AGRONOMIC PROBLEMS OF THE SUGAR BEET INDUSTRY IN RELATION TO A RESEARCH PROGRAM

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In speaking to you whose experience has led each one in his field much farther than I can presume to follow, I wish, first of all, to recognize the great achievements in research that are already to your credit. The foundation for many of the practices now followed in this industry as well as important changes in its conduct have been due in no small part to the effectiveness of your work.

I doubt whether anyone could bring up a problem in connection with the culture and management of the sugar beet crop that has not already received consideration by some member of this group. Yet, who can say that even the oldest of these problems has been fully solved? The answer that appeared so convincing under one set of circumstances may be entirely inadequate when the circumstances themselves are different. A practice, the merit of which appeared so evident in experimental plots, has not passed its final test until its application has been accepted and found feasible.

I hardly remember when I was not interested in the problems of the sugar beet industry, agronomic and otherwise. My first vivid recollections of the sugar beet date back to a 4th of July morning about 1902, when the highway passing the beet field on our home farm was busy with a stream of horse-and-buggy traffic of holiday picnickers while I spent the morning on my hands and knees trying to make one beet grow where two grew before. Right then I decided that growing sugar beets had to justify itself as an economic enterprise, for it certainly had no special appeal as a way of life.

Of course, with the sugar beet, as with any other crop, the keenest interest of grower and handler alike is in the price. However, this discussion has nothing to do with either marketing or politics. It deals with sugar beet culture.

There can be little question that the growing of a crop of sugar beets in any manner in keeping with the American way of farming, becomes most complex in its labor aspects. Heretofore, we have relied largely on agricultural engineers to remove the tedium of hand labor from many of our farm practices. In a large measure they have been successful, so successful that their achievements have often been the object of question on the part of those who would find work for idle hands regardless of the nature of the drudgery involved. From the curing of hay on the clotheslines of Norway, through the beet fields of continental Europe, to the coffee plantations of Mexico, on slopes so steep the worker ties himself into the field, I have yet to see any system of hand-worked agriculture that holds any appeal socially, economically or in any other way to the American farmer. If the growing of sugar beets is to become more widespread on the thousands of acres of excellent land that never grew the crop before, then the amount of hand labor in relation to the value of the crop must be reduced.

By and large, I still think that this is a problem for the agricultural engineer; but maybe the agronomist can simplify his task if we re-examine our

own ideas on just how to grow a crop of beets.

In Michigan, we grow corn in anything from 28- to 42-inch rows; we grow field beans in anything from 28-inch rows to drilling them solid; we are a leading potato state with the crop in 30- or 40-inch rows or take your pick in between; we grow chicory in rows, mint in rows, soybeans in rows; and when it comes to sugar beets we think we need something still different from the multitude of widths we use for all the other crops. If that isn't enough to provide a 40-horse power headache for any agricultural engineer or maker of farm equipment, - then you tell one.

We adopted the growing of sugar beets from the hand-managed agriculture of Europe. Along with it we've accepted, possibly without careful examination, most of their cultural practices. With all due respect to the capability of European agriculturalists, conditions are different in North America from those prevailing in Europe, - for which we may be truly thankful.

Returning to row-widths, (and I use this old problem as illustrative rather than inclusive), I note from a California publication that it has been "fairly well demonstrated on the fertile peat soils of the Delta that more sugar to the acre can be secured through closer spacings than has been secured in the past by ordinary 20-inch rows and 12-inch spacing." Likewise, Professor W. Morley Davies of Great Britain reports that he ran an experiment, analyzed and cross-analyzed by the most approved statistical methods, which proved that there was a "significant increase to be gained by using 15- or 18-inch rows instead of 21 or 24." Significant, but is the application universally or even generally practical? Why, there isn't a single Belgian or Percheron on the farm of the Michigan State College that can walk down the middle of an 18-inch row of beets to pull a cultivator, - they walk on both rows of beets instead. And when we find we can't get a tractor down these narrow rows either, we tend further to complicate the problem by making paired rows, necessitating new adjustments in planter equipment, cultivator equipment, and harvest equipment. A grower recently told me he had to buy a new tractor to fit his new cultivator so he could grow beets in the most approved manner.

