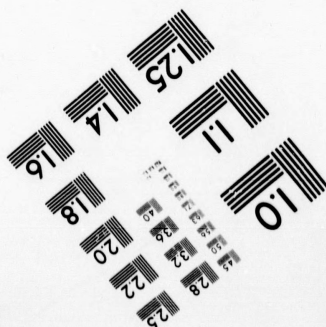
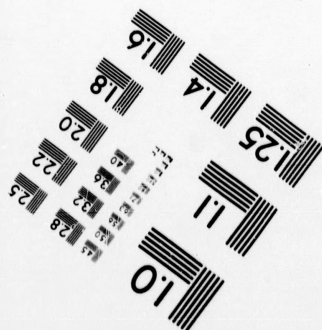
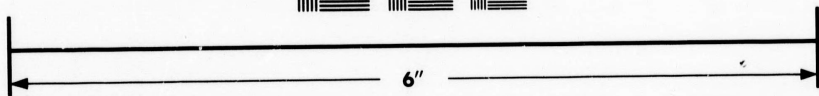
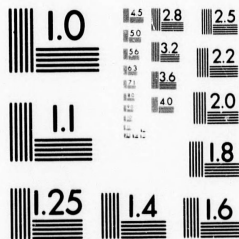


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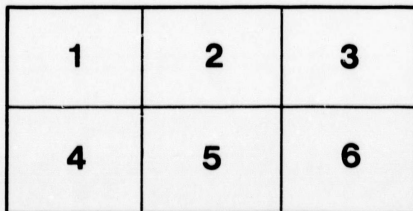
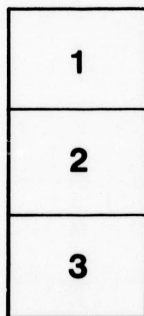
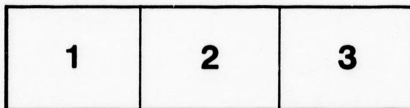
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# AGRICULTURE IN PUBLIC SCHOOLS

## AN ADDRESS

DELIVERED BEFORE THE MEMBERS OF THE ONTARIO TEACHERS' ASSOCIATION AT THEIR THIRTIETH ANNUAL CONVENTION HELD AT NIAGARA-ON-THE-LAKE, AUGUST, 1890.

BY J. E. BRYANT, M.A.

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PUBLISHED AT THE REQUEST OF THE MEMBERS OF THE ASSOCIATION BY THE HONORABLE THE MINISTER OF AGRICULTURE.

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TORONTO  
WARWICK & SONS, 68 AND 70 FRONT STREET WEST.  
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## PREFATORY NOTE.

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This address was delivered by request before the members of the Ontario Teachers' Association at their Thirtieth Annual Convention held at Niagara-on-the-Lake on August 12th, 13th, 14th, and 15th, 1890. At the conclusion of the address the subject was discussed by the members, and a committee consisting of Mr. J. Dearness, Inspector of Public Schools for East Middlesex, Mr. R. W. Doan, Secretary of the Association and Principal of the Dufferin School, Toronto, Mr. A. Barber, Principal of the Model School, Cobourg, Mr. S. B. Sinclair, Superintendent of the Teachers-in-training, the Model School, Hamilton, and Mr. D. Stewart of Dufferin, was appointed to prepare a resolution on the subject of the address and to submit the same to the Association at a subsequent session. The committee thus appointed reported the following resolution :

*The time having come when the subject of Agriculture should occupy the place on the Public School programme which its importance demands, this Association recommends to the Honorable the Minister of Education that it be given equal prominence with other subjects on the curriculum at the Departmental Examinations, and that the pupils' work in other subjects be proportionately lessened; and also that a committee of this Association be appointed to lay Mr. Bryant's paper before the Honorable the Ministers of Education and Agriculture with a request to have it published in pamphlet form and sent to the Schools of the Province and the Farmers' Institutes for distribution.*

The resolution was adopted, and the following committee was appointed for the purpose set forth in the resolution : Mr. R. W. Doan, Secretary of the Association, Mr. E. A. Chapman, Principal of the Niagara Street School, Toronto, Mr. S. McAllister, Principal of the Ryerson School, Toronto, and Mr. J. H. Smith, Inspector of Public Schools for the County of Wentworth.

In accordance with the request contained in the resolution the address has been printed for distribution by the Honorable the Minister of Agriculture..



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## AGRICULTURE IN PUBLIC SCHOOLS.

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In complying with the request of your General Secretary to read a paper before this Section on the subject of "Agriculture in Public Schools," I must confess that I felt my incompetence keenly enough; for I knew very well that not only did I lack information on many matters which ought to be embodied in such an address as this purports to be, but also that I should have neither time nor opportunity to obtain the information so as to be able to use it here. I relied, however, on the interest that I had felt in the subject for years to supply me with sufficient material for a short paper; and trusted that in offering to you such thoughts as I could command, I might possibly be instrumental in bringing other minds, more vigorous and capable than mine, into such a sympathy with my theme as would result in their permanently devoting themselves towards the great work of securing for our rural communities the inestimable boon of an education suited to their real needs.

In arguing for the placing of Agriculture on the list of studies in our rural Public Schools, I presume it will be well for me to go over the whole ground, although in doing so I shall undoubtedly have to say some very common-place things; for in a matter so little discussed as this has been (I mean, of course, in our own country) objectors will be found along the whole line of the argument, and it will, therefore, be necessary to meet their objections, and, if possible, overcome them, one by one.

