Science and Practice of Agriculture

The following is the first of a series of articles on "The Science and Practice of Agriculture, and How to Harmonize Them," by C. L. Smith, agriculturist of the O.-W. R. & N., one of the best known farming authorities in the Northwest.

THE SCIENCE of agriculture is only organized common sense. The practice of agriculture is a jumble of methods based upon tradition, superstition, more or less absurd theories and varying degrees of business sense combined with a limited measure of exact knowledge. To harmonize these contradictory and often apparently antagonistic factors, is a rather difficult task, requiring time, tact, patience and accurate knowledge. By accurate knowledge I do not mean just what can be learned from books, lectures, laboratory practice or even field studies. I have known men full to running over with all these and yet unable to harmonize any of them with actual farm practice.

One reason why the task of harmonizing the science and practice of agriculture is so difficult is found in the average conception of the term "science." I can remember when the term was to my mind always associated with unpronouncable Latin words, bad smelling drugs and sulphur fumes. But when I found so good a story teller as Charles Dickens claimed that to sow the same seed, in the same soil, under the same conditions will surely yield the same fruit according to its kind, I began to realize that science was only the knowledge that certain causes would produce certain results. The possession of this knowledge would enable me to combine causes or factors and surround them with conditions that would produce a desired result. When I had learned this much about "science" the term lost its terror and became only a name for a group of every-day things.

Like Produces Like.

From this point of view it was comparatively easy to harmonize the practice of agriculture with the science of agriculture. To illustrate, it is recognized as a scientific fact that under normal conditions "like produces like." It is also a fact that perfect plant growth can be secured only when there are present in the soil a great variety of inorganic elements such as potash, phosphorous, nitrogen, calcium, silica, iron, sulphur, magnesia, etc. That the different plants use different proportions of these elements, potatoes, for instance, require a larger proportion of potash than corn or wheat, but less of phosphorous and other elements.

What Science Says.

Clover roots and leaves make ideal homes for minute soil bacteria that help to dissolve and make available the various elements used by the plants. Furthermore the scientist will say that where the soil is too compact, heavy or cold, the plowing under of a crop like clover will loosen and warm it. Therefore tell the scientist that you have a heavy clay loam soil and wish to grow on it a prize crop of potatoes, and from his organized facts he will say: "Grow a crop of red clover, plow under the second crop, leave the ground rough over winter, work fine in the spring and plant as soon as danger of frost is past, planting smooth, sound, even-sized tubers, for 'like produces like.'"

Now let us see how we can harmonize this with practice: Jim Kelly of Marysburg had won the prize of a riding cultivator for the best bushel of potatoes exhibited at the County Fair. I wanted to know how he did it, and drove 12 miles out to his farm, which was in a hardwood district where the soil was a rather heavy clay loam.

What Practice Says.

After complimenting Jim on the prize, I asked him to tell me how he did it.

"Oh," said he, "that's easy; just plant them in the old of the moon in May."

"But how did you prepare the land; what did you grow on it the year before; when did you plow it; how deep?"

"Sure, the only way to grow good potatoes on this kind of land is clover sod plowed in the fall and plowed as deep as the team can pull the plow."

"Do anything to it in the spring?"

"Harrow it three or four times to fine it, firm it, warm it up and kill the weeds. Keep at it until the moon is right."

"What kind of seed do you plant?"

"Ah now, don't you know, any man that's got sense, will plant the kind he wants to raise?"

Here you see the practical man and the scientist have both reached the same conclusions, although they started in different directions. They saw things from a different point of view. To harmonize the science and practice of agriculture it is necessary to get Jim Kelly and the Scientist out on Kelly's field in the old of the moon in May.

Scientist on Milk.

The scientist after collecting facts regarding the "Building Up of a Dairy Herd," says: "Milk giving is a feminine function. Large milk production is due to the abnormal development of the maternal instinct. Petting, liberal feeding, frequent handling, kind treatment, all aid in the development of the milk producing characteristics.

