

# SCIENCE

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## OFFICIAL FIELD CROP INSPECTION

Now, when it has been forcibly brought out that the nation is vitally interested in farm results and that to get maximum production, some system of efficient supervision is essential it may not be out of place to call attention to a line of work in which official supervision would be beneficial and for various reasons quite essential, even under normal conditions. There is a phase of farm cropping, especially with cereals, in which the state is not only vitally interested but could become of great aid to growers, and to the consuming public. That line of work may perhaps be properly named official field crop inspection.

Great strides have been made, from the educational standpoint, in crop improvement during the past twenty-five years. It is apparent, however, to those who are closest to the work that improvement in cereal cropping is not nearly proportionate to the general gain in information as to possible cropping methods. There is much knowledge as to tillage, crop rotation, seed breeding, and much improvement in farm machinery and methods of crop handling through farm machinery; yet the processes which, from a scientific standpoint are necessary to high production of yield and quality are not in common practise and, when used, are so intermittently followed as to cause failure of crop improvement that should otherwise naturally follow.

If the above is true, it is worth the attention of those of us who are specialists in certain lines of agriculture to try to determine the reasons for such failure to follow best processes and to arrive at a remedy along the lines which may result in getting the process constructively carried on.

For example, much work is done in breeding seeds. The states and nation are at much expense to allow certain experts to study Men-

delian methods of cross-breeding and other lines of work which result in the introduction of new varieties and kinds. Certain business men who are concerned with the results are not backward in saying that this introduction of varieties is often harmful rather than beneficial and those of us who are close enough to the field to note the results are perhaps willing to admit that many valuable varieties are so intermixed and so jumbled as to merit such disapproval.

It is safe to say that in cereal agriculture varieties are not kept separate, and are not handled in the same intelligent method as that which characterizes the best fruit and vegetable growing methods. Is there any reason why such should be the case?

Again, as I have pointed out in other addresses, though most agriculturists and many able farmers are convinced that a crop rotation is a necessary process for best seed and crop production in cereals, yet, there are few crop rotation series which are recognized for any particular region which are carried out with any consistency. There must be some general reason which accounts for such failures to apply the principles, methods and teachings which all of us and many able farmers believe in.

I do not wish here to enter into a discussion of crop rotation, soil tillage or purely sanitary matters of cropping, but will call attention to one phase which I think illustrates the way out, so that processes known to be necessary may be constructively continuous. I advocate a legal basis for bringing about stability and standardization of varieties in cereal cropping. I believe that there is good excuse for official supervision of seed production and distribution.

I am not, I believe, unduly optimistic when I affirm that under properly systematized seed standardization and sanitary cropping through means of proper handling of the soil and seed, any state or the nation might readily lift its annual average yield of wheat several bushels per acre per year. I think that a minimum increase of five to ten bushels per acre for proper systematic handling of the seed crop

might not be beyond reasonable expectation. Further, I believe this would be doubly assured were it no longer possible for a man to plant the same general crop two years in succession on the same land. For the land control proposition, we may not yet be ready, but certainly, for the seed control proposition we have reached the stage when it is folly to claim that further improvement can be made by simple process of education when almost all the processes of marketing and general farm procedure are so conducted as to offset any improvement that can be made by intermittent educational processes, however effectively administered. I need not only call attention to the fact that there are very few new varieties of cereals which remain in reasonably pure form past the third generation on the farm and in the market. Very few of the wheats in the leading districts survive a decade before they are replaced by some new creation which runs perhaps only a shorter more precarious existence.

