You must not think, because I say that these plants, which are known as the legumes, and to which belong clover, peas, beans, etc., can utilize the free nitrogen of the atmosphere, that they take in this nitrogen through their leaves. No; they cannot absorb free nitrogen any more than any other class of plants. If you take a clover plant from a field which is growing clover luxuriantly and examine its roots, you will probably see upon them a number of nodules or tubercles, varying from the size of a pin-head to that of a pea. If you were to break such a nodule open and examine the extents under a microscope you would see that the liquid contents contained a whole swarm of what we call now-a-days bacteria or germs, names meaning the same thing and meaning miscroscopic plants. These are altogether too small to be seen by the naked eye. It has been clearly proven that it is through the agency of these bacteria that the clover, peas, beans and other legumes can take free nitrogen from the atmosphere. Not from the atmosphere above the soil, but from the air in the soil. If our soil is in a proper condition of culture there will be air between the particles that make up the soil, and it is from the air which is enclosed in the soil that these clover germs take their supply of nitrogen. For every other class of plants we have to furnish nitrogen, whether it be in our orchards, our cornfields, or our cereals; every time we grow a crop we take so much nitrogen out of the soil. This must be put back in some form or other. We can do this by growing clover.

We have done a great deal of experimental work in Ottawa in this matter of clover for the recuperation of soils, and the results we have obtained are really astonishing. There is no doubt in my mind that it is the most economical method we can employ for keeping up the store of nitrogen and humus, which is decayed vegetable matter. Humus, though in itself not a direct form of plant food, is the storehouse which not only holds and prepares food for the plant, but prevents this plant food from undue waste by leaching. There are very many functions humus performs and we have not in the past recognised the great value of its presence in the soil.

I have a word to say in connection with the relative cost of these three elements of fertility: phosphoric acid, potash, and nitrogen. If we have to purchase them in the form of a commercial fertilizer, nitrogen is the most costly; it is worth about 10 cents a pound; potash about 4½ cents; and available phosphoric acid in the neighbourhood of 6 cents. You can see, therefore, that any system of farming or fruit growing which conserves and adds to the store of humus and nitrogen cheaply is one to be looked into. Nitrogen is essential to plants and they cannot grow without it, and our plants, with the exception of the legumes, must take their supply from the combined nitrogen of the soil.

Let us make a few practical applications of these principles—which you may have heard before in some form or other—with regard to fruit growing. It has been only quite recently that anything has been done in a systematic and rational way towards finding out what are the best forms in which to furnish these essential elements of fertility and the most economical quantities in which they should be applied. That comes about, of course, from the fact that it is only quite within recent times that fruit growing has developed into the industry we now find it; we consequently have not many data on hand to help us. We have a large amount of data with regard to the effect of phosphoric acid on wheat, etc., but it is an exceedingly difficult thing to put your hand on any data with regard to the economical fertilization of orchards. It would be very well if orchardists would keep a record of the results obtained from their work, because it is only in the amassing of data of that kind that we can draw safe conclusions for future work.

Another thing which has retarded progress in this work, and made it exceptionally difficult, is that orchard trees are not annuals. If we fertilize a field and put it in with wheat and oats, we can tell the same season what the result of that fertilization will be; but with an orchard it is different. We are storing up in the tree for a number of years a certain amount of material before we shall get any returns in fruit from the fertilizer. It requires a shrewd head to see how best to treat a tree to get full results from it when it comes to maturity. There are, therefore, difficulties in fruit growing that the ordinary farmer does not have to contend with. There has also been the very mistaken impression—I have often heard it stated—that orchards do not exhaust the soil in the same way that our ordinary crops do. There never was a greater mistake. They say again, "Why, look at our forests: did you ever hear of putting a fertilizer on our forests?" But you must remember forest conditions are not orchard conditions. Not at all. With forest trees all their leaves drop and are returned to the soil. The vegetable matter which they contain is gradually, but nevertheless constantly,