In the first place, then, the question must be met, What *right* has Agriculture to be considered as a subject of elementary education? For, of course, we are considering now the relation of agricultural education to the primary schools, and not to higher schools, or to schools of special instruction, like the Ontario Agricultural College. The answer to this question must be sought for in the consideration of what that is which justifies *any* subject of instruction being placed in the school code; for I for one would admit (though many would not)



that if you cannot find in Agriculture—I here use this word, and shall frequently do so, in the sense of a subject of study, and not in its more common significance of practical art or occupation—that if you cannot find in Agriculture the same sort of justification for being placed in the school curriculum that you find in arithmetic, say, or in geography, or in history, then you ought not to have it in your school curriculum. What, then, justifies any subject being made a part of elementary education? This brings us further back to the fundamental question, *What is Education?*

Now, without going into the refinements of accurate definition, we may say that education is the process by which the immature youth is best fitted for the discharge of the duties and the enjoyment of the privileges of his manhood. And the experiences of the best educators seem to agree in this, that all good education must be of a three-fold character; one phase of which, perhaps, is more prominent in one part of the educational process, and another phase in another part, but all three phases being more or less prominent in every part, namely, (1) of a *disciplinary* character, that is, concerned with the training of the *intellect*, the powers of observation, judgment, reason, and so on; (2) of an *aesthetical* character (including in this the *ethical*), that is to say, concerned with the development and cultivation of the ability to perceive and personally realize *beauty* in all its infinite manifestations,—whether the beauty of character and conduct, which we call moral excellence; or that of thought and language, which we call poetry and oratory; or that of motion and sound, which is music; or that of form, color and structure, that is to say, sculpture, painting, architecture, or the many modifications and blendings of these; and (3) of a *practical* or *utilitarian* character, that is, concerned with securing results which we call “information” or “useful knowledge”—acquisitions that shall be immediately available in after life as so much mental capital.

But we shall find that while all people will pretty well agree as to the importance of every one of these characteristics in any educational process, they will differ very materially as to the relative importance which these characteristics should hold one to another. Some are all for the *disciplinary* value of education, and care very little for its practical aspects. The mind, they say, must be taught to think

and to observe, and the object matter, both of thought and observation, is to them of little consequence. Among this class are many mathematicians; and it would really seem, judging from much of the work currently set to be done even in elementary schools, that their influence in our educational councils is very considerable. Again, others are all for the *aesthetical* side of education. The mind, they say, must be taught to feel, to appreciate *instinctively* the differences between the true and the untrue, the noble and the ignoble, the beautiful and the unbeautiful; and the logical processes which lead up to these discriminations may (they say) be more or less neglected. These are your true classicists and literarians, lovers of myths and fancies, who make poetry a religion and romance or the drama a rule of life; to whom the form and the effect are everything, the method nothing. And yet, again, are the educators of the third class, who are all for what is *immediately useful*, by "useful" meaning that which they themselves can see the direct utility of in the stations of life of which they happen to be observant, forgetting that what is one man's use is another man's aversion, that while A may find the rules of interest of great service to him in calculating the income he can derive from his bonds and stocks, B has very little occasion for such knowledge, but would very much like to know how to keep the mildew away from his gooseberry bushes; and so on. But I have said enough to show that while the disciplinary, the *aesthetical* and the utilitarian elements of the education process are each important, each may be pushed to an extreme; and that, therefore, in deciding whether or not a new subject of study should be admitted into a school curriculum, we ought to be very careful to see that its advocates are not extremists, and that the subject they propose to introduce does fairly enough permit of the play of all the three elements of the educative process which have been enumerated.

And now, that we may see that this test is not a fanciful one, let us for a moment consider how it applies to some of those subjects of school-work which, by common consent, are universally admitted into the Public School curriculum. We shall find that while one subject allows of greater stress being laid towards, say, the disciplinary end, and another towards the *aesthetical* end, and so on, *all* the subjects permit the teacher to realize progress in a greater

or less degree towards all three ends. *Reading*, for example, though to some extent disciplinary, is however, as is evident, principally taught with a *utilitarian* object in view. *Writing*, as a subject of study is to some extent disciplinary; but it also owes its importance in the school curriculum principally to its value as an acquisition universally admitted to be of the greatest utility. *Arithmetic*, too, is looked upon by the layman as an important study in the school curriculum, principally because of the power, which, in after life, it gives to him who is proficient in it to make calculations which are useful to him; but to the professional teacher it is much more than this, and is held in esteem by him because of its great *disciplinary* value, so much so that by some who are more enthusiastic in its praises than others, it has been called "the logic of the public school." On the other hand, *history* gains for itself admittance into the curriculum largely because of its *æsthetical* or *ethical* value; that is, because of its bearing upon the conduct of the learner, both as an individual and as a member of the state, though it is also highly regarded for its effect in contributing to his stock of positive knowledge.

If we reflect, however, we shall discover that there is a constant contest going on between the professional educator and the layman as to the relative importance of the disciplinary and æsthetical sides of the education process on the one hand, and the practical or utilitarian side on the other. Hence such a subject as writing, which is very largely utilitarian in its object, is neglected by the professional teacher, though it is deemed of the utmost importance by the unprofessional public; and a similar remark might be made with reference to geography; while other subjects, such as geometry and algebra, though deemed by the professional teacher as of the greatest disciplinary value, are yet thought by the general public to contribute so little store of positive knowledge to the young learner (that is, when the length of time that he must devote to them in order to gain any real acquaintance with them is taken into consideration) that they have never found very much favor with people of a practical turn of mind, and, therefore, in deference to the opinion of this sort of people they are now almost wholly omitted from an elementary educational course.

To the question, therefore, What constitutes a valid reason for admitting any proposed subject into an elementary course at school? the answer is that the pursuit of it as a study must contribute, in a greater or less degree, to the three ends of education above mentioned: the disciplinary end, the æsthetical and ethical end, and the practical or utilitarian end. And we have seen that our ordinarily admitted subjects of study do comply, more or less, with this test, but that in applying the test the professional educator is apt to lay most stress on the two ends first mentioned, namely, the disciplinary end and the æsthetical and ethical end, while the layman is apt to lay most stress on the end last mentioned, that is, the practical or utilitarian end.