I'm not recommending that we launch on a program of wider rows for sugar beets, but I am suggesting we re-examine this and other agronomic problems in the light of what farmers in general have to do, rather than on the basis of what may have been deduced under special circumstances.

In 1939, we started a restudy of this problem as the result of a suggestion by Fred Bach, research agriculturalist for the Michigan Sugar Company. Bach, like myself and others, was advocating narrower rows in a section where beet growers also grow beans. Using results of old experiments and some agronomic inferences which the Farm Management boys pulled out of the grab bag in their cost account studies, we could prove that a beet grower could make $150 on every ten acres of beets by changing the cultivator from 28 inches for beans to 22 inches for beets. It worked out swell statistically. The only difficulty was that the farmers kept on growing beets in 28-inch rows.

Now maybe, on an experimental plot, we could get an extra ton and a half of beets in narrower rows; but the farmer, with his cultivator set for beans, and remembering the last time he'd knocked the hide off his thumb with a monkey wrench, said, "I'll let the beets go another week till I can give the beans one more run." - As a result he lost in practice, through failure to control weeds,

what we thought we had gained in theory. (I don't know what the standard error of that conclusion is. But as a practical consideration, the farmers still use 28-inch rows and there are about 17,000 degrees of freedom when it comes to determining what Michigan beet growers are going to do).

The general idea we followed in our 1939 trials was that if 28-inch rows are bad, how much worse are 38-inch rows? Maybe we can grow corn, beans, beets and potatoes all at the same row width, - so we tried it. Thirty-eight inch rows made no difference in 1939 with beans, improved our yield of corn, were essentially standard for potatoes, and with sugar beets proved no worse than 28-inch rows, and under the conditions of this experiment, fairly typical of the environment under which much of the Michigan crop was grown, both 28- and 38-inch rows outyielded 22-inch rows and were vastly superior in net dollars per acre.

No, we haven't settled the problem. But we've found an exception to the old rule, and, if the exception covers any appreciable range of conditions, one means of reducing labor and reducing expense for the average sugar beet grower is indicated.

Another agronomic problem which we in the eastern sugar beet area must consider, comes in connection with our breeding program. You of the west have already upset tradition, have your own varieties which meet your special needs, and grow your own seed. Our plant breeders in the east are also doing a good job. We have lines resistant to leaf spot, as you have. We have hybrids of superior vigor. We have a strain that maintains satisfactory sugar content on muck soils whereas others fall off. But we don't know what to do with them.

Must we follow the tedious methods of seed production used abroad? You in the west don't. You grow your seed after the American style of farming. Must we send our varieties to the southwest to be increased where winters are less destructive and seed yields large? That method, too, has its faults. Control of seed stocks is secondhand. Our best lines may succumb to curlytop, Curlytop resistant lines may be inferior in tonnage or sugar content when grown in Michigan or Ohio. For many reasons the home growing of seed is superior; so we are looking for feasible methods of growing seed, at least foundation seed, in the eastern area. We have found one locality where we can over-winter beets in the field, but the land is acid and infertile. Can we get satisfactory seed crops on that land by using lime, fertilizer and manure? We can get good seed crops from small stecklings. Is this method cheap enough? Is vernalization merely an interesting phenomenon or does it provide a practicable means of producing sugar beet seed in a single season? Twenty years ago they told us we wouldn't grow alfalfa seed profitably in Michigan. Maybe not, but in 1936, we grew more of it than any other state and we are essentially self supporting in this respect, to the tremendous advantage of our alfalfa growers.

We have a chicory industry in Michigan which, like the beet industry, was once entirely dependent on Europe for seed. According to European literature the chicory roots had to be over-wintered in storage, transplanted to an 18 x 36 inch spacing, the plants cut by hand and wrapped in cloth, 4 stalks per bundle, to avoid shattering, and the seed was priced to the American industry at anywhere from 30¢ to $1.50 a pound, depending on how friendly the European folks happened to be with each other.

Discarding European tradition, we sowed chicory in barley, overwintered

it in the ground, as the west does with beets, cut it with a binder and threshed it with a grain thresher, producing, at current war prices, something over $300 worth of seed an acre. We never expect the chicory industry again to be dependent on remote sources for seed. What has been done with alfalfa, and chicory, what the west has already done with sugar beets, the rest of the beet growing area can do too, when research tells us how.

