologist, meat inspector, vegetable inspector, environmental engineer, quality control director, agricultural engineer, fruit inspector, water supply engineer, food grader, rural electrification engineer, forest products engineer, and lumber grader.

Manufacturing and Processing Scientists and Engineers, 1980-1985

Supply 4,575

Demand 5,544

The study results show an average annual demand during the early 1980s for 5,544 manufacturing and processing scientists and engineers compared with a projected average annual supply of 4,575 individuals. Approximately 50 percent of the aggregate demand is for engineers, 15 percent for processing and manufacturing scientists, and 35 percent for quality controllers including inspectors and graders.

Also, data indicate that approximately three-fourths of the average annual supply of graduates who are available for these positions will have the baccalaureate degree; only one-fourth will hold advanced degrees.

Analysis

The projected average annual supply of manufacturing and processing scientists and engineers will meet slightly more than 80 percent of the anticipated annual demand.

It appears that the most significant shortages of individuals will be in the areas of food engineering, food manufacturing research and development, regulatory medicine, and forest products engineering. These occupations usually require persons having advanced academic degrees and a significant shortage of masters and doctoral graduates in the early 1980s is anticipated.

The desire for greater energy efficiency in the food delivery system along with changing dietary patterns in the United States suggest that the future demand for food manufacturing scientists and engineers will likely increase rather than decrease. In addition, escalating construction costs underscore the need for greater efficiency in harvesting and processing timber resources. Therefore, forest products scientists and engineers should enjoy a strong employment position during the next five years.

Sales and Service Representatives and Purchasing Agents

Included are the occupations related to marketing agricultural and food products and jobs involved in the sales of production inputs such as feed, seed, fertilizer, pesticides, and machinery. Service occupations, such as those where representatives provide lawn and landscape care and maintenance, are also a part of this category.

Several specific jobs included in this cluster are as follows: sales representative, grain broker, landscape contractor, field representative, food buyer, elevator operator, food broker, technical service representative, sales demonstrator, grain trader, cattle broker, purchasing agent, tobacco buyer, and livestock buyer.

Of the eight occupational employment clusters defined, the projected annual demand is the largest for sales and service representatives and purchasing agents. During the early 1980s, the average annual demand for college educated sales and service representatives and buyers totals 15,319. This compares to an expected average annual supply of 13,434 graduates, some 12 percent less than the annual demand.

A more detailed assessment indicates that more than one-half of the total demand is for sales representatives

Sales and Service Representatives and Purchasing Agents, 1980-1985

Supply 13,434

Demand 15,319

and brokers plus buyers of grains, livestock, horticultural crops, and timber. In addition, a sizable demand is noted for lawn care and landscape sales and service representatives.

On the supply side, 7 percent of the graduates competing for buying and sales and service positions are expected to have degrees beyond the baccalaureate level. The projected average annual supply includes 9,453 individuals with degrees from agricultural and natural resources programs of study, plus 3,981 persons with degrees in related curricula such as business and economics who compete in the food and agricultural sales and service employment market.

Analysis

Extensive evidence suggests that the strongest market for baccalaureate degree graduates in the food and agricultural sciences is for positions as salespersons, technical service representatives, and buyers. Supply and demand data identify an approximate 12 percent annual shortage during the early 1980s.

Buying, selling, and technical service representative positions are closely related to agricultural production levels. With the expected increases in agricultural output during the coming years, some expansion of sales and service career opportunities is anticipated.

Graduates from plant sciences, animal sciences, agricultural mechanization, and agricultural business curricula are expected to command the greatest interest from firms seeking salespersons and buyers to serve farmers and ranchers. Individuals having a combination of technical understanding plus business and marketing training should be in the strongest employment position. There appears to be a significant shortage of persons having baccalaureate degrees in the plant and animal sciences followed by a master's degree in agribusiness management.

A couple of factors may limit the demand for sales representatives, buyers, and technical service representatives. Restricted foreign markets or a prolonged economic recession would likely result in diminished agricultural production combined with a decreased demand for sales and technical service representatives.

An expected continuation of the trend which has seen Americans eating a greater proportion of their meals away from home should augment the demand for food buyers and food salespersons. Also, a continued strong demand is anticipated for lawn and landscape management firms.