We come now to the main question of our argument, namely, How far does the subject of Agriculture comply with the proposed test? That is, we must ask, and endeavor to answer, these queries: (1) Will it afford scope for the disciplinary training of the mind? If so, will it do so to an extent sufficient to warrant its admission to our Public School course? (2) Will it afford scope for æsthetical and ethical training? (3) Is it sufficiently utilitarian? Is it not, indeed, *wholly* utilitarian?

Taking up the first question, then, Does the subject of Agriculture afford scope for the disciplinary training of the mind? the answer, I think, will at once be evident when it is remembered what Agriculture is. Agriculture, as an art, comprehends all those operations and processes by which the resources of the soil, in so far as these can be utilized by the vegetable kingdom, and thus, through the vegetable kingdom by the animal kingdom also, are converted into products that are useful to man. The *science* of Agriculture, therefore, will consist of the orderly presentation and explanation of all those natural laws which are concerned in these operations and processes. A little reflection will make clear what a comprehensive subject of study the science of Agriculture is. Geography, geology and mineralogy, botany, animal physiology and chemistry, meteorology, entomology and mechanics, are all sciences contributory to Agriculture; and vast provinces of these great divisions of natural knowledge are *wholly* comprised within its domain.



Therefore, it may well be said that if any one science has any disciplinary value to the mind when made a subject of study, Agriculture, which includes so large a part of so many sciences, must also possess a similar disciplinary value.

But the objection will at once be made: If Agriculture, as a science, is so comprehensive, and embraces so many other sciences which are not found in the Public School curriculum, how will it be possible to treat it sufficiently simply for the young mind of the Public School pupil to get benefit from studying it?

The answer to this question might be extended to great length, but I will try to put the points briefly.

(1) Is it not by any means fixedly established that an elementary knowledge of at least some of the contributory sciences just enumerated ought not to be given to the pupils of our Public Schools? I for one claim that facilities for acquiring such knowledge ought to be afforded, and in saying this I am only echoing the opinion of some of the foremost educators and foremost leaders of thought in the world. But as we have to deal with things as they *are*, and not as they *ought* to be, we may as well let this point pass.

(2) The main point, however, is this: That the *first principles of natural science are always easy to be understood*, and therefore easy to be taught. The first principles of any science are merely the methodized arrangement of the inferences to be drawn from observations of simple phenomena occurring in the field of that science; and every child will take as much pleasure in observing such phenomena when his mind is directed towards them, and in arranging thereafter the inferences to be drawn from his observations, as he will in any other mental pursuit—we might say, in any other pursuit whatever; for in doing so he is but gratifying the curiosity for natural knowledge which is inborn in him. I venture to say that a fairly good elementary knowledge of all the branches of natural knowledge enumerated above—good enough, indeed, as a preparation for all the ordinary walks of life—can be imparted to a child of average ability with far less difficulty than he can be made to understand thoroughly the first book of Euclid; and a sufficient knowledge for the purposes of elementary instruction in Agriculture with, I might almost say, infinitely less difficulty.

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(3) A third point is the following, and it is perhaps the most conclusive: Courses of elementary instruction in Agriculture have been established, and been successfully pursued, in many schools—in England and Scotland to some extent; on the continent almost everywhere; in the United States a little; and even here in Canada. Text-books have been prepared by able authors; and that these are largely used is evidenced by the fact that many different publishers compete in supplying them. In Britain elementary text-books of Agriculture are to be had all the way from 1s. and 1s. 6d. up to 3s. 6d. and 5s. For the continent I have not at hand information in regard to text-books sufficiently definite to quote; but I may say in passing that agricultural education is very much further advanced in every European country of progressive ideas than it is elsewhere in the world. I mention the fact of the existence of many text-books as important in the argument; for unless schools required them and pupils used them, authors and publishers would not waste time and money in supplying them.

(4) Another point in reply to this objection and I shall be done with it. It will be remembered that we are considering how it is possible to present so complex a subject as Agriculture to the young pupils of our Public Schools with sufficient simplicity and definiteness to be intelligible to them. The complexity of Agriculture lies in the fact that it is what is called an "applied science;" that is, a science capable of being applied, and intended to be applied, to a practical art. And every educationist knows that the methodical pursuit of an applied science is, at least for many minds, more difficult than that of a pure science so-called; for in a pure science you proceed from premise to conclusion unhindered, whereas in an applied science you are brought at every step face to face with the limitations of your subject. To illustrate this by a very simple example: Suppose that in mechanics you are considering the relation of the lengths of the two arms of a lever to the magnitudes of the power and resistance. You know in theoretical mechanics how simple a problem that is, and how simply the relation can be expressed, namely: that the product of the power multiplied into the length of its arm is equal to the product of the resistance multiplied into the length of its arm. But, in practical mechanics, notice how

many other things there are to be considered before you can arrive at any similar result—the friction of the pinions ; the resistance of the air ; the weights of the various parts of the lever ; the areas of the surfaces on which the power and resistance impinge ; the flexibility of the materials ; and so on. However, it is just because Agriculture is an applied science that any progress whatever can be made in teaching it in elementary schools. On its theoretical side it is so complex, and embraces so many divisions of contributory sciences, that a pupil would soon become bewildered and be lost were he to attempt to follow its principles without reference to their practical application. But supposing he is receiving his instruction at one of our rural schools : he will see the application of the principles he studies everywhere—in the farm-yard of his father, and in the fields at spring time, when these are being prepared for the summer harvest ; in his own orchard and garden, as he works in them at nights and mornings ; by the road side, as he trudges to and from the school house ; in the woods and meadows, where he rambles at play-time—his whole life, all his occupations and amusements will be, in fact, so many practical exemplifications or illustrations of what he learns of the science of Agriculture in his lessons at school, provided of course that he is properly taught there ; and the best, the most complete, the most interesting of laboratories, will always be open to him, namely, that of nature and the husbandry of his own home.

