Wants Government Ditching Machines.

Prof. W. H. Day (Bulletin 174) says that, after careful inquiry, he has made the calculation that at least one-third of the cleared land of the Province, or 4,710,000 acres, is in urgent need of underdrainage, which would bring an annual increase in crop worth $94,200,000, and this leaves out of the question altogether 5,000,000 acres of swamp, marsh and waste lands that are useless because too wet for cultivation; but he says that, at the present rate, it would take one hundred years to accomplish the drainage. But does it need to take 100 years? Does it need to take 25 years? If it is left to individual enterprise and to old methods it will likely take 100 years to accomplish, but if it is taken hold of by our Government, and with the steam ditchers, and put through with the energy that could be put into it, 25 years would see a vast change for the better throughout our Province. But it might be said that such a scheme is out of the realm of Government enterprise, but we understand our Government to exist to look after the general wellbeing of our Province. It takes hold of many large interests of our Province—our mineral and timber lands, building of railways, opening up new parts of the Province for settlement, development of electric power, etc.—into which it puts many thousands of dollars, and all for the material wellbeing of our Province; and which of these, or all of them put together, will give anything like the immense and perpetual profits that the underdrainage of our country will give? The Government did a wise thing to inaugurate and carry on through the O. A. C. Department of Physics the systematic surveying of wet lands for underdraining, but we are practically where we were, and are waiting the next move. I have realized for many years, though my farm could not be classed as a wet farm, that a thorough system of underdrainage would greatly benefit, but the thing was to get the system at a reasonable cost, and then get the right men to carry it out, neither of which seemed to come my way, until the Government's proposition to meet the farmers' wants through the O. A. C. Department of Physics. This I considered a splendid proposition, and I made early application, which was responded to by Prof. Reynolds (by whose suggestion, I believe, the plan was adopted) coming up to my place, and not only taking a survey, but also giving a public demonstration on underdrainage; and a short time afterward a chart of my system was forwarded, and a good deal of information in detail relating to the working-out of the plan. Well, so far, very good; but the next thing was to get capable men to do the work, which has proved unattainable. The Government has also another splendid standing proposition, and that is to advance money at a low rate of interest, and repayment in easy annual installments; but, to round up this whole plan, we think the Government needs to go one step further to enable the farmer to put into operation the two standing offers now before them, and that is to purchase one or more steam ditchers to begin with, and increase the supply as the demand for their use increases, have them properly manned and placed at the disposal of applicants, regardless of distance between places. It might be said, perhaps, that a plan of that kind would interfere with private enterprise, but we don't think it would materially affect any machines that are now in the country; at any rate, there are some things that can't afford to wait for private enterprise. The same might be said of other public works undertaken by the Government. Last spring we made inquiry of Prof. Day as to the probability of being able to secure the use of a steam ditcher in the near future, and his reply was that, while several new machines were coming in, they were all heading for Essex and Kent Counties, and he could give us no assurance when one would be obtainable. So much for private enterprise; the machines go where the best promise of steady work is offered, and rightly so. Then, let the Government take hold of the more scattered jobs of drainage. A farmer could then make application for a machine, and depend on getting it at the time agreed upon, and in the meantime get his survey and have the tile on the ground; and if he needs to borrow Government money, he will know that it can all be used at once, and he will get the immediate benefit of his outlay. And then, think of the ease and pleasure with which land is cultivated under such conditions. We think this a grand opportunity for our Minister of Agriculture to launch out into. We feel confident that, were a plan adopted somewhat after the method outlined, a new era would dawn on the agriculture of our Province. Our sons would see such great possibilities in agriculture that, instead of seeking a living anywhere but on the farm, they would be satisfied with a thorough training at our O[illegible] College, and return to the old [illegible]n after the most intelligent [illegible]ation of farmers would come [illegible] their place socially, politically, or professionally, with any class or calling in our country, and agriculture would be looked up to as one of the most desirable professions in our land.