Administrators, Managers and Financial Advisors

This group is comprised of food and agricultural occupations which require managerial and administrative competencies. The occupations involve financial management, public administration, real estate appraisal, business analysis, and program direction.

Some specific examples of occupations associated with this cluster are: agricultural economist, marketing forecaster, park superintendent, contract analyst, land appraiser, commodities broker, agricultural credit officer, farm loan inspector, trade economist, public agricultural administrator, and market analyst.

Administrators, Managers and Financial Advisors, 1980-1985

Supply 4,293

Demand 6,184

Results of the USDA investigation show an average annual demand for 6,184 food and agricultural administrators, managers, and financial advisors from 1980 to 1985. This compares to a projected average annual supply of 4,293 for the same period. Major demand components are agricultural credit officers, market analysts, public agricultural and natural resource administrators, and food and agricultural brokers.

Supply data indicate approximately 75 percent of the graduates competing for positions as administrators, managers and financial advisors have baccalaureate degrees and 25 percent with advanced degrees. Only one-half of the average annual supply is estimated to have degrees from colleges of agriculture and natural resources with a like percentage having related degrees in such areas as economics and finance.

Analysis

The demand for financial advisors and managers should remain strong during the 1980s due to trends toward larger firms, restricted money supplies, smaller operating margins, more extensive use of credit, greater emphasis on tax management and property transfer, and more complex organizational structures in agricultural production and agribusiness operations.

The need for economic impact analyses related to alternative land uses and environmental quality supports a continued strong demand for investigators and appraisers with expertise in soils, plants, and natural resource uses.

The more detailed findings suggest that the most critical shortages of graduates will be for those with advanced degrees. Persons with a master's degree in agricultural economics emphasizing financial management and analysis are projected to be in especially short supply.

Educators

This occupational employment cluster includes secondary school vocational agriculture teachers, adult education teachers specializing in agriculture and food, and college faculty involved in teaching and research directly related to agriculture and food. Occupations in the Cooperative Extension Services with the exception of home economics positions are also included.

Specific examples of occupations in this cluster are: vocational agriculture teacher, adult educator, college professor, county extension agent, area extension specialist, and state extension specialist.

Educators, 1980-1985
Supply 5,337
Demand 3,696

Results of the study show an average annual demand for 3,696 food and agricultural educators compared with an average annual supply of 5,337. The demand for vocational agriculture teachers is the largest component, representing 43 percent of the demand. College faculty openings account for 20 percent of the annual demand and the remaining 37 percent is represented by Cooperative Extension Services personnel and adult educators.

An evaluation of the highest degree level achieved shows 14 percent of the annual supply of educators with doctoral degrees, 26 percent with master's degrees and 60 percent with baccalaureate diplomas.

Analysis

In the aggregate, it appears that an oversupply of educators will be available during the early 1980s. However, one must look beyond the number of educators trained each year to effectively analyze this particular component of the labor force.

For example, a 1978-1979 study by the Agricultural Education Division of the American Vocational Association (AVA) indicated that only 55 percent—974 of 1,751—of the vocational agriculture graduates certified that year accepted employment as educators. The same AVA study showed that fewer than 60 percent of the vocational agriculture teachers certified during the past decade have accepted teaching positons. Also, the study projected an average annual shortage of 600-750 high school vocational agriculture teachers in the United States for the early 1980s.

It is apparent that the secondary schools are being outbid by business and industry for trained vocational agriculture teachers. Some of the shortages noted earlier for sales and service representatives and purchasing agents are likely being met by trained educators.

Likewise, there is significant evidence that colleges and universities are being outbid by other employers for entry-level professors. The most significant shortages of college educators in the food and agricultural disciplines are in agricultural engineering, agricultural economics, animal production, plant sciences, and forest products as well as the veterinary specialties including internal medicine, pathology, and preventive medicine.

In response to expanded missions in food and agricultural teaching and research during the late 1940s and early 1950s, many universities significantly increased their faculties during this period. Consequently, a greater than average number of doctoral graduates will be required as replacements for faculty who reach retirement age during the middle and late 1980s. Also, expansion of efforts in providing technical assistance to other nations will place further strain on the supply.

