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FORTY YEARS OF HELPING THE FARMER WITH KNOWLEDGE[1]

By Dr. W. H. CHANDLER

UNIVERSITY OF CALIFORNIA

IN 1900 the United States Department of Agriculture, state experiment stations, state agricultural colleges and secondary agricultural schools expended about two and a half million dollars, in 1940 more than a hundred and ten million dollars; this last includes the cost of vocational agriculture in high schools. In 1900 many of the colleges were still accepting students with little or no high-school training. Such subjects as mathematics, chemistry, physics and English were taught in courses about equivalent to those taught in high schools, and a considerable percentage of students enrolled in agricultural colleges were taking these courses to prepare for admission to other colleges. The teachers in agricultural subjects seemed to be exceptionally earnest and had developed forcefulness by their contact with robustly critical audiences at farmers' meetings. What most of them taught, excepting teachers in soil science, animal nutrition and entomology, was the result of reasoning from inadequate knowledge of plant and animal processes, experience of exceptional farmers who wrote for farm journals or talked in farmers' meetings and data from rather poor field trials that were beginning to be published.

Soon after 1900 new men were taken on rather

[1] Parts of the address as retiring vice-president and chairman of the Section on Agriculture, American Association for the Advancement of Science, Dallas, Texas, December 30, 1941.

rapidly in colleges and experiment stations, mostly men with good personalities who manifested an interest in agricultural problems and had completed only the rather superficial curricula for the bachelor's degree. These undergraduate courses had not been intensive enough to disclose capacity or lack of capacity to study such problems as they would encounter. Many of them never acquired as much scientific training as their teachers had. They tended to emphasize the view that they were practical rather than scientific. Some depended for success upon rather arrogant forcefulness and contact with the influential farmers and business men such as bankers and newspaper men. Many such business men had become interested in improving the farmers and were glad to support plausible efforts by such aggressive young men. Some of these men whose spirits were too animated for patient, effective study, accepted industrial employment during or following the first world war, with companies expecting to profit by farmers' increased purchasing power.

The ten or fifteen years following about 1900 may, I think, be called the propaganda era in agricultural education. With the purpose of uplifting the farmer quickly men were sometimes employed for extension activities who knew too much: a worker in one agricultural college said that his extension associate could make more discoveries during one lecture than the best scientific worker could make in a lifetime of research. Perhaps the dogma that was the subject of most sermons was that of the water-conserving effect of a dust mulch maintained by diligent cultivation. Yet one experiment station in seeking support now claims to have saved the farmers of its state ten million dollars a year by having discovered that the story of the dust mulch was not true.

By 1904 or a little later many of the agricultural colleges had entrance requirements as high as those of other colleges and the students took the same courses in chemistry, physics, mathematics, botany and zoology as students in colleges of letters and science. These better students tended to be critical of superficial, applied courses. When such students graduated and were employed in the colleges, they wanted to become as well trained as the botanists or zoologists. Somewhat before 1920 such young men were improving the teaching and research of the colleges considerably. Extension activities, however, continued to be of the propaganda type until the representatives of the colleges living near the farmers, the county agents, discovered its ineffectiveness or even harmfulness.

Shortly before and for a number of years after the establishment of farm advisers or county agents in the counties, as a result of the Smith-Lever act in 1914, much was said in extension central offices about salesmanship in presenting ideas to farmers. Extension offices were influenced by what seemed to me a very flatulent pedagogy. To some of the educational advisers the farmers were pathetically dull. One very impressive teacher, from a university that was insulated from farm problems by several million tenement dwellers, was at great pains to tell a convocation of county agents and extension specialists how they could improve their techniques by studying the Hearst newspapers, learning to express themselves in words of one syllable. The actual problem these workers faced was not dullness in the farmers but the uncertainty that what they would say would be true: intensity of personal interest accentuates the understanding of farmers.

Under such influences as these some of the earlier county agents undervalued detailed knowledge of crop and animal problems and overvalued smart politics: skill or imagined skill in manipulating farm groups in the interest of "objectives." In sections that I know, experience has tended to correct this evil. Being so close to the farmers, county agents receive very unpleasant reactions when their manipulations or their objectives prove not to be beneficial. Furthermore, they find that most of the questions good farmers ask can not be answered by any one except after new research, if at all. In the states with which I am acquainted, objectives, smart politics and other heroics have gradually receded, and farm visits, field trials, demonstrations at trial plots and quiet helpfulness at conferences and community center meetings have taken their place.