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Experimental Errors.

By B. Leslie Emslie, P.A.S.I., F.C.S., C.D.A. (Glas.).

In chemical terminology an "experimental error" is the exceedingly small or infinitesimal discrepancy between the actual and detectable results of a test. It is the limit of error permissible, an unavoidable but negligible quantity. With such errors it is not at present our intention to deal, but with the grosser errors, whose enormity, in that they are avoidable and almost unpardonable, approach in degree the sins of omission and commission. "To err is human; to forgive, divine." We are all prone to the former, but, unfortunately, slow to exhibit any little spark of the divinity which may repose in our natures, and if there are any "angels in disguise" amongst us, the disguise is usually so thorough as to defy detection. Well, lest this should assume the nature of a theological discussion, let us get down to the hard facts of the present work-a-day evil world.

The object of an experiment is to discover some unknown truth or to establish or confirm this truth. The experimenter owes it to himself and to those in whose interest the experiment is conducted, to thoroughly satisfy himself that he has got a proper basis on which to make the test and to endeavor to eliminate any undue elements which might become factors in influencing the results.

A careless experimenter in a position of trust becomes virtually a "blind leader of the blind," and morally responsible for the consequences of his inadvertency. Having realized, then, the necessity of exercising the greatest care and prudence in the conduction of experiments, let us consider the application of these principles to those experiments in which we, as farmers, are most intimately interested, confining ourselves, for the present, to those which have to do with soils and cropping.

A farmer's experiments are numerous and varied. A few of the more important may be classified as feeding tests, milk-production tests, and crop-production tests. The last embraces tests of quantity and quality of crop yields, as produced by different varieties of plants of the same species, change of seed, various methods of cultivation, manuring and fertilizing.

For purposes of illustration, we shall only deal with crop varieties and fertilizer tests.

The selection of plots would appear to us to demand much judicious care, since in both cases it is fundamentally essential that the plots should be as nearly equal as possible in the nature and quality of soil and previous treatment. If the land has a considerable slope, we should naturally decide to have the plots run as nearly as possible parallel with the direction of the slope, so that the drainage in all cases might be equal.

The size of the plots is another important consideration, and something can be said in approval and disapproval of both large and small plots. Confronted with the choice, we should argue that it is much easier to find equal conditions within a small area; but then, we shall have to be more accurate in details when making our computations at seed time and harvest.

The nature of the crop to be experimented upon might also guide us in this respect. For instance, in an experiment with potatoes, the failure of a few tubers to germinate would more seriously affect the ultimate total yield of a small than a large plot; whereas, with a cereal crop, the failure of a few grains to germinate would have a relatively lesser effect.

When very small plots are employed, we would prefer to have them separated by a margin of at least two feet in width, which would serve as a footpath, and at the same time facilitate seeding, fertilizing and harvesting the small quantities involved, besides obviating, in the case of the fertilizer experiments, the blending at the borders of the different fertilizers employed.

The treatment of the plots, as regards cultivation, must be the same in every case, and in the variety tests the manuring or fertilizing must be the same over all. In fertilizer tests, the variety of the crop must essentially be the same on all plots, but, of course, the fertilizer will be varied, since here the fertilizers are at test.

The fertilizer ingredients which we have to consider are the three, nitrogen, acid phosphate and potash, and it might be in place to give here the recognized basic plan of experiment:

Plot 1.—Check plot, no fertilizer.

Plot No. 2.—Complete fertilizer (nitrogen, phosphoric acid and potash).

No. 3.—Without potash, but same amounts phosphoric acid and nitrogen.

No. 4.—Without phosphoric acid [illegible] amounts of potash and nitrogen.

No. 5.—Without nitrogen, but same [illegible] phosphoric acid.