Then along comes the practical man with the assurance that the best cow they ever had on the farm was "Bessie," a pet calf that mother and the girls raised.

Continuing the same topic, the scientist says "The profitable dairy cow is an artificial animal built by a combination of factors, all tending to the extrn development of the milk-producing organs and characteristics. The order runs something like this:

First—Selection.

Second—Care, which includes shelter, feed, water and method of treatment.

Third—Testing, sorting and weeding out.

Fourth—Breeding.

Fifth—Feeding, handling and development of heifer calves.

Carelessness, negligence or ignorance on the part of the dairyman in regard to any of these factors will eliminate or seriously impair the results.

As any capacity above the normal is artificially built up, by the above factors, it follows logically that neglect of any of the above will tend toward deterioration or return to the natural condition.

Ignorance Means Loss.

When a practical man buys one of the highly developed, large producing, artificial cows, and, ignoring the "science" of dairying, turns her out in the woods pasture to find her own feed, and is surprised that each year she gives less milk. Her heifer calves are not as good as the mother, and by the third generation they are comparatively worthless for dairy purposes, and the owner declares that "All this talk about pure-bred stock is nonsense." He has tried it and "there is nothing to it." Yet his experience has further demonstrated that the scientist was right. His conclusions were based on a collection of facts, which is the real "Science of Agriculture."

Again the scientist says: "A liberal supply of humus in the soil, deep tillage and cultivation will conserve moisture, regulate temperature, stimulate plant growth, increase the available plant food and check against bad weather, drouth or hot winds.

Farmer Shiftless.

Farmer Shiftless ignores the science. The weather conditions are all favorable and he secures a normal crop. He boasts of his "practical experience" and continues his unscientific practices until an unfavorable season. Then the scientist has a full crop and Shiftless blames his "luck."

The weakness of much of the so-called "Agricultural Science" is due to the fact that an experiment has been tried for the purpose of demonstrating some theory, and a summary of conclusions compiled, based on the single experiment. The practice of agriculture has always to do with variable conditions, and those conditions are often of a character so important as to require radical changes in any set of rules or methods of practice? It has, therefore, become a rule among those students of "Scientific Agriculture" who are striving to harmonize science and practice, to reject as really scientific, any conclusions based on a single experiment, or any summary of conclusions that does not harmonize with conditions that are normal to the average farm of the district. When this point of view is maintained, it is far less difficult to harmonize the science with practice.

Science Dependable Today.

Recognized agricultural science is today a radically different proposition from the so-called agricultural science of 25 years ago. What was then termed agricultural science was made up largely of single demonstrable facts, while today agricultural science is a collection of demonstrated facts considered in their relationship to each other and also to such variable influences as temperature, rainfall, wind and sunshine.

I can best illustrate this by my own experience as an institute lecturer. At that time I had no knowledge of, and very crude ideas concerning "science," but I did have a large measurue of practical experience, and some pretty strong opinions based on observation. My talks consisted almost entirely of stories of what Jones, Smith or Brown had done with certain things under certain conditions. No one at that time realized that such a collection of facts was the best kind of agricultural science, or the very essence of the science of agriculture, already harmonized with practice.

Dogmatism.

One evening when the subject of fertilizers was being discussed, some one in the audience asked the speaker: "What is the value of a ton of stable manure?" The professor was a recognized authority, a man of national reputation, a leader in the new movement for scientific agriculture, and he answered promptly: "The only elements lacking in your soil, or that you will ever find lacking, are nitrogen, potash and phosphorous. Therefore your stable manure is worth just as much as it would cost you to purchase that amount of nitrogen, potash and phosphorous that a ton of stable manure contains. Approximately $1.50 worth of nitrogen, potash and phosphorous, and this practically measures the value of your stable manure."