As to the part that the study of Agriculture will serve in developing a sense for the beautiful and pure, or, as we have preferred to express it, What will be its æsthetical and ethical value ? it will be necessary to say only a word or two. Nature is our great mother, and the ultimate source of all our impressions, whether beautiful or sublime. That nature should become less beautiful and wonder-inspiring when studied intimately, although this is often asserted by unthinking idealists, is something I have never been able to admit. The study of Agriculture, it seems to me, by making us understand more clearly the wonderful resources of that bounty which nature everywhere holds in readiness to bestow upon us, do we but properly ask her, cannot but make us more devout, more reverent, more thankful, more humble, and in turn more beneficent to others ; and again,

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by forcing us to be more observant, cannot but lead us to appreciate much beauty of form and color and changeful variety of light and shade which now, for lack of proper early training, is wholly lost to us.

In coming now to consider the utilitarian grounds for placing Agriculture on the list of our Public School studies, we will admit frankly that it is *solely because of its utility* that its advocates desire to see it so placed. Were it not for its paramount importance as a *subject of useful study*, its place in the school curriculum as a means of disciplinary training, or of æsthetical and ethical culture, could be easily supplied by one or more of its contributory sciences. But it is just because of its paramount importance as a subject of useful study that its advocates wish to see it on the list; and I have endeavored to show that in addition to its paramount utility it also affords sufficient scope for disciplinary training, and ethical and æsthetical culture as well, to warrant its admission thereon.

To present to you fully the claims, on utilitarian grounds, why Agriculture should be scientifically studied in our Public Schools, I should need rather a whole day than the short time left to me; so I must content myself with hurriedly touching upon a few points. It will be necessary, however, to consider in passing the claims of the other great industries of our country, as well as that of Agriculture, to a similar recognition. I regret that I shall be forced to take up the necessary points, one by one, very briefly.

The great industries of the country (that is, taking Canada as a whole,) may be classified as being (1) Agriculture; (2) Lumbering; (3) the Fisheries; (4) Mining; (5) Manufacturing; and (6) Mercantile pursuits.

The number of people, however, engaged in agricultural pursuits far exceeds the number engaged in any other pursuit.

The value of the aggregate produce of those engaged in Agriculture almost equals the total production of those engaged in all other pursuits.

The principal competitor of the agricultural industry, that is, in the gross value of the articles produced, is *lumbering*, which must, however, in the nature of things, grow of less and less account year by year.



Moreover, lumbering is not a scientific pursuit, properly so called; and therefore no special provision need be made for it in the scheme of education.

A similar remark applies to the *fisheries*.

*Mining*, which is the next great industry, is a scientific pursuit; and it is right that in a national scheme of education the amplest provision should be made for its being effectively carried on in accordance with all the latest scientific discoveries and most approved practices. But the scientific knowledge and skill requisite in mining may properly enough be confined to a comparatively very few directors-of-work, and therefore no provision for a scientific instruction in mining need be made in a *general* scheme of education—the only scheme that we are considering just now.

*Manufacturing*, the next great industry, is also to some extent a scientific pursuit, but far less so than Agriculture. In manufacturing also we have, as in mining, two classes of producers—the *directors-of-work* and the *operatives*. The directors being comparatively few in number need not now be considered, and of the operatives it is *technical skill* rather than scientific knowledge that is principally required, and that, too, of a highly developed kind. This technical skill can be acquired only by long experience—that is, each technical operation demands its own apprenticeship. On the other hand the agriculturist, at least in Canada, must be director and operative as well, and thus needs, unlike the operative, both scientific knowledge and technical skill. The better conducted farms of the country, together with the influences of such centres of technical instruction as the agricultural colleges and experimental stations, can for the present sufficiently acquaint the agricultural workman with the technical parts of his business; especially if he takes advantage of the means of gaining information which attendance upon our well organized Farmers' Institutes will afford him. But what he principally lacks is the necessary *scientific* knowledge by which this technical skill can be made fully valuable to him; especially since he is in so many cases not only to be an operative on his farm, but the director of all its processes and operations. He can, it is true, get this scientific knowledge now by attending our agricultural college; but in the first place not one young farmer in a thousand is able, or (which is the same thing) supposes

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he is able, to attend our agricultural college ; and even if he were to attend it is an expensive means of getting what could be largely acquired at a Public School, if our Public Schools were required to teach Agriculture elementarily. Moreover, the proper function of an agricultural college is not to impart an *elementary* knowledge of Agriculture, either in science or technique, but to give instruction in the higher branches of the subject and to afford facilities for experiment.

Again, continuing our comparison between Manufacturing and Agriculture, we may remark once more that what manufacturing needs is skilled operatives mainly, and scientifically instructed operatives (that is, those capable of becoming directors-of-work) in only a second degree. And the latter class can be got only from, or rather out-of, the first class ; therefore, for the proper education of those intending to devote themselves to manufacturing pursuits, that is, as we may say, for the proper education of operatives, what is wanted are *technical schools*, or, rather, technical departments in our already established Public Schools. Yet, owing to the fact that operatives are needed only in considerable centres of population, and again since even in these centres only a portion of the population are interested in manufacturing, or desire to have their children educated so as to be able to follow manufacturing, it follows that a scheme of technical education sufficient to supply any real demand for scientific instruction suitable for manufacturing pursuits would, after all, be *only an adjunct* to the general scheme of public instruction. Whereas, with respect to Agriculture, it is very different. In rural schools nine-tenths, perhaps ninety-nine-hundredths of the attendants are vitally interested in Agriculture, because, indeed, it is to be the occupation of their lives ; and what they need is *not technical instruction*—for that they can get, sufficiently good for all practical purposes, at home, or from observation, reading, attendance at Farmers' Institutes, and the like—but *the scientific education* which will enable them to apply their home-acquired technical skill to the pursuits of their after life with intelligence and effect ; and this all the more so because the majority of our young farmers hope and expect to own their own farm and direct all the operations upon it.