[illegible] may be augmented by the [illegible] or series of plots to [illegible]

fect of each ingredient applied separately, or of varying combinations or quantities of two or more ingredients. If barnyard manure is used as an adjunct, it is obviously essential to apply it equally on all the plots of the series.

We have now outlined the necessary precautions to be taken in conducting the experiments under discussion, and it all appears to us very simple and self-evident, yet the curious fact remains that frequently men of more than average intelligence, in conducting such experiments, either lose sight of, or ignore, the use of these precautions, which is the sine qua non of success.

We have heard such men explain the superiority of one variety of grain over another, in a variety test, as being probably partly due to the fact that the plot on which the highest yield of grain was produced was in a more fertile condition, having had a heavy manure application in the previous season. Likewise, we have known—not one, but many—fertilizer experimenters state in their reports that the reason that a certain plot gave such a low yield in comparison to the others might be owing to the fact that a different variety of potatoes was grown on that plot, this variety being naturally a lower yielder than the other. These men are samples of what we should call gross experimental errors.

We could even cite instances of men, posing as authorities among us, who will point to the result produced by the application of a single fertilizer ingredient, and because the increase in the yield may have been insufficient to return a profit in that particular case, owing to the deficiency of the other essential ingredients, pretend to deduce therefrom the fact that the fertilizer employed is unprofitable on that crop and soil.

An analogy would be represented if the experimenter would diet himself for a certain period on water alone, and then, because he did not gain in weight on his water diet, declare that water was useless to the human system. Likewise, he might diet himself for another period on bread alone, and, because the results were still unsatisfactory, declare bread to be unservient to his bodily requirements. But let him try a combined bread-and-water diet, and the results will be very different. Now, do not show such alacrity in jumping at the apparent insinuation that we would condemn such experimenters to a term on bread-and-water diet, with its usual attributes. Let us rather exercise the forgiving spirit, and try to reform them by less rigorous methods.

The successful experimenter ought to be careful and painstaking, possessing, besides, a keen observation, and yet not depending too much on his visual powers, or he may fall into error. We know experimenters who have had such faith in their powers of observation that, because they could see no difference between the plots of grain, at once condemn the experiment as a failure, without troubling to harvest and weigh the produce separately. Now, he is a very clever experimenter who can measure results in this way, for we have often seen a crop of growing grain, where the difference in growth of the various plots did not appear evident to the eye, produce, after harvesting widely-varying results, particularly in the quantity of grain and weight per bushel.

The residual effects of fertilizers seem to be taken rarely into consideration by experimenters, and yet how important they are, as we shall endeavor to prove.. How frequently we find the efficacy of a fertilizer measured only by the results produced in the season of its application; whereas, if means were taken to ascertain its after effects, it would be found effective for at least three subsequent seasons. This is certainly true of the mineral fertilizers, although not in the case of nitrogen, which gets leached out of the top soil.

Now, the "Agricultural Holdings (Scotland) Act," which provides compensation for unexhausted improvements being paid to an outgoing tenant of a farm, assumes in its scale of compensation that fertilizer materials are exhausted at the following rate:

Fertilizer applied.	Rate of Exhaustion.
Nitrate of soda Sulphate of ammonia.	On arable land entirely exhausted by first crop.
Acid phosphate and all potash fertilizers.	On arable land, ½ exhausted by first crop, and ¼ of remainder by each succeeding crop.
Basic slag. Dissolved bones.	On arable land, ⅓ exhausted by first crop, and ¼ of remainder by each succeeding crop.

From this table can be seen the estimated period of efficacy of some of the more popular fertilizer materials in a moister climate than ours, so we would naturally assume that in this country the effects would be even more prolonged. Fertilizers require a certain amount of moisture to promote their solution and assimilation, so that in a dry season, especially if applied late, we should not expect them to produce so much effect as they would in the subsequent season.

[illegible] in our experimental work we ought to take advantage of the base lines laid down for us by those who have gone before, and have spent [illegible] in wresting from nature some of her