*Opposition to Progress.*—Many of us are prone to descant on the initiative being left in the hands of the farmer and many in the business world or manufacturing side are pretty sure to decry any attempt to improve matters by the enactment of law. I am quite convinced that laws which are enacted but never put into operation are useless. I am also convinced that those which are enacted and put into operation and which remain in operation, such as the sanitary laws for the control of Texas fever, smallpox and compulsory disinfection after diphtheria, scarlet fever, etc., are laws which should have been enacted and which, because they are still in force, prove that there was a necessity for such enactment. I also believe that it will be understood that many laws are enacted which do not need to be enforced. They form the educational basis for stable processes. Many good laws are self-operative. Such laws remain on the books as a basis and guide for those officials whose business it is to advocate progressive advance. Such law, for instance, is the ordinary anti-expectoration law. It was easy to make fun of and to say that it

was unnecessary and that everything could be done by education, but who among us will contend that such criticism or opposition was well founded?

Nevertheless, when we strike the matter of farming processes and indicate that there should be sanitary laws affecting farm processes, officially supervised by state officers non-amenable to politics, etc., there are many who object and say that such laws are unnecessary and that we should "rely on educational methods," indicating that too much supervision will bring about stagnation, etc. Then there are others who are sure to call such laws "sumptuary," etc., tending to prevent individual freedom of action and toward depression of business operations.

In years past we have gone so far in this laissez faire line of non-control of farming matters that any approach to supervision by the state of any farming work is sure to be resented by some line of business, even though it meets with favor in the eyes of those for whom it is intended to directly help. Thus, for example, there are few of us but can remember the strenuous efforts to resist fertilizer control lines of work, and the strong opposition to enactment of horticultural and entomological supervision for control of insect and fungus pests, and to the enactment of simple seed inspection laws. Even now, in the work of plant disease control, it is apparent that there are yet those who insist that the state should keep out; that there should be no supervisory laws affecting control work. When, for example, but lately it was proposed that the states and nation should attempt control of wheat rust through barberry eradication, there were not a few who should know most as to the reasons for the necessity of such eradication, who spoke out freely and feeling in the advocacy of a "campaign of education" and as though we had not had that campaign for nigh on to two centuries. And now, if one should but propose compulsory seed treatment for cereals for prevention of smut and control of scab and similar cereal diseases, or a law simply to prevent continuous cropping of the land so that there might

not be a continuous accumulation of such diseases in the soil and seed of special crops, there would be many so-called "educated men" who would throw up their hands in feigned horror. Yet enactment of such soil seed laws would be but a natural consequence following upon years of investigation and established knowledge relative to what should be done in order to control such cereal diseases. In other words, it would be but a natural step toward carrying out present knowledge of cereal control through sanitary methods so that the work done may not be continually and perpetually a loss through the carelessness of ordinary marketing and farming processes.

I discuss this phase of the sanitary question as to soil and seed only to introduce the idea of the necessity that the states attempt by law to standardize seed quality through proper methods of seed cropping and seed control.

I propose the thought that many of our so-called "educational campaigns" need a basis of equitable law. One can not expect sanitary or proper planning to be carried out merely on the suggestion of a professor from the agricultural college or of an extension worker if the carrying out of the processes must be placed eternally upon the utopian basis that the man who does the work may hope for some results but whether he does or does not get them he *should* and *is expected* to do it so that his neighbor may also prosper. Merely to recite to him that the public should have the benefit of the better crop that he will raise loses force after a time except it be backed by an emergency such as has come about under war conditions. It is too great a strain on the word "loyalty" to ask it, unless asked of all. In fact, the work will not be done with sufficient unanimity to give worth while results except it be done by all continuously, year by year. The proper basis for sanitation on the farm as to crops is not different from in the home, factory and school. It should rest on equitable law, educationally and equitably administered. I believe that the first step in cereal crop improvement rests in a further extension of

our state seed and weed laws and in the activity of the forces represented by them, to include proper control of seed crop production and of seed and grain distribution.

*Present Status of Seed Production, Cropping and Marketing of Cereals.*—In the line of cereal cropping and marketing we are not progressing as fast as the growth of our population calls for. The increase in population and of the population of the world, even in peace time, calls for a marked increase in cereal crop production. This increased demand has brought the total acreage of the wheat crop in the United States close to the maximum acreage at which labor is available for its production, and, what is worse, has reached such a high annual acreage in the chief regions of wheat culture that it is becoming extremely difficult to plan a rotation which will give sufficient improvement in the sanitary status of the soil as to crop refuse as to allow of seed improvement. In spite of our knowledge in the matters of sanitary cereal cropping no consistent steps are taken to bring about such uniformity and continuity as may be likely to tend to improvement either in the seed quality used in bulk, from year to year, or in crop quality.

