

The Uncertainty of Conclusions from Experiments in our Agricultural Experiment Stations

Along with advanced civilization and as one of its causes, comes intensive work in agricultural pursuits. A steady but rapid growth in this direction for the past few years has brought this industry to a perfection where shrewd management and strict attention to little points dictate a farmer's success. It is this condition which has called science to the aid of farming. Governments have seen fit to take hold of the matter and establish institutions whose duty it is to establish old researches and conduct original experiments on all questions bearing directly on the agricultural industry of the country.

The Agricultural Experiment Station was a German invention. It was introduced into the United States in 1885, the first one being established in the state of Maine.

The object of our stations is to make experiments: First, on the physiology

of plants and animals. Second, to analyze soils, water, and fertilizers. Third to ascertain the composition and digestibility of plants. Fourth to conduct such other experiments as have to do with the agricultural industry of the United States.

It is not difficult to see the uncertainty of the results of such experiments when we take into consideration the complicated proceeding necessary to reach definite conclusions in this industry. To illustrate let us take such an experiment as would involve the growing, feeding, and analysis of certain plants. Among the questions to be taken into consideration are:

I. The climate which varies (a) from year to year, (b) with the seasons, (c) with the elevation and slope of the land, (d) with the location, and (e) with the rain fall.

II. The soil, varying with (a) the year and season, (b) the location, elevation, and slope, (c) the amount of moisture. A great variety of soils are frequently found in an immediate vicinity.

III. The fertilizers used. the causes

of variation in climate and soil are applicable to fertilizers. The temperature gives rise to the greatest variation here since, as is known the most effective work of the micro-organisms is done at a temperature of about 90° Fahr.

IV. The time of seeding.

V. The vitality of the seed used.

Some seedmen are dishonest, and some honest ones liable to mistake.

VI. Insects and Fungus. Nothing short of extermination can prevent their influencing the certainty of conclusions in experiments. Shut them out and other things which influence the growth of plants are shut out.

VII. The laborers employed. Quite frequently the work is done by uninterested parties. Particularly is this true of student labor where the students are compelled to perform, to them obnoxious duties. Even the presence of an overseer will not always obviate this evil.

VIII. The animals used in which variations arise from; (a) The breed, (b) The age, (c) The health, (d) The disposition of the

animal. All these figure conspicuously, but the last gives rise to the greatest uncertainty in results due to the unlimited range in degree of temperament and the peculiar qualities of feeding habits of the animal.

IX Combinations. The above are only a few of the causes of uncertainty. But it will be seen that from these an almost unlimited number of combinations may be had. Considering the age of the work and the difficulties under which it is carried on it is not to be wondered at that the station officers have been slow to draw definite conclusions with regard to their experimental work.

These conditions involving such uncertainty are some of them under control. It was with a view to control many of them at once that laboratory experiments were instituted. These answer many questions of importance and reveal many scientific truths but since it takes away the very conditions under which the farmer must work it necessarily

fails to answer the practical questions of farming at least from a financial standpoint. A better method and one in almost universal use is to make so great a number or variety of experiments of an exactly similar nature with conditions as similar as possible and take an average of the whole.

The fact that farmers have been slow to accept the results of our stations is not surprising when we search carefully and find the number of erroneous conclusions due to causes above mentioned. Another cause for lack of appreciation of station work is the fact that so many experiments succeed in proving nothing not already known to the farmer.

As examples of uncertain results from this kind of work may be mentioned

I The Iowa State Station (Bul. 6.) undertakes to answer at least thirty very important questions in stock feeding with but twelve steers. The Bulletin states that the work, necessitating the use of

but two steers for each ration was laid out after mature thought and carried through in the belief that farmers want as many facts as possible as soon as possible. The station officers evidently regard haste as more expedient than certainty.

II. The grass experiment at our own station published in the Industrialist a few years ago. Hogs were turned into tame grass about the middle of May. The grass was rank and tough. The hogs refused to fatten on it and the conclusion was against pasturing hogs on tame grass.

III. In the U.S. Station at Geneva a single four-year-old Jersey cow was fed alfalfa hay for a period of nine days with a view to ascertain the amount of digestible matter in the hay. The question of breed, physical condition, nervous temperament, etc are involved. The conclusion was as follows. Nutritive ratio. 1:4.3 or closer than the German standard. This is in the face of the fact that a series of more than four thousand experiments were conducted by the Germans to ascertain

the digestibility of the principle food stuffs.

IV. Utah Station Bul. 5 p. 17 contains an account of the effects of manure on the quality and composition of potatoes.

Result.

With no manure 23½% starch.

" ordinary " 24½% "

" heavy " 25% "

This variation is about what would be expected from almost any three packages of potatoes even though taken from the same plat. Yet after acknowledging inequalities in the soil and then using but a single plat for each variety it is concluded that manure gives the potato greater cooking value. I think most people would accept this without the experiment still it would have afforded some satisfaction to be real certain of the truth.

V. The Louisiana Station Bul 12 p 7 after reviewing the work of a sugar factory during a single year concludes as follows.

Value of seed and molasses remaining \$17,000

This sold the net for the year will be 73,000

Since the company as we learn has closed

its works for the coming season it is fair to presume that some of its stock-holders do not regard the enterprise as profitable. "However the question of sugar making from sorghum is solved." If this conclusion means the ability to produce sugar from cane was solved it was no conclusion since the company was well assured of this fact before they invested their capital. If on the other hand it means what it appears to, that all mooted questions with regard to its manufacture were solved, then the conclusion had better not have been written.

VI. A review of Bul. 73 from the N. Carolina Station will convince anyone that there are more conclusions drawn from inference than experiments. The following was probably drawn from observation of neighboring fields as no experiments are recorded or mentioned as being made. "In forming mixtures for mowing land the farmer must not only select species suitable for his soil but from among them he must choose those which come to the cutting stage nearly at the same time."

He must also choose tall and deep-growing deep and shallow rooting species" All that is not already known in these statements is very doubtful. The last statement may not be accepted without authentic data of a series of carefully conducted experiments pointing directly to this conclusion.

VIII. The Argow Station Bul. 6. contains the following results. "The effect of cooking ensilage is: First, to decrease digestibility of nitrogenous substances. Second, to increase the digestibility of crude fibre. Third, " " " " of nitrogen free extract. Fourth " " " " fat. Fifth " " the amount of sugar contained. Sixth, cooking ensilage for stock does not pay." All of which was determined from the feeding of One grade Shropshire sheep. I believe they began with two and one died. Ensilage was used exclusively from one silo.

A fair number of experiments of decidedly uncertain results have been given here. Others might be given. But of the great number of experiments being conducted in stations in nearly

every state in the union it is surprising that so few are open to question.

The fact that only a few years have passed since the birth of this branch of industry; that our farmers needed to be initiated into an appreciation of this work before it could be effective; and that seven thousand Bulletins are being sent from this station with every issue bespeaks for our Agricultural Experiment Station a broad useful work for the future. It means a thorough education in their line of labor to thousands who could not have had it otherwise. The distribution of knowledge through these agents must depend very largely for its success on the certainty with which their results are obtained in experimenting.

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