Executive Committee, American Society of Sugar Beet Technologists, Biennium 1960-61

Left to right: Secretary-Treasurer, James H. Fischer, Beet Sugar Development Foundation, Fort Collins, Colorado; Immediate Past President, Harvey P. H. Johnson, American Crystal Sugar Company, Denver, Colorado; Vice President, J. C. Keane, Utah-Idaho Sugar Company, Salt Lake City, Utah; President, Dewey Stewart, Sugar Beet Section, U. S. Department of Agriculture, Agricultural Research Service, Beltsville, Maryland.

President's Message[1]

HARVEY P. H. JOHNSON[2]

Members of the American Society of Sugar Beet Technologists and honored guests.

I believe this would be an appropriate time for the members of the Society to congratulate themselves upon the fact that this promises to be the largest gathering at a general meeting throughout our 25-year history. Registration, which began last evening, indicates that more than 500 are in attendance representing nearly every state west of the Mississippi and a goodly number of states east of that historic geographical dividing line. I am told there are about 30 states represented. In addition, we have with us friends from countries other than our own Canada, Great Britain, West Germany, Chile, Japan and Poland. To these good people we bid welcome and trust that their stay with us will be most pleasant. There are, too, with us, in addition to those directly affiliated with the beet sugar industry, representatives of equipment and machinery manufacturers, from chemical companies, and other concerns upon whom we rely for a multitude of supplies and services. Our welcome to these gentlemen.

A common purpose has brought all of us here—to exchange ideas and information on beet sugar production with all its varied facets, and to learn of new horizons, new challenges which confront us, and the steps we are taking to meet those challenges.

New vistas are opening before us every day, and it was both the thrill of observing these and conjuring with the future that gave impetus to the formation of this Society a quarter-century ago when only a handful of men met for what they called a "round-table" discussion of topics of mutual interest.

Thus we are, in effect, here today celebrating our Silver Anniversary—the Silver Anniversary of a phase of agrarian reform, American style.

We are going to talk of research of the tools we have used, new tools that our scientists are developing, of our successes—and surely some disappointments. The many papers which will be presented before our ultimate adjournment represent long periods of preparation. The things which will be reported in these papers represent even longer periods of earnest and devoted effort and painstaking study.

[1] Presented at the 11th Biennial Meeting, American Society of Sugar Beet Technologists, Salt Lake City, Utah, February 2, 1960.

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And, as I mentioned, not all the results to be reported will bring forth encouraging answers, for that is part of the very nature of the work in which we are engaged.

I am reminded that once a youthful and impatient young assistant asked Thomas A. Edison:

"Don't you get terribly discouraged after these thousands of failures knowing that all our research has been utterly in vain?"

And Mr. Edison replied, "Our research has not been in vain, for there is always value in finding out what will not work."

Research has become basic to human progress. In a recent national magazine it was reported that currently we are spending approximately 13 billion dollars annually in this country for research and development. It was further stated that we will probably make an investment in planned growth through research and development of no less than 150 billion dollars in the decade of the 1960's, or an average of 15 billion dollars per annum.

The scope of research in our own field is amply testified to by this meeting alone where we are gathered from many places to exchange information in no less than six broad categories and by means of some 150 separate papers on an almost unlimited variety of specific subjects.

Agricultural research today calls upon the combined efforts of a variety of trained specialists in numerous fields of knowledge such as organic, physical, analytical and biological chemistry. We rely upon engineers, chemists, entomologists, bacteriologists, plant pathologists, plant physiologists, agronomists, nematologists, plant breeders, geneticists, soil scientists and all manner of biologists. We have representatives of all these fields at this meeting.

The joint efforts of these and related workers are brought to bear upon the development of a better agriculture. While the costs sometimes appear to be high, the dividends from a well-organized and operated program are virtually unlimited and have become essential to the very existence of agriculture.

For any one person to attempt to summarize a conference such as this would be both brash and absurd—certainly to do so before sessions were even well under way would be a virtual impossibility. Yet, there would seem a place for briefly highlighting certain phases of these meetings on which we are now about to embark.