These conditions result from: (1) The failure of our educational campaigns to prevent the constant cropping of the soil to one crop or its close disease infected cereal relations, and (2) the failure to hold varieties up to the standards of purity necessary to meet cropping and marketing needs. In the chief areas of cereal production, whether we mean wheat, oats, barley or corn, constant cropping prevail as against constant processes of sanitary crop rotation. Particularly in wheat, barley and oats cropping, the chief methods of production violate all the rules relative to standardized seeds more commonly than they are practised. Here the large acreage producers and the elevators and processes of marketing, speedily undo all the ideas of crop sanitation and grain standardization. At least, they speedily bring the entire mass to an equilibrium of minimum yield and uniformity of admixtures. As the country elevator furnishes the chief

supply of seed for the general cropped areas, an area of wheat does not represent one of one variety but of several and of many types of infectious diseases which accumulate in seed and soil. In other words, we have no reliable basis of holding a crop to standardization; and the work of each cereal crop improver and public educator on breeding dies with him. As to the truth of this, one could cite many instances as Wellman, Haynes and Saunders.

These are strong assertions but are easily maintained to the satisfaction of any person who knows field and market conditions. In the corn states, corn culture is so overdone in large districts that the soil and seed is so contaminated with Fusarial types of fungi and other corn root and seed infecting organisms that the seed is generally reduced in vitality and the soil is so infected that in spite of the cultivation which is a necessity in that crop, good disease-free seed often fails to properly germinate in good fertile soil. This is but the story of the cotton crop, the flax crop and the wheat crop over again.

*The Way Out.*—Without attempting to further argue the matter, I propose in every cereal-producing state a law authorizing seed, field crop inspection, seed certification, seed standardization and seed sales lists, all to be done under supervision of an officer who holds his position not through local or political appointment, but because of his position as an investigator and educator associated with and directed through the proper educational board. The law should be of such scope as to afford the basis for proper educational propaganda which would come as a necessary adjunct of a law which should carry sufficient funds to allow of demonstrations and field work in the laying out of seed plots for standardization work. It should carry sufficient funds to allow of proper survey of every township so that there should be at least a local supply of seeds grown which may be looked upon by the residents of that township as standard stuff of a given variety, and so inspected that it is reasonably free from the infectious diseases characteristic of the crop. The law should be

equitably drawn and should be so worded as to allow enforcement in the face of wilful violation.

It is, I think, self-evident that the work of crop inspection, standardization, certification and seed listing should be free—open to all so far as done—for it is for the state, for all citizens, consumers as well as growers. Further, those who do the certifying and listing should not be dependent for their position on the number of bushels standardized, certified and listed. This is perhaps the chief argument against the fee system. No citizen should be able to charge or think that the *fee* pays for the work.

It may be asked why the necessity? Simply because: (1) The states and nation are creating many varieties, perhaps valuable ones at great expense, only to be lost inside a few seasons of general cropping and marketing through admixtures, disease contamination and deterioration. If not lost their qualities are quite camouflaged by the products obtained. (2) Seed inspection laws which only inspect in the bag or bin in the place of seed sales after the seed is sold off from the farm have failed and are failing to insure seed and crop improvement.