*The mercantile industry*, the only great industry remaining, also requires some special preparation, but this need not necessarily be of a scientific character, like that required for Agriculture and Mining. Writing, spelling, reading, arithmetic and book-keeping are the special requisites of a mercantile training—with, of course, in addition such a development of general intelligence as is best possible in the circumstances of any given case. But I may here remark, in passing, that the mistake is often made by educators of supposing that highly elaborated courses in arithmetic and book-keeping are indispensable parts of an ordinary preparation for a business career. The intricate problems in arithmetic and book-keeping, to be seen in examination papers, very rarely find their counterparts in actual business; and when they are encountered they will, in practice, be quite well enough met by the young clerk without special preparation therefor if he has been sufficiently well grounded in the elementary principles of these subjects; whereas if he has spent time and patience in solving these problems at school, he has probably done so with considerable haziness of apprehension, since they could not possibly have come within the range of his practical experience, and perhaps also he has done so at the expense of time that could have been more profitably employed otherwise.

I have thus endeavored to show that while claiming for the agricultural section of the community the boon of a special scientific instruction in the subject of their life's pursuit, wholly on the ground of its utility, we are not doing so without having fully considered the claims of other sections of the community to like benefits.

It remains now that I should present you with what may be considered a necessary and sufficient syllabus of Elementary Agriculture for instruction in Public Schools, and show you if possible how the study of such a syllabus would be practicable and beneficial. I find however on reflection that I can scarcely dignify what I shall put down by the name of syllabus, for I have already said so much that what I further say must be put in the briefest possible form.

First, then, in our course of study, there should be instruction on the nature and composition of the *soil*, for that is the foundation on which all else is built. The young student should be taught to discern

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the differences between soils, and to know the good properties and the defects of the various sorts of soil that he is likely to meet with. Of course it may be said that he can learn all this at home; but his home experience must necessarily be limited, and therefore very defective. And herein lies the advantage of the whole study of the subject in the methodical and comprehensive manner which should characterize its pursuit at school; it supplements the empirical knowledge gained by the young pupil at home and makes it general; in other words, it transforms his narrow personal experience into science.

Then the *plant* should be studied, and its various methods of feeding and sources of food. This leads naturally to the questions so vital to every farmer, How do soils become exhausted? and How may this exhaustion be made good again? This again brings in the whole subject of *manures*, both natural and artificial. It is the sheerest nonsense to say that the farmer can best obtain a sufficient knowledge of these matters from practical experience. Agriculture remained at a standstill for a thousand years until it began to be studied scientifically. The whole doctrine of scientific manuring is not a century old yet, one might say scarcely a half-century old, and it is safe to say that the practice of Agriculture has been more than revolutionized within that time. To obtain an instance of the importance of this one subject to the Canadian farmer, let us reflect a moment upon what has happened to Ontario wheat growing. Not so very long ago, before however our soil was exhausted by continued cropping, 35, 40 and in some cases even 50 bushels of wheat to the acre were common averages; then the average dwindled down to 30, then to 25, then to 20; till finally last year the average of the fall wheat yield in our province was only 15.8 bushels to the acre, and of spring wheat only 14.3 bushels. Now how stands it in countries where Scientific Agriculture has for some time past been made a part of the public system of education? We are told that while in France thirty years ago a wheat crop was considered quite good when it yielded 22 bushels to the acre, now 33 bushels is considered only a good yield; and on the best soils 43, 48 and even 55 bushels are constantly expected and have frequently been obtained. In Northern France there



are farms which yield regularly, year after year, from 55 to 68 bushels to the acre, and even so high as 80 bushels to the acre have been obtained. But France, let us remark, is one of the countries in Europe in which great attention is given to the dissemination of agricultural science among the people, its Department of Agriculture being most vigorously conducted, and special schools for forestry, agriculture and stock-breeding being liberally provided for. I have not been able to obtain the particulars of its scheme of elementary agricultural education, but I notice that last year the French Government devoted to the subvention of the salaries of the teachers of Agriculture outside of the special schools the sum of \$150,000. Notwithstanding the teaching which we should derive from the fact that owing to continued cropping and the lack of manuring our land is so exhausted that wheat-growing is no longer profitable to us, yet the lesson is left unheeded. As a prominent agriculturist remarked to me a day or two since, the best of fertilizers lie at our very doors, and we do not know how to use them. Hundreds of farms in the country would be benefited by the use of such common manures as lime, wood-ashes, bone and muck, not to speak of others, but the average farmer is absolutely at a loss to know when he shall use one kind of manure and when another, and so he equally neglects them all. From long use, it is true, he has got to know in an empirical sort of way a good deal about barn-yard manure, which owing to its composite nature happens to be pretty good for almost every sort of soil and every sort of crop. But beyond this he is ignorant. The result is that two of our most valuable manures, wood-ashes and apatite or phosphate of lime, the first of which we have in fairly large quantities and in the purest form, and the other in inexhaustible quantities and of excellent quality, find no market whatever at home, though they form large articles of export—the one to the United States, the other to both the United States and England, and also to Germany.