One of the primary interests of our industry for the past quarter-century has been mechanization mechanization in growing the crop and mechanization in extracting sugar from the beet once it has been delivered to the mill. Much progress has come. Just 30 years ago, Colorado surveys, for example, showed that it required an even one-hundred man-hours to produce and harvest an acre of sugar beets, which even then represented no little improvement over earlier years. By 1948, this 100 hours had been cut to 60 man-hours. And today there are growers who tell us that their performance is less than one-half the 1948 average and they think there's no doubt they'll cut that even more and very soon.

And what has happened with sugar beet yields during this last twenty-five year period since the organization of the Society? Many areas report that yields have doubled. The national average, however, shows just about a 60 percent increase in yields, which becomes an even more imposing figure when one considers that this is a period during which new production areas came into being, some of which are not aided by irrigation.

But a most startling, and encouraging, statistic is this: In just 25 years total sugar production is up 90 percent on only 10 percent more acreage.

What has happened in the mills during this time? A check of the average daily slice in mills owned by two of our major processing companies showed that in just the 25 years since our Society was born, daily slicing per mill has increased 83 percent.

These are accomplishments which provide a true measure of the value and achievements of research, for research paved the way for most of the gains I have described in the statistics I have presented. This is the surest way, too, for us to catch some of the drama in research, where methods and techniques frequently appear to the untrained eye to encompass a particularly unglamorous realm of activity. To the researcher, the great drama is there before him as he delves behind previously unopened doors where man has never looked before.

Less than 15 years ago, practically all factory processing stations were operating on a batch basis, but today we find that all modern mills have continuous diffusers, continuous carbonation, automatic or drum-type filters and some have continuous crystallizers. Continuous centrifugals are being developed.

A gas-fired lime kiln, about which we will have a paper presented at these meetings, is now a reality and has been successfully operated for the past two seasons.

Ion exchange investigations have unveiled new possibilities in juice purification and, with new resin development, should within the foreseeable future be in a position for incorporation into factory operations.

At its Carlton plant, the Holly Sugar Corporation is taking a step which is being closely followed by the industry and with deep interest. Perhaps some of you are not familiar with this project which, briefly, we understand amounts to construction of another beet end of a house through the evaporators; and instead of proceeding from there as is now considered normal, they will store thick juice in a tank farm, thus allowing the sugar end of the present plant to be operated a greater part of the year. This plan will also, of course, allow them to process beets at nearer their optimum and greatly extend the production of the sugar end of the plant with resulting economies, longer use of equipment and greater sugar storage.

It is generally recognized that all plants must be further automated, and this can be accomplished in some cases through re-design of present equipment. We understand that there has been a demonstration of the physical possibilities in a beet sugar plant in England. Perhaps what was done there constitutes a more ambitious undertaking than any one privately-owned company would be able to tackle. But we are informed that certain technical personnel of the armed forces in England were not needed for a time, so these people were, so to speak, turned loose in a sugar plant and they have come up with an almost complete automation. From across this ocean span can and no doubt will come technical information which will be applied either in part or its entirety to sugar beet processing plants in this country.

A changing sugar market which demands ever greater stocks of bulk granulated or liquid sugar also is influencing the direction of our factory improvements and changes, all pointing to a streamlining of operations.

Automation, indeed, is helping our operating efficiency, but what of our extraction efficiency? Here progress has been more difficult to evaluate. To improve this the only answer is different and better processes arrived at by a vast program of research entered into and carried on by all beet sugar companies as a joint venture.

These things, then, are some of the subjects to be more fully explored in the ensuing Section E. of our meetings.

Agriculturally, the mechanization of the steps in production of the sugar beet crop still tops the list of our investigations and development. Notably absent this year, in contrast to previous meetings, are papers on techniques and results of mechanical thinning. Often at past meetings in recent years, the best attended sessions were those which dealt with this subject. Why the change? Well, I believe it would be erroneous to think that interest has died. The fact seems to be that the general techniques adopted are now considered too commonplace for further discussion. We have entered a phase in which we are gathering experience in actual practice—a settling down period on known techniques. While it is probable that no one person may accurately know how widely machines are used in thinning operations today, a guess of 60 percent, or even more, would probably not be too far amiss.

If there be a bottleneck to further utilization of machines in the spring thinning program, it undoubtedly is in better weed elimination. There will be a number of papers presented at this meeting reporting results with materials such as Eptam, Endothal, and TCA, to mention just a few. Knowing what materials are available is not enough. We must know precisely how to use them, whether these chemicals must be applied before or after emergence of the beet seedlings, and the toxic effects they have upon the beets themselves.