Our worst disease in the east is leafspot (Cercospora beticola). Right now we are turning to dusting and spraying, defensive measures that add to the expense of producing sugar. Plant breeders can aid materially in reducing leafspot losses if agronomists provide a better means of growing the seed of their leafspot resistant varieties. Incidentally, breeding and cultural practices which lead to the development of strong healthy tops have much to do with the practicability of any harvesting machinery.

If, to control leaf diseases and provide strong tops, spraying or dusting are necessary, are there any additional benefits beyond disease control which might accrue if the right formula is used? In some of the spraying experiments there has been noted a seeming tendency for sugar content of the sprayed beets to be relatively higher even in the absence of disease on the untreated plants. Our horticulturalists tell us that Michigan's famed sour cherries become sweeter when the trees are sprayed with suitable copper formulae. Is there a comparable relationship between certain formulae and the sugar content of beets which goes beyond the effect in controlling leaf spot?

Another of our troublesome diseases caused by a complex of organisms, is damping off or black root. Pathologists tell us the trouble is intensified when beets are grown after alfalfa, sweet clover and other soil improving legumes. So we generally give lower value crops such as corn and beans the great advantage of following immediately after alfalfa in the rotation. Some of the best beet crops in the east follow alfalfa, while others when so planted succumb to disease. What is the difference? Would the proper time or manner of plowing, a different method of seed bed preparation, some soil treatment, a special fertilizer application or a resistant variety make the growing of beets on a plowed-under alfalfa sod more dependable? If it would, that too would reduce labor for each ton of beets and each pound of sugar.

What effect do different preceding crops have on beets, and beets on following crops? J. G. Lill of the United States Department of Agriculture is seeking an answer to this question with work in Ohio and Michigan. No one agronomist can study all the crops which are involved on an economic basis throughout the United States, but Lill's work has already shown sufficient differences in the growth of crops following oats, corn, soybeans and sugar beets to warrant much more study of this nature. Nothing has been found to support the fanciful claims occasionally heard that the sugar beet is a soil building crop. Likewise the response of other crops after beets has not reflected to the discredit of beets in comparison with other row crops and non-legumes. Such information should help the beet crops find its strongest place in the rotation, a problem which of itself demands constant consideration.

As a general statement of the sugar beet research problem, there are highly cogent reasons for devoting attention to that type of research which seeks new truths without immediate regard to their potential application. The plant breeder, for example, has only partially fulfilled his mission when he has developed a superior variety. He will have contributed much more to his

field, and eventually to agriculture, if in the process of breeding a superior variety he has learned one thing more about the processes of plant breeding or the manner in which the characters of his plants react. The agronomist who starts some of his questions with "Why?" rather than "Whether?" will eventually make a lasting contribution to his field.

However, most of the problems of the sugar beet industry are intensely practical problems which demand practical answers. Those whose research activities are sponsored by the sugar beet industry directly are perhaps unlikely to lose sight of that industry as a highly important economic enterprise; the rest of us cannot afford to do so.

That cloistered individual who works and sits and thinks as one apart may fulfill a mission in life. Should he ever become a member of society, I am certain we should be greatly bored in his company.

We have meetings such as this at which agronomists and sugar beet technologists discuss their various experimental projects. Is there a tendency to set up those projects to catch the interest of sugar beet technologists when the man who is vitally concerned with their solution is a farmer? Perhaps not. But whether or not the project is set up in that way I am quite certain that results are frequently reported so that they are intelligible only to that limited group. For certain types of work such reporting may be excusable.

However, picture the absorbing interest with which a beet grower who wants to know about fertilizer might peruse the following bed-time tale taken from a bulletin published for farmer use, "On the Jones farm all the fertilized plots outyielded the untreated plots, but the difference in one case was not significant and just barely significant in two other cases. In fact, the "F" value obtained for the placements is less than the "F" value at the 5% point."

The achievements in research which must be credited to sugar beet technologists have been fundamental to the well-being of this industry. Adequate support of research is absolutely vital to its future security. But research cannot stand apart. Research is diligent investigation to ascertain some truth or principle. To interpret is to explain, to understand and appreciate in the light of individual interest. Neither one alone, but research and interpretation together provide the motivation which leads to progress.