to separate the hypothetical from the actual, and to draw reliable conclusions based upon a wide range of experiments.

I shall divide my subject into three parts: the corn put into the silo, the process of making ensilage, the use of the ensilage thus produced.

THE CORN PUT IN TO THE SILO.

Out of nothing nothing comes. Good ensilage can be made only from corn of good quality. What comes out of the silo depends upon what goes into the silo.

Circumstances affecting the quality of the corn are: –

1. Variety of corn.

2. Nature of soil, method of preparation, fertilizers used.

3. Method of growing corn, whether broad casted or drilled, cultivated or uncultivated.

4. Season.

5. Stage of maturity at time of cutting.

The chemist is concerned principally with Nos. 3 and 5.

3. Method of Growing.—The general conclusion of experiments at all stations, based on chemical analysis and actual feeding tests, is that the best ensilage is produced from corn that has been drilled and not broadcasted. Every stalk of corn should be grown so that it has plenty of soil room in which to develop its roots, plenty of rich soil to draw nourishment from, plenty of air-breathing space, and plenty of sunlight falling directly upon all of its leaves. The immaturity of closely growing corn depends more upon its lack of sunlight than upon any other cause.

Prof. Roberts (Cornell Experimental Station, New York, 1888) valued as follows:

One acre of hay	$18 00
" broad casted corn	19 72
" drilled corn	35 74

4. State of Maturity.—*This is controlled greatly by method of growing.* Prof. Roberts, *following out his experiments as cited above,* says: – "From the above facts it will be seen that the real feeding value of the corn *increased 160* per cent. after it had tasseled out, and 80 per cent. *after it had nearly reached the roasting ear stage.* This being so, *the greatest* care should be taken to select those varieties of corn *intended for* ensilage that will fully mature before frost, in the *localities* where it is proposed to grow them."

Bulletin 9, 1889, Missouri Experimental Station, discusses the life history of corn and contains this among many important statements. "The considerable increase between Sept. 10th and Sept. 17th (amounting to 24 per cent. of the total weight) indicates clearly that a crop of corn should remain in the field as long as possible, the weather permitting, to reach its greatest perfection."

Mass. Report for 1888, says, (p. 551) "One ton of green fodder corn in tassel contained in one case 307.2 lb. of dry vegetable matter; whilst in the case of the seed just beginning to glaze 463.8 lb. of dry vegetable matter are found in one ton,—a difference of 156.6 lb. in favor of the more matured state of the growth."

Mass. Report for 1888, "The ensilage of a more matured fodder corn has a higher feeding value pound for pound, compared with that cut at an earlier stage of growth."

Other experiments might be referred to, the general conclusion is that for *quantity and quality* of corn and ensilage the plants should be grown in drills and allowed to grow until the kernels begin to glaze. So long as a plant is increasing in height there will be little sugar or starch accumulated in its stalks or leaves, its compounds will be principally in a state of translocation, in a soluble form liable to easy change.

CHANGES TAKING PLACE IN THE SILO.

In 1884, Dr. A. Voelcker, F. R. S., addressed the Royal Agricultural Society as follows:—"I feel compelled, however, to say at once that a careful and critical study of the literature of the subject, and attentive perusal of most of the original publications on ensilage in England, America, and the Continent, have shown me how scanty and imperfect is our knowledge of the complicated processes of fermentation and of similar chemical and physical changes to which succulent green food is liable under various conditions of temperature, the total or partial exclusion of atmospheric air or its free admission."

The same can be repeated with equal truthfulness in the year 1890. The changes taking place in the silo are principally changes that are classed as *fermentations*, and the latest English, French, and German *investigations* of fermentations leave us in much uncertainty as *to their nature* and conditions. From the conflicting opinions and the varying results I have selected a few results that are the *unmistakable outcome* of a large range of experiment and experience.

1. Loss.– There is a loss of valuable plant material due to the chemical changes taking place in the silo. It will vary from a very small per cent. to one-half of the dry material of the corn. The loss will depend upon the condition of the corn placed in the silo and the fermentations taking place. The substances lost or used up will be in the following order: – Sugar, starch, fibre, nitrogenous compounds. The distinction of these constituents will be accompanied by the production of acids (carbonic, lactic, butyric, acetic, etc.), so that the acidity of silage is a fair test of the loss sustained, and the production of as sweet a sample as possible is both advantageous and economical.

2. Production of Acid.— We have just stated that this is carried on at the expense of the most valuable portions of the corn. The difference between sweet and sour silage is one of degree of acid, varying in sweet ensilage from .02 per cent. to .30 per cent. of acid to 2.0 per cent. or over in sour ensilage.

Now let us look at some of the conditions controlling acid production, for in understanding them and following out their conclusions lies the difference between sweet and sour, good and poor ensilage.

(a) Water.– Ordinary fermentations are carried on in solutions, in presence of water. Matured grains, straw, well-cured hay, succulent foods thoroughly dried, manure deprived of all of its moisture will not ferment. Even concentrated solutions ferment but slowly. It would seem that when the plant is young and succulent when the amount of water rises much above 75 per cent. that the cells are in their most favorable water condition for fermentation. Water is not only a favorable medium in which the fermenting cells develop most vigorously, but is also demanded for many of the chemical changes, many fermentations being processes of hydration. To retard acid formation therefore, save loss of food, and make sweet ensilage the material put in should not be too succulent.

Conclusion.—For sweet silage use well matured, or partially dried and wilted corn.

The amount of water in the corn depends upon the state of maturity, the method of growing, and the treatment at harvesting.