We are to hear reports on new formulations of the more promising weed control chemicals. It will be suggested that granular herbicides for band application offers promise in improving effectiveness and reducing costs.

Recently, there has been much hue and cry concerning use of chemicals with certain other crops. Researchers with sugar beets have not been unaware of such possibilities and some time ago undertook studies to ascertain residual effects of weed chemicals. And in the plant breeding approach, at least one company has embarked upon a program to determine whether certain sugar beet strains might be more tolerant to one herbicide, Endothal, than were others. This, of course, is an effort to eliminate one of the chief pitfalls of chemical weed control, that of injuring or unduly delaying growth of the sugar beet plant. Early results of the study offer encouragement.

While chemical controls offer much promise, we cannot afford to lose sight of the values of mechanical methods. There has been wide acceptance of weeding tools used across the row and over the row, even though some of these had formerly been considered too severe. Admittedly, it takes a lot of sheer guts to apply weeding machinery seemingly indiscriminately across the row both before and after the young beet seedlings emerge.

Yet we find that such practices are enthusiastically employed on thousands of acres nowadays. Company magazines are devoting increasing space to reporting on such methods and rightly so, in my personal estimation, because I feel that here is an opportunity for labor savings which will pay inestimable returns.

We also know that mechanization is not simply a matter of inventing a new device. There are inter-related problems which must be solved before an overall new technique is successful. An example of this is provided in the area of seed processing prior to drilling. We shall hear papers dealing with methods to obtain uniform sizing of seed so that the new precision drills may perform more effectively. Segmentation and decortication of seed have been commonplace for a number of years, but now we have monogerm and a new problem. The monogerm seed is somewhat flat, rather than a ball, which poses a new problem for our agricultural engineers in developing drills. Other improvements are being made to drills to obtain more uniform spacing of the single germ seed units as well as improving soil environment in which the seed unit is placed.

Akin to all this are the fungicide and insecticide additions to the seed which chemical companies are constantly developing and revealing to us. Again with such new development, testing and re-testing is demanded and results of such tests are to be reported here, revealing that some of these new materials have proven to be selective in the disease they will control.

Another field in which much work is proceeding is that of physiology. It is necessary that we gather as much basic information on the physiology of the sugar beet as we can, else we shall find ourselves more or less stumbling in the dark and unnecessarily complicating our efforts. We want to know, for example, why a particular hybrid that seems to be satisfactory in all agronomic characteristics and is highly acceptable so far as sucrose content is concerned, lacks good processing qualities. One research station tackled this problem of purity through investigation of promising new monogerms. The wide array of results obtained is of interest. In commercial processing, agronomic, weather and climatic variances have long been known to have effect upon purity, but now comes a revealing study that warns us care must be taken in developing new varieties, also.

Still in this general realm, there are to be three papers presented on an intriguing subject dealing with a chemical known by number as FW-450, which has been tested as a gametocide. How does this chemical affect the physiology of pollen production? The answer is being sought with the hope that we may find a chemical that would do a better job of preventing the functioning of the male gamete without affecting the female gamete. If this could be done by chemical means, almost any hybrid combination could be obtained, with the result that the plant breeder could save space, energy and labor which is now necessary to carry along cytoplasmic male sterile equivalents.

Much still remains to be learned concerning the various factors which affect reproduction in sugar beets, and we have all grown somewhat familiar with investigations of the role of gibberellic acid in this field. Some have explored the use of gibberellic acid in hastening bolting of otherwise slow-bolting varieties in seed production. Others have studied the possibilities of obtaining better root growth in commercial varieties, to increase the weight, purity and sucrose content. These are challenging studies which are not always successful, but nonetheless intriguing at the outset.

And we still are not able to assign definite values to the effects of temperature or light or to the interaction of these two factors in seed production, but there are scientists painstakingly pursuing these answers.

In the field of plant breeding and genetics, increasing attention is being focused on evaluation of more efficient breeding methods. Major emphasis currently is upon development of superior monogerm varieties, some of which already compare very favorably with the best multigerm varieties in yield, quality and disease resistance.