Continuing our syllabus, I would say that after a full treatment of manures should follow treatments upon the different methods of *tillage*, or the various processes by which the soil is prepared for the seed; and this of course would include *drainage*. It would seem at first sight that if any enterprise could be left to the good sense of

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those likely to be benefited by it, surely draining could be, since its value as a means of improving the productiveness of land is so obvious. But this view is far from being borne out by facts. Although the value of drainage in removing water from wet and boggy lands is freely enough admitted by most farmers, what they do not see and do not understand is the value of drainage in improving the productiveness of all soils, in almost all situations, independently of the foregoing benefit. It is not merely in the removing of superabundant water that drainage is useful, but also in the equalizing of the temperature of the soil, in assisting in its pulverization, and in facilitating those necessary chemical changes by which the soil when exhausted gains from percolating water, from the air, and from the ingredients of the manures applied to it, the fertility which it has lost by cropping. All this should be explained and emphasized in the scientific presentation of the subject at school, so that in no possible condition of soil or climate could the young farmer, when so instructed, be without the necessary knowledge how to act. And it may be remarked that even the most obvious benefits of draining are ignored by many farmers, not to mention those less obvious but quite as important ones which I have just referred to. I am told that in the eastern townships of our province the crops this year are failures. The soils there are light and porous, and the surface water of the spring-time, as well as the superabundance caused by rain, is, as a rule, sufficiently carried off without drainage to ensure a crop which satisfies those who are well-enough content to farm in an easy-going way. But this year, owing to the lateness of the season and the frequency of heavy rains, the seed either has failed to germinate properly or else has resulted in a foul growth that has yielded little produce to the harvester, and the consequence is that disappointment and complaint are everywhere prevalent.

Following the "preparation of the soil" should come a description of the different *crops* that we raise on the farm, and their various requirements in the matter of soil, seeding, cultivation and harvesting, the rotations which should be employed in distributing them over the farm, and the best uses that can be made of them. The rotation of crops, it may be observed, is a subject that never can be

properly understood except by those who have had the requisite scientific training. And yet it is of the greatest practical importance, since by it the farmer is able very considerably to delay the exhaustion which, as we have said before, continued cropping inevitably ensures. Rotation, however, it may be remarked, cannot wholly prevent exhaustion. That which is taken from the soil can in no way be regained by the soil, unless by artificial means; and here is where many, even practical farmers, make a great mistake, and where even a very little scientific training would do a world of good. As an illustration of this, I may say that in England, despite careful tillage, well chosen rotations, and the free use of home manures, the average wheat crop per acre steadily diminished until the farmers were in despair; then, about forty-five years ago, the practice of using artificial manures was begun, and since that time the average wheat crop has just as steadily increased, so that instead of thirteen bushels to the acre, which was the average yield in 1845, the average production over all England in 1885 was 31.24 bushels to the acre.

Then, after the useful crops, should follow a treatment of the *weeds* of the farm, and of the ways these may be eradicated. To give you some idea of the importance of this subject, I may mention that there are said to be at least ten weeds in Ontario which are especially injurious to farm crops, and of general occurrence, some of them of course being far more abundant in certain parts of the country than in others. Out of this number it is said that the average farmer will scarcely be able to identify more than the half, although the others may be on his farm, and steadily and surely gaining such a foothold as will cause them greatly to injure its productivity in a very few years. The inference is that the young student should be taught to recognize these noxious plants, to study their habits, and be acquainted with the best means of eradicating them, and thus be prepared to encounter them whenever that is necessary, and to check their growth with the greatest possible economy of time and labor.

Then should follow a short account of the *diseases* to which crops are subject, and of the means of preventing them; also an account of the various injurious *insect pests*, which, if left unsubdued, soon rob

the husbandman of all the fruits of his labor. As an instance of the value of some knowledge of this branch of our subject, I may mention the now well-known case of the clover-seed midge. Not many years ago the growth of a second crop of clover, for the sake of getting a yield of clover seed, was one of the most profitable undertakings of our Ontario farmers, as perhaps most of you know. Then all at once the crops failed, the farmers knew not how or why. They only knew that instead of a fully matured seed they found merely a worthless hull. However, after some time, the work of destruction was ascertained to be due to a little insect that soon became known as the clover-seed midge. The female midge laid her eggs in the little tubes of the clover blossom, and the grubs when hatched gradually made their way to the base of the tubes and fed themselves on the germs of the seed there forming, and so effected their destruction. Knowledge of the cause soon led to the cure. Entomologists by observation ascertained that the eggs were laid in the latter part of June, say about June 20, and the larvæ or grubs were developed to full growth early in July; and also that a second brood of the larvæ were hatched in September. They, therefore, recommended instead of cutting the first crop of clover so that the second crop should mature in September, just in time to afford feeding ground, for the second brood of larvæ, that the first crop should be cut earlier, say about June 10, or else be devoted entirely to pasturage, so that the second crop should be quite immature while the first brood of larvæ were in their prime of vitality, and be quite mature and ready for harvesting before the second brood were ready to feed upon it. In this way both broods of larvæ were outwitted, and the farmer permitted to grow a profitable crop. And yet, though this is a well ascertained fact, and one that ought to be in the possession of every farmer, but very few know anything about it, as I have happened to learn by enquiry. Such facts as these, with all the necessary concomitant illustrations and observations, ought to form a part of every farmer boy's education, so that when he gets at his life's business in earnest his faculties may be on the alert, trained by practice and sharpened by an instructed intelligence to take advantage of every discovery which science can bring to the aid of his difficult profession, and if possible to make useful discoveries for himself.



Then, next in our course, we come to that which in Canada ought to be the most important part of the farmer's business, *the breeding, care and management of live stock*; and any treatment of this part of the main subject would necessarily include the difficult and highly scientific doctrine of *feeding*. I could detain you for a whole day with a discussion of the importance of instruction in the principles and practices of live stock keeping, and of the *absolute necessity* of a preliminary *scientific* training in it, in order to secure success in the actual practice of the art in after life. But I can only take time to say that without *some* scientific training the stockman must be a mere mechanic, doing that which he sees others do without being able *even to guess* why or wherefore. For he cannot even intelligently read what is said about the matter in the current journals of his profession, or understand what is written about it in books, or take part in those discussions which, through the instrumentality of Farmers' Institutes, conventions and other meetings held under the supervision of our Government commissioners are doing so much to disseminate accurate information throughout the land, unless he has such an acquaintance with its underlying scientific principles as at least he ought to be able acquire at school. And here let me remark, lest some should pooh-pooh the amount of scientific instruction which it is possible to acquire at a public school, that we ought not to despise scientific knowledge because it is elementary and goes but a short way. The main thing is to be sure that it *is* scientific; that it has been obtained in the right way, acquired in the right order, that it is correlated to other knowledge in the right degree, and sufficiently solid to form a basis upon which afterwards we may raise as large a superstructure as we please by our own observation and reading. I am free to admit that the most valuable part of my own education was obtained at the common school—the most valuable, I say, because the most thoroughly understood, the best remembered, the most solidly and compactly put together, the most fit and substantial for building upon in after life by reading and observation. And so, I believe, it will be with the study of Agriculture in our elementary schools, even with that most difficult part of it comprised under the term "stock-raising." Give an intelligent boy a chance to master its principles and he will so fix those principles in his mental being, by the illustrations and