In summary, through the mid-1980s there apparently will be some specialized, but significant "real" shortages of educators as noted in the foregoing discussion. Such shortages will likely occur because of salary differentials between educational institutions and other employers. Two occupational clusters previously discussed—scientific and professional specialists, and sales and service representatives and purchasing agents—will continue to be the most significant competitors in attracting trained educators.

Media Specialists

This occupational group includes the professional workers in all media such as radio, television, newspapers, and other operations which specialize in reporting for food and agriculture. In general, these specialists are journalists, librarians, public relations specialists, and archivists. The occupation of curator is included since many of its functions are analogous to that of the archivist.

Some specific examples of occupations in the media specialists cluster are: farm broadcaster, information specialist, aerial photographer, technical writer, archivist, magazine editor, public relations specialist, newspaper farm editor, journalist, curator, and director of information.

Compared to the other occupational groups defined in the USDA report, the aggregate supply of and demand for media specialists is quite small. The results show an

average annual demand for 505 food and agricultural media specialists compared with an average annual supply of 692 during 1980-1985.

Media Specialists, 1980-1985

Supply 692

Demand 505

Editors, reporters, public relations specialists, and publicity writers account for some 70 percent of the projected annual demand. On the supply side, 63 percent of the graduates are projected to be produced in media-oriented curricula of colleges of agriculture and natural resources. The other 37 percent of the supply is projected from related programs such as communications and journalism. Fewer than 40 percent of the graduates are expected to have degrees beyond the baccalaureate level.

Analysis

The projected average annual supply of graduates from media-oriented curricula in colleges of agriculture and natural resources accounts for only 87 percent of the projected demand for food and agricultural media specialists. However, the competition of graduates from communications and journalism schools suggests an oversupply of qualified individuals during the early 1980s in this occupational cluster.

Three areas account for the more significant demand for media specialists. Governmental agencies and educational institutions employ media specialists to report research findings to producers, processors, and consumers. Agribusiness firms and commodity organizations employ editors and writers to publish newsletters and magazines for employees, members, and customers. Newspapers and magazines require editors for farm and ranch subscribers. Advertising and public relations firms employ individuals as account executives for agricultural and forestry clients.

The demand data show a very limited need for librarians and archivists with food and agricultural expertise. Also, there is a quite small demand for agricultural radio and television announcers because many stations are using syndicated reports of a relatively few farm and ranch broadcasters.

The general oversupply of media specialists indicates that graduates having multi-disciplinary preparation in food, agriculture, or natural resources and communications are best qualified for available positions. Non-agricultural journalists and communicators are expected to continue to be a major competitive factor and should more than compensate for any expansion of career openings for food and agricultural media specialists during the early 1980s.

Agricultural Production and Management Specialists

This occupational employment group includes persons directly involved in the production of raw agricultural products such as grains, fibers and livestock, including dairy and poultry. Also included are the growers of horticultural crops—fruits, vegetables, flowers, and landscape plants.

Examples of specific occupations include farmer, rancher, farm manager, farm labor supervisor, tree farmer, nursery operator, greenhouse superintendent, herd manager, and arboriculturist.

During 1980-1985, the projected average annual U.S. demand for higher education graduates for entry positions as farmers, ranchers, and other producers of raw agricultural products is 6,245. This compares with an expected average annual supply of 6,238. Farmers and ranchers (owners and tenants) account for 59 percent of the projected demand. The remaining 41 percent is identified as farm and ranch managers, farm labor supervisors, and food and agricultural producers not usually classified as farmers or ranchers.

Agricultural Production and Management Specialists, 1980-1985

Supply 6,238

Demand 6,245

Projected supply data indicate that only 5 percent of the graduates competing for positions as agricultural production and management specialists will have master's degrees, with the remainder having baccalaureate or associate degrees. Some 86 percent of the graduates are projected from the curricular areas of agricultural business management, plant sciences, and animal sciences.

Analysis

There appears to be an adequate supply of college graduates to fulfill the demand for agricultural production and management specialists during 1980-1985.

It is expected that the trend toward larger and more complex production units will continue during the 1980s. This suggests that somewhat fewer farmers, ranchers, and other producers will be required when compared to the previous decade. However, it is anticipated that the decline in the number of openings for farmers and ranchers during the 1980s will be at a much slower rate compared to the 1960s and 1970s.