The rapid increase in commercial production of monogerm varieties indicates the success thus far achieved. In just three years—from 1958 through 1960—production of monogerm beet seed for commercial planting has increased from approximately 20 percent to 65 percent of the total production in this country's two leading sugar beet seed producing areas.

Today's commercial monogerm varieties are being produced by two principal methods, namely (1) backcrossing, and (2) cytoplasmic male sterility. These two terms are destined to be used so frequently in years to come that soon they will become common phrases in the language of sugar beet agriculturalists. This being true, it might be well to take a moment briefly to describe these breeding techniques. To the present novice it might make the many papers presented on these subjects more meaningful.

The primary objective of the back-cross method as used by the sugar beet breeder is to transfer the valuable character—

monogermness—into an otherwise desirable variety that lacks this character. The first cross is made between the monogerm variety and the desirable multigerm variety. All of the offspring are multigerm. These offspring are allowed to cross-pollinate and their offspring are made up of both multigerm and monogerm plants. Then only the monogerm offspring is saved and tested for favorable characteristics. The best of these are again crossed to the parental multigerm strain and the cycle I have just described is again completed. At any step in this backcross program, an improved multigerm variety may be substituted as a parent.

After the original cross, the selected monogerm is 50% like the multigerm parent and in each cycle after the original cross, the selected monogerm becomes progressively more like the multigerm parent in all respects except that it still remains a monogerm. The percentage of similarity to the multigerm is, in succeeding crosses (1) 75%, (2) 82.5%, (3) 93.75%, (4) 96.82% and (5) 98.4%. Usually, five or six cycles of backcrossing are practiced to transfer a characteristic such as monogermness into a commercially acceptable variety. Some plant breeders now suggest that fewer backcrosses may be sufficient as the parent monogerm is improved.

The second method, cytoplasmic male sterility, is more difficult to understand. It is a relatively new tool to the plant breeder. As the name implies the inheritance is dependent upon the cytoplasm, or on objects contained in it. This is different from most other characteristics where inheritance is based upon entities carried on or in the chromosomes. The effect of cytoplasmic male sterility is to make the sugar beet male sterile, or female only. This characteristic, by appropriate procedure, can be transmitted to a monogerm selection of sugar beets. The then female monogerm can be crossed with a commercial or highly desirable multigerm. The seed formed on the male sterile monogerm is all monogerm. It also carries a portion of the desirable characteristics of the multigerm parent. Only the seed from the male sterile monogerm plants is harvested and used as commercial seed, if complete monogermness is desired.

To be sure, there are many complexities in these two breeding methods that I have not attempted to discuss, but as more and more information is obtained, these complexities are being simplified.

Polyploidy is another broad field of interest to the plant breeder and geneticist, and we are to hear five papers on early experimental work in this field. Most of the processing companies having research facilities already have work under way on polyploidy, and many have employed special technicians to hasten research in this promising area which now is in early commercial use in Europe. Although plant breeders have barely scratched the surface in this field of endeavor, there already is promise of increased yields, better quality, increased disease resistance and larger seed size through use of this valuable tool.

What is polyploidy? In the very simplest of explanation, it is the multiplication of inheritance carrying chromosomes by the addition of a chemical called colchicine to the sugar beet seed or young seedling. It is this multiplying effect of desirable traits that seemingly gives rise to the promise this breeding technique affords. It is an exacting procedure, one that must be carried out with a high degree of skill and know-how if its full value is to be attained.

Much more will be heard about polyploidy in sugar beet breeding circles in future years as use of this tool increases and knowledge enlarges.

Many of the papers to be presented in the Genetics and Variety Improvement Section will deal with procedures and techniques that are valuable to plant breeders only. In title and subject matter, these papers may seem utterly incomprehensible to the layman, yet to the geneticist and plant breeder, they represent an opportunity to exchange with fellow researchers in these fields case histories of pitfalls which may be present and how to avoid them.

Turning to another general topic of wide interest to be covered in Section C., or Entomology and Plant Pathology, here will be presented new basic information about the organisms which are responsible for the classic and most prevalent disease problems in sugar beet production — virus yellows, curly-top, mosaic, leaf spot, root rot and others.