observations that he will be able to make by virtue of his personal interest in all the agricultural operations going on around him, that they will never forsake him, but remain with him all his life as a firm and well-compacted foundation for such a superstructure of accurate and useful knowledge as would have been utterly impossible to him were he not so instructed in his earliest youth.

Following the treatment of stock in all its parts should come some practical instruction in *dairying*. Anyone who remembers how butter was made some twenty years ago, and compares that long and toilsome process with the quick and labour-saving methods of to-day, as practised in our best dairies, will readily admit that we have passed through a butter-making revolution. And these new methods are not due to mere mechanical devices; they are rather due to a better knowledge of the scientific conditions under which the cream can best be obtained from the milk and be transformed into the solid substance we call butter. But even to-day, despite all this progress, Canadian butter making is a reproach to the country. And, as a proof of this, compare our butter-making with our cheese-making. Our cheese-making, thanks to the wide dissemination of scientific dairying principles and practices by means of Government commissioners and otherwise, and to the acceptance and application of these principles and practices in the factories in which our cheese is now made rather than in domestic dairies, thanks to this diffusion and acceptance of scientific information, I say, our Canadian cheese-making is now among the best in the world. We all remember when it was even more of a reproach to us than our butter-making. But now, on the contrary, it leads at any rate this continent; and so much so, that in the world's market to-day Canadian cheese is worth on the average two cents per pound more than the best cheese produced in the factories of the United States; and these two cents represent merely the market value of the skill and knowledge which Canadian cheese-makers put into their pound of cheese over and above that which the American cheese-makers can put in, for of course the constituent materials in each case are exactly the same. And what has been done for Canadian cheese-making could without doubt be done for Canadian butter-making, were the average Canadian butter-maker as intelligent and receptive as the average Canadian

cheese-maker. But butter-making is, at present at least, a domestic industry, and for lack of knowledge and skill on the part of the farmer an unscientific and unintelligent industry, and therefore an unprofitable one.

I should like, if I had time, to tell you how I think this subject of Agriculture should be taught ; to what extent theoretically and what extent practically and so on ; and to show how, in my opinion, it could be made interesting and enjoyable to the pupils. I should like also to discuss what encouragement it should receive from the Government and from the Department of Education, and how it should be regarded by inspectors and teachers. I should like to say a word or two, also, as to the way it ought to be examined, and the importance it should have in the examination programme. And, moreover, I should like very much to bring before you some facts which would show you what is being done towards securing scientific instruction in Agriculture in foreign countries, in England and Scotland and the United States, but especially in France, the different States of Germany, and in Austria. But I have trespassed on your patience long enough. I must, however, offer one or two more thoughts.

First.—Owing to the transcendent importance to the general well-being of the community of the greatest possible prosperity of the agricultural interest, I would say, and I trust my argument has borne me out in saying so, that the subject of Scientific Agriculture should be taught at least in every Public School which is supported in whole or in part by the rates of farmers.

Second.—Owing to the fact, however, that it is a subject of *special* interest rather than of *general* interest (although in the greater number of that class of schools to which I have referred the special interest is so wide as to be tantamount to general), it, in my opinion, ought not to be compulsory on every pupil. The school should be required to provide instruction in it, the teacher should be required to teach it, but no pupil should be required to study it whose parent or guardian objected to it.

Third.—Neither the teacher nor the Education Department should attempt too much. I am fully cognizant of the difficulty which

the rural teacher already labors under in his endeavors to teach all the subjects of the curriculum to the various classes of his ungraded school. I would not have this difficulty increased one iota. But some subjects already receive more attention than they deserve. It is not that too much is *done*, but that too much is *attempted*. The teacher is led, perhaps by his very conscientiousness, to feel with regard to every subject in which he has a class that he must teach everything in the text-book prescribed for that subject. This is absurd. The text-books are made for the varying exigencies that may arise in instructing a half-million of pupils, and therefore must necessarily contain far more than the average pupil can well master or the average teacher find time to teach. Therefore the teachers as a body must see to it, if they are required to put another subject on their programme, that they shall be permitted to find time for it by giving somewhat less time to other subjects. In order to accomplish this they must further see that the examinations which their pupils are required to pass are such as shall not require of them teaching that is too minute or too extensive for the time which they have to spare. And the limitations I have proposed for other subjects I would propose for this of Agriculture also. If it is to be a subject of examination, as I trust it may, only a small portion of the prescribed course should during any one term be set down as obligatory; and this portion should be circumscribed enough to comply with the exigencies of the most crowded schools. The main thing is to get the subject taught at all; to get the current of rural public opinion directed that way; to get the farming community interested in the scientific aspects of their business; to get the youth of that community alive to the fact that progress and improvement are possible; that the world is not all hedged in by their father's stake-and-rider fence; that by observation, comparison, and the looking at things in the light of the experience of others, there is always an abundance for them to learn which by diligence and good heed they can turn to their own lasting account. If this is done it matters not so much if the whole of any prescribed course be not followed out to its entirety, or that the whole of any authorized text-book be not mastered at once. The bright boy, when once his appetite is whetted by a taste of that which is good not only for his mental and moral



well-being but for his material well-being also, as it is sure to be by this subject of Agriculture, will soon of his own accord go on devouring and digesting the rest.