Further intensification of animal production units, including more confined swine and cattle feeding opera-

tions, and the expected larger crop operations will increasingly require management expertise gained from higher education in agriculture and natural resources.

The strongest demand for college graduates in the agricultural production and management specialties during 1980-1985 will be for people who have significant applied production experiences or farm and ranch backgrounds combined with college degrees in farm management, ranch management, agricultural mechanization, agronomy, and animal sciences. Individuals without farm or ranch backgrounds or related production experiences will continue to encounter significant difficulties in obtaining positions in farm or ranch operations.

Miscellaneous Agricultural Specialists

Included are a diverse group of professionals in food and agriculture with specific technical skills which are not accommodated in the occupational groups discussed previously. The technical expertise required of these workers varies widely.

Miscellaneous Agricultural Specialists, 1980-1985

Supply 3,628

Demand 7,301

Some examples of occupations identified in this cluster are: animal caretaker, veterinarian assistant, vegetable inspector, farm implement mechanic, egg grader, meat department manager, zoo keeper, fruit inspector, and farm equipment assembler.

The projected average annual demand for miscellaneous agricultural specialists during 1980-1985 totals 7,301. This compares with an expected average annual supply of 3,628. Animal caretakers and implement mechanics and assemblers account for nearly two-thirds of the annual openings.

Occupations in this group generally do not attract college graduates with degrees beyond the baccalaureate level. Therefore, the projected supply includes 56 percent baccalaureate degree recipients and 44 percent associate degree graduates.

Analysis

The largest demand component is for some 2,675 animal caretakers. The diversity inherent in this occupational employment cluster permits associate degree graduates to compete very well with baccalaureate degree recipients. Also, there is significant evidence that individuals previously having earned animal biology degrees may strongly compete for these positions and the actual supply may be somewhat greater than the totals listed in the study.

Within the miscellaneous agricultural specialists category, the most significant shortages are identified for farm implement mechanics and related mechanization positions. Graduates in these areas should encounter a very strong job market during the early 1980s.

Increasing demand for convenience foods and for meals consumed away from home undergirds a continued strong employment market for graduates in food technology programs. Rising concerns with food safety and nutrition indicates a strong demand for graders and inspectors.

How the Study Was Conducted

The average annual supply and demand projections for college graduates in the food and agricultural sciences were primarily based upon data sources maintained by various agencies of the federal government. It should be noted that there are significant differences in the educational and occupational taxonomies used to classify data by the various agencies. Consequently, it was necessary to use a panel of experts representing U.S. colleges of agriculture and natural resources throughout the study to integrate information bases into a single consistent analytical model.

A sumary of the methods used to determine the average annual supply and the average annual demand for food and agricultural graduates follows.

Average Annual Supply

The study defined supply as new associate, baccalaureate, master's or doctoral graduates of higher education programs representative of the food and agricultural sciences who are qualified for and seeking employment in food and agricultural occupations.

The chief data source used in determining the average annual supply was the Higher Education General Information Survey (HEGIS) conducted annually by the National Center for Education Statistics (NCES) of the U.S. Department of Education.

The number of degrees (associate degree or higher) which are annually conferred by all accredited public and private colleges and universities in the United States are included in the HEGIS data. Degrees are classified by level—associate, baccalaureate, master's, doctorate of philosophy and doctorate of veterinary medicine—into discipline divisions such as agricultural and natural resources and degree specializations such as dairy science.

Of the several hundred degree specializations included in the HEGIS data, the panel of experts selected 122 specializations for which some or all of the graduates were identified as being qualified for jobs requiring food and agricultural expertise. In each degree specialization, the panel estimated the percentage of graduates by degree level who were qualified for food and agricultural employment.

Using *agricultural* degrees such as agronomy, poultry science, veterinary medicine, and forestry plus *agricultural-related* degree specializations such as economics and biology, eleven educational clusters were defined to aggregate the 122 degree specializations. The eleven clusters were: general agriculture, agricultural business management, agricultural engineering, agricultural related sciences, agricultural social sciences, animal sciences, food sciences, international agriculture, natural resources, plant sciences, and soil sciences.

On the basis of a format patterned after the NCES model for projecting future numbers of college graduates, 1985-1986 projections were established for higher education graduates in each educational cluster. Average annual supply was then defined as the mean value of the 1976-1977 actual supply and the 1985-1986 projected supply. The average annual supply was determined for each degree level in all educational clusters.