Through increased knowledge of the organisms involved in these diseases, the plant breeders are becoming better equipped to develop new disease-resistant varieties. Chemical companies are working on some of these problems too, and seem constantly to be producing new chemicals to control diseases and combat insects and other pests found in the production of sugar beets. These new products must be, of course, tested for effectiveness in varying rates.

There has been an intensified study of the habits and control of the lowly nematode during the past five years which has unearthed evidence that this little rascal may find it more difficult to be the troublesome nuisance he has been in the past.

Here again the plant breeder is on the attack, making crosses which may be more tolerant to or free from nematode onslaughts. Some of these crosses are being made with wild forms of the sugar beet family.

One other problem of which we are to hear a good bit at these meetings, and which is of grave concern to all of us interested in the steady increase of beet sugar supply for the American consumer is that which we may call quality control, for want of a better term. This problem may stem from many sources or factors, but the one control which seems presently available to us is the proper use of commercial fertilizer in growing our sugar beet crop. More specifically, one might say the proper use of nitrogen-carrying commercial fertilizer.

Now, no one is suggesting that this important element—nitrogen—should not be used in the production of sugar beets. As a matter of fact, much urging has been used in the past to convince growers of its value in producing greater tonnages.

However, we seem to be confronted with the old idea that if a little is good, a lot is better, which may be at least partially true, up to a point. But the fact is that nitrogen use is on the verge of getting out of hand. Too much nitrogen is bad, having a very adverse effect on sugar content, plus reducing percent of extraction at the mill. We are confronted with a snowball which must not be allowed to roll and grow bigger. On the contrary, it must be permitted to melt down a bit to return us to saner levels of application.

Who is to blame, if we are letting this business of nitrogen use get out of hand? Perhaps no one in particular—perhaps all of us. Nitrogen manifests itself so beautifully in increased foliage growth that it is only human to go overboard. It is becoming the popular way to increase farm productivity with every crop in the rotation being fed more and more of it. Recently, a farm paper carried a headline reading, "The Nitrogen Revolution," beneath which was a story pointing out that commercial nitrogen output has almost doubled in the last 15-year period, and that it now almost equals the combined output of phosphate and potash. The article further stated that yields have been driven up to heights unheard of a few years ago, with an accompanying rocketing of profits. The story told how some Nebraska farmers on irrigated land now are using as much as 320 pounds of nitrogen per acre per year and from this are obtaining corn yields of 150 to 200 bushels per acre.

From Georgia and South Carolina have come glowing reports of high yields of straight coastal Bermuda grass and better quality. So well might the sugar beet growers be influenced by reading such articles. But this does not alter the fact that what may happen with some crops does not necessarily happen to sugar beets. We know better. Nitrogen is not a part of the chemical formula that is sugar. Only carbon, hydrogen and oxygen are found in sucrose. The presence of excessive nitrogen—called harmful nitrogens—tends only to make sugar extraction more difficult and to divert valuable sucrose crystals into the by-product molasses.

There are to be a number of papers on this subject presented here. Some of these reports will be in the nature of survey results showing how widely and extensively nitrogen is being used. Other researchers will tell us of the interplay of nitrogen with soil temperature, irrigation and sugar beet plant populations. Still others will shed light upon the effect of crop residues and the carry-over of nitrogen from one crop to another. There is strong evidence that nitrogen is not dissipated—leached out—to the extent formerly believed. Some experiments on nitrogen carry-over are telling us that check plots, those without current nitrogen application, are producing as well as those with high increments. Why? Certainly not because nitrogen is not needed in sugar beet culture, but because nitrogen carry-over from other crops appears to be so great it is able to sustain a year's growth of sugar beets.

I cannot over-emphasize the importance of this phase of sugar beet agriculture, for I feel we must stem a mounting tide. We need to seek the optimum level and not exceed it to our own detriment and expense.

This highlight review, I trust, gives some indication of the many subjects to be dealt with in the course of this meeting and the significance of the investigations upon which there will be reports in the various section gatherings. Here, as we exchange the results of our labors will begin to form the shape of things to come, the future of our beet sugar industry. For it has been wisely said that three basic factors will shape our tomorrow in agriculture; our farm youth, education and research. These, after all, are the channels of continuity in all our effort and the ceaseless building of knowledge to insure that the future, as well as the present, will be fruitful, meaningful and satisfying to the souls as well as the bodies of mankind.