Fourth.—Neither must the teacher feel that because he has not been brought up on a farm, or has had no special agricultural training, he will therefore be utterly incompetent to teach his class in this new subject. Of course he will be handicapped at first by his ignorance. But so much of those contributory sciences as will be necessary for an elementary course on the subject he will have already largely mastered in his study of chemistry, botany and physiology at the High School ; and the remainder will be so amply illustrated by the operations going on on the farms about him that he will have little difficulty in making it a part of his educational equipment. And at any rate, if he is a true teacher, he should not feel above being, what indeed theoretically he only is, namely, a *leader of his boys, a paidagogos*. He but goes before ; they follow. Should it happen now and then that some one of his young followers, through having had more practical acquaintance with the work of the farm than he has been privileged to have, should discern that he is quitting the path a little and think it necessary to give him a twitch of the coat to recall him to it, his vanity may suffer a little, but if he is a true man, neither his capacity as a teacher nor his influence with his class will be impaired. Of course I think *some* provision ought to be made, too, for *professional* training in this important subject ; but we need not discuss that matter now.

Fifth and last.—Supposing everything be done for the scientific training in Agriculture which we are asking for here, viz., the placing of Agriculture as a necessary subject of study in those schools which in whole or in part are supported by the rates of those engaged in farming, and the providing also, in our model and normal schools, for some fit professional training in the subject, what is it going to cost you—or, rather, the country at large ? Not one cent. The mechanism for instruction is already set up ; it needs only to be put in motion. The intelligence and capacity of the Canadian teacher will not in my opinion be strained a particle to provide everything that is asked for ; and what is more, the exchequer of the country will not suffer to the extent of a farthing. Then, supposing

all this work of public school elementary agricultural education in actual operation, let us ask, What else does our large and wealthy province of Ontario do for this important branch of study—of all technical and special studies no doubt by far the most important to the country as a whole? Simply maintain one agricultural college, with four or five professors and two or three other teachers, and with facilities for practical experiment which, though good as far as they go, are quite disproportionate to the needs of our country with its widely-varying conditions of soil, climate and natural resources. Besides this, for a month or two in the year it employs a few of our best and most successful farmers as commissioners to visit the different Farmers' Institutes and lead in the discussions that take place. This is the entire effort it puts forth in the way of agricultural education; although it does a little more in the way of indirect encouragement. I have not the statistics at hand to give the cost of the whole matter, but you can easily see it is not very much. It is admirable as far as it goes; but does it go far enough? Comparisons are odious, and they sometimes hurt our vanity—national vanity no less than individual. However, notwithstanding this risk, let us see what a few of the smaller States of Europe are doing in the way of agricultural education. Bavaria, which has about twice the population of Ontario, maintains twenty-six agricultural colleges, besides keeping up an agricultural department at its famous Polytechnic School at Munich. Würtemberg, which has about four-fifths the population of Ontario, has sixteen agricultural colleges. Saxony, with a population only a very little larger than that of Ontario, and with an area only one-fortieth that of Ontario, maintains at Leipsic an agricultural department in the university with twenty professorial chairs, and, besides, four agricultural colleges of the highest class, twenty other agricultural colleges, and one veterinary college. Baden, with a population about one-half that of Ontario, although it is not larger than five or six of our counties, has one agricultural college of the highest class, thirteen other agricultural colleges, four schools of gardening and forestry, one school for horseshoeing, and one for irrigation and draining. Hesse-Darmstadt, whose population is less than one-half that of Ontario, maintains one agricultural college of the highest class, and eight other agricultural colleges. But in Hesse-Darmstadt they

never have a yield of wheat of an average over the whole country of less than 37 bushels to the acre, while we are satisfied in Ontario with an average of less than 15. Saxe-Weimar, with a population less than one-eighth that of Ontario maintains an agricultural department in its University of Jena with fifteen professorships, and provides for several travelling professorships in the subject as well. And if I were to go beyond these smaller States and mention what is done for higher scientific agricultural education in the larger State of Prussia, you would be wearied with the mere description of the various schools, colleges, and special institutions which have been erected in that behalf. However, at the risk of tiring you, I will briefly enumerate them: Four agricultural colleges of the highest class, with about eighty professorships; forty-one lesser colleges, all connected with model farms; five special schools for the cultivation of meadows and the scientific study of irrigation; one special school for the reclamation of swamp lands; two special schools for industrial agriculture; one school for horseshoeing; one school for the raising of bees; one school for silk-raising; one school for fish culture; twenty special laboratories and conservatories for the education of gardeners; and three higher schools and twelve secondary schools in which instruction in the culture of the grape-vine is made a specialty; and it must be remembered that these schools, as well as the higher colleges, all have model farms attached to them for the practical instruction of their students. Moreover, in addition to all this, there must be taken into account the provision that is made for elementary agricultural instruction, not only in the ordinary primary and higher schools of these various States, but in the special schools as well. And what is true of the German States is true, with but little variation, of every other progressive European nation—France, Austria, Denmark, Belgium, Sweden and the rest.

The lesson is obvious: If Canadian Agriculture is, as we believe it is, the foundation structure of all our industries, and the principal support of our material well-being, then in order to maintain its position in the world in the face of the world's competition, it has to become more scientific; and if it is to be made more scientific, the place to begin the work is in our Public Schools.

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# PUBLIC SCHOOL AGRICULTURE.

THE FIRST PRINCIPLES OF AGRICULTURE

BY

JAMES MILLS, M.A.,

*President, Ontario Agricultural College,*

AND

THOMAS SHAW,

*Professor of Agriculture, Ontario Agricultural College.*

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