Average Annual Demand

The primary data source utilized in calculating the average annual demand was the Occupational Employment Statistics (OES) Program of the U.S. Department of Labor. The national industry-occupation matrix system provides tabular presentation of current and projected employment statistics cross-classified by industry and occupation. The matrices used were based on the 1970 Census of Population concepts and classification systems. With data from a base year matrix, a projected year matrix, and with job separation rates developed from decennial census data and working life tables, the matrix system was used to determine future job openings for occupations. The national matrices have been used as important tools for employment projections and policy decisions.

From the total roster of OES occupations, the panel of experts selected the occupations which likely require persons having college degrees in the food and agricultural specializations. Likewise, the panel of experts reviewed all OES industries and chose those which employ individuals with food and agricultural higher education degrees.

After selection by the panel of experts, the chosen occupations and industries were arranged in matrix format.

For each industry chosen, the panel reviewed each selected occupation and estimated the percentage of workers having food and agricultural higher education degrees. Subsequently, the total number of persons in each selected occupation having food and agricultural higher education degrees was determined by adding employment data in a given occupation across all selected industries. The number in each selected occupation was calculated for 1976 on the basis of employment data. Corresponding data were established for 1985 based upon U.S. Department of Labor projection methods.

Average annual employment growth was determined by dividing the total growth during the projection period by the number of years. Using dietitians as an example, the 1976 employment was 45,790 and the 1985 projection is 51,997. With nine years in the projection period, the annual growth is 6,207 divided by 9, or 690.

Employment demand is also created when individuals leave their jobs because of retirement, disabilities, death, or other reasons. Using U.S. Department of Labor methods, annual replacement numbers were calculated for each selected occupation.

Average annual demand in each occupation employing persons with college degrees in the food and agricultural sciences was determined by adding average annual growth and average annual replacements.

The 83 selected occupations were aggregated into eight occupational clusters as follows:

- Scientific and professional specialists
- Manufacturing and processing scientists and engineers
- Sales and service representatives and purchasing agents
- Administrators, managers, and financial advisors
- Educators
- Media specialists
- Agricultural production and management specialists
- Miscellaneous agricultural specialists

Data included in the OES program did not provide definitive demand statistics for high school agriculture teachers, college faculty employed in the food and agricultural sciences, and Cooperative Extension Services (CES) agricultural specialists. Consequently, the annual demand data for high school vocational agriculture teachers were based upon statistics published yearly by the Agricultural Education Division of the AVA. The annual demand for college faculty employed in the food and agricultural sciences was based upon a 1979-1980 Clemson University survey contracted by the USDA. The demand for CES agricultural specialists employed at local levels and on college campuses was determined from USDA data.

Relating Supply and Demand

The panel of experts did adjust the average annual supply of graduates in each degree level for each educational cluster by estimating the percentage who do not compete for U.S. employment in the food and agricultural sciences. Adjustments were made for graduates who return to native countries, continue in higher degree programs, or elect employment in occupations unrelated to the food and agricultural sciences.

Finally, the panel allocated percentages of graduates by degree level in each educational cluster to the various occupational clusters. After the percentage allocations were established, the resulting supply and demand totals were calculated.

Average Annual Supply and Demand, College Graduates Qualified for Positions in the Food and Agricultural Sciences—Agriculture, Natural Resources, and Veterinary Medicine, United States, 1980-1985.

Occupational Cluster	Demand	Supply - Degree Level				
		Assoc.	B.S.	M.S.	Ph.D.& D.V.M.	TOTAL
Scientific and professional specialists	14,986	—	10,227	1,664	1,888	13,779
Manufacturing and processing scientists and engineers	5,544	44	3,377	806	348	4,575
Sales & service representatives and purchasing agents	15,319	1,378	10,991	922	143	13,434
Administrators, managers, and financial advisors	6,184	—	3,185	1,044	64	4,293
Educators	3,696	—	3,231	1,358	748	5,337
Media specialists	505	—	419	267	6	692
Agricultural production and management specialists	6,245	1,384	4,497	357	—	6,238
Miscellaneous agricultural specialists	7,301	1,726	1,902	—	—	3,628
TOTAL	59,780	4,532	37,829	6,418	3,197	51,976

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