I did not at that time know anything about nitrogen, potash and phosphorous; but I did know a lot about stable manure and its action when combined with the soil, and the effect that it had on plant growth. I had observed numerous experiments made by farmers of my acquaintance with so-called commercial fertilizers, and without thinking where I was going to land, I promptly told the professor that he was mistaken. That a ton of stable manure was worth more than twice as much as a chemical analysis indicated. Whether because of some other valuable elements than those found by the chemist, I did not know; but I did know that it would produce much more marked results in plant growth and show its effect on the soil for a much longer period than would a sack full of commercial fertilizer containing as much nitrogen, potash and Phosphorous as the chemist said would be found in a ton of manure.

Then he asked me why, and I had to confess that I didn't know; but still insisted that it would do it. Then he came back with the question: "Would it improve your soil to add to it any element of which it already had a sufficient quantity?" I had to admit that I didn't think it would. "But," said he, "if the soil is lacking in any particular element like nitrogen, potash and phosphorous, then when you add either manure or any other compound, it is worth to your land just the market value of those elements which it contains and no more."

Science Based on Facts.

Thirty years ago that was agricultural science, and that was the dogmatic way of teaching it. The practical men couldn't give any reasons that would logically contradict the scientific conclusions, so he rejected the science, clinging to his tradition, and continued to practice certain methods without being able to explain why. It took ten years for the scientist to reach the conclusion based on experiment, observation and collected facts, that physical condition was quite as important a factor as chemical composition.

Then came the bacteriologist who discovered that live soil was productive and dead soil non-productive, regardless of the composition. That live soil contained innumerable quantities of microscopic organisms that through their life and death made available for the use of the plants the various elements which the plants used. Still further investigation demonstrated the fact that a proper proportion of air, water, heat and light were just as necessary for perfect plant growth as any other element.

Bacteria In Soil.

Next, the scientist explained a fact long well known, but apparently lost sight of, that bacteria were found only in organic matter. They vindicated by their collection of facts the theory of the fact that nothing could live but something else must die. So after 20 years I could answer the Professor and tell him that the value of stable manure was in its physical effect upon the soil composition rather than its chemical compounds. That it furnished a home for those minute bacteria that made available those inorganic elements; that it regulated to a marked degree the soil temperature, increased its capacity to absorb and hold moisture and could therefore carry a much larger amount of oxygen without which the little bacteria would have to quit business.

And then I remembered what 40 years ago a practical German gardener, when showing me a row of rutabagas, said. At one end they would average about ten pounds apiece and at the opposite end of the row about two ounces apiece. I asked him why, and he said: "Oh, this ground up here where the big ones are is alive. That over there where the little ones are is dead." I asked him what would put new life into the soil and he answered: "Plenty of stable maiure."

Impractical Science.

Down in Georgia, one of the old school scientists applied ten dollars' worth per acre of nitrogen, potash and phosphorous and doubled his yield of cotton on a piece of worn-out land; but the next year it took twelve dollars' worth to accomplish the same results. He kept increasing the doses of medicine until the medicine cost as much as the market value of the crop.

The old darky who drove the mules to cultivate the cotton had seven acres of the same kind of land, but no money to buy medicine, so he just grew weeds until they were a foot high, and then plowed them under. Then he sowed some oats, cut off the heads and plowed under the straw. Then he sowed some cowpeas and harvested for hay, sold the hay to the boss for $15 per ton to feed the mule used to cultivate the cotton that was taking medicine.

For convenience the mule was stabled on his seven acres, and he kept the manure.

Harmonizing.

The fourth year his three acres of upland cotton that hadn't had any medicine, produced more than any three acres of the scientist's that had had forty-five dollars' worth of medicine. While his other four acres produced oats, corn, sweet potatoes and pea hay equal in value to any four acres of the doctored cotton. Then Sam, the practical, and Professor Jones, the scientist, got together in the cotton field, submitted their facts and formulated a new agricultural science that was in perfect harmony with practice.

In conclusion, the true science of agriculture is easily harmonized when the scientist and practical man get together in the field, lay aside the traditions of the college and the farm and from their collected facts, formulate a method that is in entire harmony with scientific methods and intelligent practice.