I do not mean by this that such inspection laws have not prevented the sale of much worthless seed. For under the present seed laws it has been possible to prevent the sale of large quantities of perfectly non-viable seed and it has been possible to prevent the sale of seeds containing quantities of noxious weed seeds. It is not in this sense that I claim they have not succeeded, but rather that inspection after the crop is sold can not improve the crop. Indeed, it may even deteriorate until there is really nothing worthy of the inspections and analysis wasted upon it. The seed merchant can only sell that which he buys and that which he buys can not be better than that the farmers grow. It is thus evident, if we are to improve that which is grown, the inspection must be commenced earlier and with the cropping processes. One can not improve that which is in the bin by inspecting it, he can only refuse to allow it

to be sold until graded or cleaned, etc. As, however, the admixtures are usually such that cleaning machinery can not remove them, no amount of inspection will improve the breed and sanitary qualities for seed at this point. If the inspection starts on the farm and goes into operation with a view of aiding the grower to produce a better crop to be sold for seed for sowing purposes, or even for commercial purposes, then the money involved in the inspecting and in educating the public acts directly and readily leads to an improved pure-bred seed plot and within two to three crop generations to an entire farm crop of improved or pedigreed seed in sufficient quantity to fill wholesale seed house or manufacturing wareroom. A sufficient number of such properly inspected crops will provide for the township and county needs, and the process soon becomes infectious on adjacent farms. Thus standardization of varieties and proper recording of the growers may be established and through authorized lists the grower of improved or pedigreed seed may be brought into authentic touch with those who wish to use the seed on the land. Seed inspection thus becomes at once a constructive process for improvement of seed quality and a means whereby records may be established and kept so that the breed may not be lost through misrepresentation or ignorance.

Some may say that this can be done through cooperative breeders associations and by constantly renewed educational campaigns. That this is not possible, never has been done and can not be done because there is no tie to prevent such organizations running wild or dying when the originators die is self-evident and a fact of history. Such organizations usually die a natural death through the action of greedy members and false advertising propaganda. Who is there to check up the cooperative breeders associations? Seed improvement must last through the life of many men and for this there must be plans based on established law.

The one thing that can be said about our present haphazard method of breeding, seed recommendations and educational propaganda

is that all die out. Through this system or utter lack of system there has accumulated an enormous number of synonyms, and numerous varieties mixed and jumbled into junk lots and misbranded kinds and the nation quarrels as to how such cereals may possibly be graded for commercial purposes. These methods with the craze for introduction of new kinds and the accompanying fallacies that varieties run out have so beset our agricultural public and plant breeding workers that many able men are spending their time on the study of synonyms and the separation of varieties which, were the tasks accomplished, would be lost within three years should they cease their labors.

Even in potato culture there are getting to be so many varieties and so much disease contamination in the chief potato districts that one can scarce load a car of a single variety reasonably fit for use as seed or even commercial marketing without hand selection and disinfection. What then must be the status with reference to wheat, oats and barley?

The average person seldom sees anything smaller than potatoes and walnuts accurately, and this is literally true in regard to cereals. Some claim there is no necessity for such work because the national grain grades will eventually take care of this matter or should take care of it. Nothing can be farther from the fact. Nothing can be farther from possibility; for the national grades do not recognize variety. All hard spring wheat looks alike to the elevator and commercial man regardless of the variety. In milling and for feed purposes in actual fact, it should make little difference. These should not concern themselves with variety further than the matter of kind. For commerce and manufacturing national grades are an essential necessity in order that all may be properly safeguarded. They should recognize qualities as hard and soft, damp and dry, bright and mouldy wheats, etc., but they have little concern with variety. If they should, under present conditions there could not be constructed sufficient elevator bins to separate the varieties in any large cropping district. In

fact they do not. The fact that a sample of wheat is of no. 1 cereal quality as "no. 1 hard spring," does not at all insure its seed value. It may bear all the weed infection, disease infection and types of wheat admixtures, to which that particular region is heir, and the more the national grading system attempts to separate varieties in the grading system, the more certainly will their processes be damaging to agriculture.

The seed proposition must stand on its own merits and must be recognized as separate from the manufacturing proposition. If we care for crop improvement we can not allow the seed standards in cereal cropping to be based upon national standards for flour and feed manufactory. Nor can we as agronomists allow those in charge of the national grades to claim without rough challenge that they are protecting the varieties. As long as our farmers believe or are taught to believe that they have some protection from this source it will be possible for our wholesale seed houses to buy "no. 1 northern spring" or whatever the designation may be and sell it back to our farmers for seed as a basis for crop production.