When a county agent finds questions of considerable importance to his constituents that he can not answer, he gets in touch with an extension specialist from whom he thinks he may obtain an answer. If the specialist can not answer, they consult some one in the experiment station or some conveniently located worker in the U. S. Department of Agriculture. If no one has the answer, a study of the problem may be started, probably in both the field and the laboratory, the county agent keeping interested farmers informed concerning progress of the study. Sometimes the procedure is in the opposite direction: a scientist who has started from leads in the fundamental aspects of his field of study may think he has made discoveries of value to farmers. If he is moderately humane, he does not write a spectacular story for the newspapers and risk causing unwise investments. Instead, he will get trials made cautiously through county agents where the discovery is most apt to be useful.

Probably as many well-trained scientists are doing research in the U. S. Department of Agriculture as in all the experiment stations. I am acquainted only with some parts of the Bureau of Plant Industry; workers in these tend to cooperate with county agents

and with the experiment stations and avoid bringing confusion and ill-considered practices onto the farms. Every worker in plant science must be interested in this bureau. In recent years it has been searching the group of graduate students in plant science for the very best men in all the different aspects of botany: probably nearly half the well-trained young men in plant science in the country are in it. Being held each to the solution of certain definite problems, these men bring to their work a continuity of effort that is not always possible for teachers or even for experiment station workers with local obligations. They can follow their leads across state lines or even into foreign countries. They tend to work on problems that the best plant scientists have recommended as needing the comprehensive study a large organization rather well supplied with funds can support. If funds for maintenance of this bureau should be reduced, a considerable part of its special value would be lost, and growth of plant science as well as help to the farmer would be retarded.

County agents are learning, I think, that for effective help on problems that arise in their counties, they must find men whose thinking concerns the processes and responses of crops and animals rather than practices. Little initial help comes from mere trials of practices: farmers' rough trials over wide areas and throughout the years seem to have given nearly all the information that can be given by simple comparisons of practices. In fact, one noted experiment station director has said that experiment stations of the world have spent millions of dollars proving that farmers are right.

Nearly all the information that has enabled farmers to protect their crops and animals against diseases, animal parasites and malnutrition has been obtained by use of techniques in basic sciences such as chemistry, physics, botany or zoology. To become effective in studying crops or animals, or their parasites or soils, and safe in teaching the results of such studies, a man must acquire good training in one or more of these basic sciences and a skeleton of orderly, detailed knowledge concerning the processes, environmental responses and other characteristics, of the group of crops, animals, parasites or soils that constitute his field of study. The graduate student in horticulture, for example, should obtain as much training in chemistry and botany as workers in botany obtain, and this skeleton of knowledge about his class of horticultural plants besides. Even if his undergraduate curriculum contained as much science as a curriculum for students in botany would contain he will need more time for his training than a graduate student in botany would need. Students whose undergraduate training was in schools of chemistry or of letters and science with science majors, are coming to be preferred as graduate students in some departments of soil technology, plant pathology, horticulture, agronomy and other fields in agricultural science; and if applied agricultural courses come to precede courses in sciences in all agricultural colleges, the new workers on agricultural problems are apt to be nearly all from colleges of chemistry or of letters and science.

The system of publishing technical papers, piecing together systems of knowledge about plants, animals or soils, for example, is indispensable for effective aid to farmers. Attempts at graduate or undergraduate teaching or advice to farmers would be hopeless shams without it. A man may be exceptionally well trained when he leaves the graduate school and hopelessly deficient within ten years if he does not have ready access to this growing literature; and, valuable as the county agent is, he would be helpless without the aid it gives him directly, by his own reading, or indirectly, through his contacts with scientists who read it.

This literature, I am convinced, could be used more extensively and more effectively by workers and students if it were published in an orderly system of journals each filed in definite places in libraries and coming regularly to the desks of members of societies for special fields such as horticulture or plant pathology. Such society journals, each publishing all the papers in the country or even in a larger unit, in a fairly well-defined field would not only enable members to use all the new data in their fields more quickly and effectively, they would also give workers in related societies more ready access to such of these data as they might need. The data would probably be more accessible also because presented with less cumbersome discussion and review of literature. Journals published by chemical societies seem to have developed the best system of reporting only records and discussion enough for the needs of workers who use them. Biological societies, such as the American Botanical Society, seem to me to be making great progress in this regard. Apparently, however, they have fewer paying members who do not publish and the nature of their problems make longer reports necessary, so that the dues of such a society will not pay for publishing nearly all data obtained by members. A periodical such as the *Journal of Agricultural Research* that publishes papers from many fields usually does not go regularly to the desk of workers; and if it did it would contain such a large percentage of papers in which a worker is not interested that he would not be apt to develop the habit of examining it carefully. Even a journal of this kind, however, has a great advantage over papers published by experiment stations: it is usually edited by men free from close association with the authors. The average paper in the *Journal of Agricultural Research* seems to me to

present its data very much less cumbersomely than the average experiment station technical paper. Because of this cumbersomeness and editions much larger than enough to supply all really interested libraries and workers, publishing in experiment station technical papers is much more expensive than publishing in journals. Experiment stations could publish much more usefully by buying space in journals, and some experience convinces me that they could save 75 to 90 per cent. of their printing cost for technical papers.

Very few men with money for endowments have given support to journals of special scientific societies. By giving only to separate research institutions, they seem to me to be supporting the tool houses around the temple that is being built and ignoring the temple. If they gave to society journals, each a well-placed part of an orderly system of publishing data, they would be improving the breadth of knowledge and vision of teachers and research workers; and at the same time they could be certain that for every dollar they gave to promote economical, effective publication, they would prevent research institutions from spending two or three to ten dollars for expensive, cumbersome publication. In other words, they would be contributing more toward actual conduct of research than if they gave the money directly to the research institution.

Obviously, only a small percentage of graduates of colleges of agriculture can become resident or extension teachers or county agents or research workers. A considerable number obtain positions in which they do not use any of the training they received at college. Observations at a few institutions make me think that agricultural graduates whose training is built around some science, especially chemistry, and those whose training includes a considerable amount of economics are a little more apt to obtain acceptable positions than others. And I believe the boy who goes back to a farm of his own and who is mentally able to use college training will find orderly knowledge of the chemistry and other characteristics of his soils, crops and animals, more helpful in decisions he must make in managing his farm than knowledge from courses built around farm practices.

Men who worked for the establishment of agricultural colleges, and early teachers in the colleges, expected nearly all graduates to operate farms. Rather few have done so, long. A large percentage have not had farms large enough to earn a living, and farm employment rarely can pay enough to permit accumulation of capital. Furthermore, no kind of college training seems to give the graduate as great an advantage in competition with farmers trained merely by farm experience and observation in their communities as was expected. In some states, perhaps because of disappointment at the rather small number of agricultural college graduates who return to the farm, secondary agricultural schools have been established. And a system of high-school training in agricultural subjects has been established throughout the country.

A difficulty that all systems of training for farming encounter is the fact that there are not enough farms for all boys born in country districts: unless an increasing number of farms are to be too small to earn a living for a family or some invention makes small manufacturing units on a farm possible, about a third of the boys born in country districts must find employment off the farm. From experience of other countries and observation in this, we can, I think, be certain that the more farmers we have above the number necessary to farm all the land well, in units large enough to support a family with at least the bare necessities, the smaller the total yield from the farms will be. For when the farm is too small the farm and the family will tend to compete: money that is needed for fertilizer or for better seed may have to go to the family for some desperate need, or the urgency for cash from a single crop such as cotton may prevent rotation of crops to maintain soil fertility. Education, therefore, can not wisely be directed toward keeping more boys on the farm, actually to reduce the national income. When farms are so small that three men are doing the work that two could do as well, the extra farmers will not be contributing as much to the national good as a WPA worker using a shovel to make a road that could be made at a small percentage of the cost with good machinery; for the surplus farmers actually reduce the national income, and we *do* have the road for our payment to the WPA worker.

A school can rarely determine in advance which boy should stay on the farm. Teaching agriculture to a boy who never farms will, perhaps, do no other harm than prevent him from learning something else that would be more helpful to him. If the teaching, however, causes him to remain on the farm and if he finds after he has a family that he made a mistake, it, of course, does him great harm. People who are so anxious to have agriculture taught as widely as possible seem to me to undervalue a good farm as an educational institution. Young men have always improved their farm practice by observing good farms in their neighborhoods. Since the county agent system has become effective, a good farm has become an even better educational institution. On it all knowledge is being used that is known to apply and trials of new discoveries are apt to be in progress. Work on such a farm is probably the best training for actual farming that a boy can obtain.