*Field Seed Crop Inspection.*—The process of proper field crop inspection for seed production and seed standardization is a very simple one when properly authorized and put into operation. It can be done under any conscientious educational official administration of the state and can be continuous from one generation of officers to another without loss of the underlying methods and records. The natural home of such crop inspection would be associated with the work of the agricultural college and experiment station, where experts should exist or where it should be possible to develop experts in seed and crop standardization. The work can very naturally and properly be centered around the work of the pure seed office of the state. In its essentials it consists in the sending of competent inspectors to inspect the growing crop of those who claim to be growing seeds for sale for sowing purposes or for special commercial enterprises. This inspection of the crop or stock may be

done at any time before the same is sold off the farm on which it is grown, but the proper time for such inspection is when the grain is in head, when even a novice in agronomic or botanical work need make no mistake as to variety and the percentage of possible admixture and the possibility of disease infections, as scab, rust, ergot, smut, etc. A certificate should follow final inspection of the seed in the pure seed laboratory following harvest and threshing. A state list should be published showing the name of the grower, his address, the variety and amount of seed saved for sale as seed and its authorization should be based upon the certificates as issued. Such state laws should specify various grades of improved grain as "bulk seed of sufficient purity for use in special commercial processes, or in general cropping as improved seed, or as pedigreed seed, etc."

Suffice to say that this state listing necessitates official records of pedigrees and makes possible standardization and retention of varietal standards of quality. The whole process tends to form a proper educational basis for seed and crop improvement. Finally, the lists put any man who wishes to use the particular seed in touch with the man who is able to provide it. Thus good seed gets used on the land. The grower and the public is assured against having the work of proper tillage and proper crop rotation destroyed or set aside through the use of false unknown or deteriorated varieties. The whole process tends to insure final crop standardization and is the necessary foundation for final establishment of marketing standards.

In North Dakota the process here outlined is not a matter of theory but has been in operation on a part of the crops since 1909, and quite extensively in operation since 1911. Some hundreds of thousands of bushels of seed have been sold under the state list. We have made a beginning step on the right road looking toward cereal crop improvement. When a farmer or wholesale seed merchant once becomes imbued with the idea of standardized seed of a known quality, sold under certification, and if necessary under lead seal,

he at once sees the necessity of following other processes of crop improvement which follow as natural corollaries, thus one will not be apt to put such seed into the lands which are weed infected, disease-infected, or contaminated with other sorts of grains of the same kind, or junk the bulk product with inferior stuff on the commercial market. Improvements in lines of tillage and crop rotation must and will follow upon seed standardization as naturally as day follows sunrise. At present there is no real necessity of much improvement in tillage and crop rotation methods; for the seed used, very often, is of such quality from a sanitary and breeding standpoint, as to thoroughly offset any improvement that might be expected from better tillage methods, and improved methods in soil sanitation.

H. L. BOLLEY

AGRICULTURAL COLLEGE, N. D.

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#### A PLEA FOR COURSES IN PHYSICAL MEASUREMENTS FOR STUDENTS OF CHEMISTRY AND RELATED SCIENCES

It has been my privilege during the past two years to visit many institutional and industrial research laboratories in various sciences and I have had the opportunity of talking with many workers in these laboratories. Before that time I had spent a number of years in teaching and research in physics. Recollections of that experience, together with observations which I have since been able to make, have forcibly brought to my mind certain convictions which I desire to express, in the hope that such expression may contribute to establishing a basis for definite progress in certain kinds of research.

What is here set down may be common realization, and it may have been expressed before. If so, this will emphasize previous remarks upon the subject; and such emphasis seems to me to be much needed.

It is probably the experience of many scientific workers at some time or other to feel that they are much handicapped by being not sufficiently familiar with the methods and the