Of the hundred and ten million dollars expended in agricultural research, extension and resident in-

struction, somewhat more than fifteen million are for special high-school classes in vocational agriculture under the Smith-Hughes act. Such observations as I have made suggest that nearly all the training of these teachers beyond their undergraduate years is in teaching methods and that after they begin teaching their contacts are with men whose interest is in teaching problems rather than with men who are associated with, and trained to evaluate, the growing body of knowledge about crop, animal and soil problems. In other words, these teachers who have a very great influence on many a boy's life seem to me to be guided by too much pedagogy and too little truth. There seems also to be in the system too much of the point of view in the propaganda era; and the students seem to be taught to expect too great an advantage from these courses when they begin competition with farmers whose knowledge was gained by experience: some of the projects suggest a view that these students will be able to succeed where whole groups of experienced farmers have failed. Some may, of course, succeed in growing and selling breeding stock because of the advertising the project gives them. To win a prize in a Future Farmers of America contest gives economically valuable publicity. The integrity we like to expect from men engaged in any kind of teaching, however, and especially teaching of agricultural science for which confidence has been cultivated at great public expense, demands that these conspicuous successes be not advertised unless the careers of nearly all students in the same classes are studied to see how many are benefited and how many are misled into staying on the farm to fail because of too little capital or unfortunate location, failing perhaps after they have families and find making a change to employment in other industries nearly impossible. In some districts Smith-Hughes teachers are anxious to have as many students as possible, sometimes taking students who go on to college and are handicapped by lack of basic training. If such a student goes to an agricultural college that permits him to take applied courses without science prerequisites he is apt to face life at graduation without opportunity for employment at any work that requires a technique, probably without money to start farming, without experience enough in any basic field to know whether or not he is suitable for graduate work, and with so little basic training that four or five years of graduate work would be required to prepare him for good teaching or research.

Many very fine young men are going into Smith-Hughes work. I believe they would serve farm life more safely and usefully if many of them were employed as special assistant county agents to give attention to young men who are actually beginning to farm instead of having to give so much of their time to boys who will not or should not farm; and if those in the high schools taught mainly the nature and operation of farm machinery, so that whether the boy leaves the farm or stays on it he may find use for what he has learned.

With the Smith-Hughes teaching as now organized, the grave responsibility the teachers assume and their isolation from men trained to study farm problems should cause them to seek the closest possible association with county agents, who have good contacts with both scientists and economists. Help of the county agent, I believe, should always be sought in directing and interpreting Smith-Hughes projects on farms.

I believe that in the school system too many grave, economic decisions are made by reasoning from pedagogic data or pedagogic dogmas. When a boy decides to stay on the farm or the teacher encourages him to do so, an economic decision is made. Either the schools should have the advice of men well informed concerning the long-time agricultural outlook and the relation of farming to other parts of the industrial system or teachers should confine themselves to developing aptitudes in basic fields of study or certain handicrafts, and should avoid activities that tend to choose a boy's lifework for him. Certainly a teacher should be reverently modest before the overwhelming complications a boy faces when he is considering farming for a lifework. Great harm can be done by the utterances of pompous high priests of the school system:

> The most important crop is the human crop.
>
> Any community that lets its young men get away is a dead community.
>
> The only place to keep them in the community is on the farm.

I believe good might follow if over the desk of every research worker and every extension worker and every agricultural and soil conservation worker and every teacher, especially every educational administrator, this motto were placed: "Blessed are the meek for they will not mislead their brothers with poorly considered teachings or strutting shams." The God of Nature reveals his laws, I believe, very rarely to the propagandist or to the pompous, or even to the merely zealous, but rather to him who trains diligently in the technique and the records of a system of knowledge, who records his own observations clearly and briefly for the benefit of all workers, who reviews and reorganizes his knowledge frequently in the light of new discoveries, who consults as frequently as possible with workers in his field and related fields, hoping for a vision that points to a safe advance in human welfare, and who is meek enough to see a vision unobscured by projections of himself.