

dit side. One short step further will show him on which side is the balance. Time will not permit me to give an illustration, but I may be allowed to give as my opinion that on well-filled Norfolk farms the balance will every year be in favour of the farm. I prefer not to give my opinion respecting an opposite class. I will also dare to remark that it might be a useful exercise for landlords to do a little of such book-keeping: they would value a good tenant the more.

The answer to the second question. Which body in each class will answer my purpose best? must depend on circumstances. If phosphates alone are required then mineral super or super and bone meal will as a rule be the body indicated, there being very few Norfolk soils where basic slag will prove so effective. If, as is generally the case in our country, nitrogenous as well as phosphatic food is required, it will depend on market prices whether guano or bone manure should be purchased, or whether so much superphosphate and so much nitrate of soda or sulphate of ammonia should be bought separately and mixed together on the farm before distribution. A very simple calculation will always decide this. For instance, to-day superphosphate of about 27 per cent. can be bought at say £3 per ton home, this at 2s. 3d. per unit. Nitrate of soda yielding nitrogen equal to about 19 per cent. of ammonia can be had at £9 per ton, equal to 9s. 6d. per unit, and sulphate of ammonia yielding about 25 per cent. of ammonia at £10 10s. per ton, or 5s. per unit. A farmer wishing to calculate whether guano, dissolved bone, rape cake, or mixtures of superphosphate and nitrate of soda or superphosphate and sulphate of ammonia will work a simple problem as follows: Guano containing 31 per cent. of phosphate and 14 per cent. of ammonia sells at £14 per ton. Allowing that these phosphates are equal in value to those in superphosphates, and that the ammonia has a value equal to that in nitrate of soda or sulphate of ammonia (a very favourable admission for the guano), we find that the 31 per cent. of phosphate are worth 31 by 2s. 3d., or £3 9s. 9d., whilst the 14 per cent. of ammonia at 9s. 6d. per unit will be worth £6 13s., hence the united value will be £10 2s. 9d. per ton. I am hence compelled to conclude that guano is a very dear source of nitrogen and phosphate, and that the farmer will be well advised to buy superphosphate and nitrate, or superphosphate and sulphate, and mix his own guano. Applying the same method to dissolved bone, which will contain, say 37 per cent. of bone phosphate and 3 per cent. of ammonia, we calculate 37 by 2s. 3d., £4 3s. 3d., and for the ammonia, 3 by 9s. 6d., 28s. 6d., or the total value will be £5 11s. 9d., at about which price pure dissolved bone may be obtained. Applied to rape cake containing 6 per cent. of ammonia and 1 per cent. of phosphates of lime and potash, we have 6 by 9s. 6d., £2 17s., plus 4 of phosphate at 2s. 3d., or 9s.; and potash worth 3s. 6d., if required, will give a total value of £3 9s. 6d. per ton, at which it is questionable whether pure cake can be purchased. The market prices of these bodies are continually varying, but their unit value and their percentages which should be guaranteed, can always be known, and, therefore, their intrinsic value easily secured. As a manure manufacturer, I am probably prejudiced, but I would suggest that mixtures may be made more perfectly by the machines of a manure factory than by the ordinary farm labourer. Moreover, the manure manufacturer may be supposed to be in a position to produce any compound quite as cheaply as the farmer at home. Hence it will be a considerable gain to the busy farmer could he be certain that he could obtain, at a fair price, just the mixture he needed for any special soil or any particular crop. But those with the largest experience dare not, and do not, so buy, because they know it is doubtful if the compound will not be too costly, and, in the absence of the necessary guarantee, it would be difficult

to obtain any redress. It is affirmed by the Manure Manufacturers' Association that guarantees are always given. But where are they to be seen? I have the circulars of many manure manufacturers. The prices are given, the quantities recommended per acre are stated, but the composition is, as a rule, not recorded. I have here a circular where the composition of the compounds offered are given. I will refer to one only as a fair example. Minima and maxima percentages are tabled, as you will see by reference to the circular. I will calculate the intrinsic value of the one taken by assuming that the maxima are present. We will adopt the same unit values as before. We have 22 per cent. of soluble phosphate at 2s. 3d., or £2 9s. 6d., plus 13 bone phosphate, which I value at the price of raw bone in bone dust; or at 1s. 6d., or £19s. 6d., plus five units ammonia at 9s. 6d., or £2 7s. 6d.; and 77 sulphate of potash, or say $3\frac{1}{2}$ of potash at 3s. 6d., or 12s. 3d., which totals up to £6 8s. 9d. The price quoted is £9 15s. per ton.

I should waste time to repeat this calculation on the other manures. I hope I have been sufficiently clear to enable you to repeat the experiment at home. It must be wise counsel to suggest to every farmer that he should first ascertain by repeated trials what manurial substances give the best returns on his soil. Secondly, that he should, in the present state of the manure market buy those substances singly and by guarantee; and thirdly, having ascertained the composition of each simple body through an appeal to the chemist of this chamber, then carefully and thoroughly mix together and apply the mixture. In Belgium, in France, in America this is now seldom necessary. Let me refer to Belgium to illustrate my meaning. For eight years the Belgian Government has maintained seven agricultural stations, where besides conducting experiments and original research, the chemists are bound to analyse without charge any sample of a manure sent by a farmer buying more than half a ton, or of a feeding material where five tons are bought. The composition of such manure or feeding stuff must be given by the seller with the invoice. This practice has afforded to the farmers such familiarity with the terms of the analytical table, with the modes of calculating the values therefrom, that both fraud and imposition are becoming things of the past. The number of analyses made is now growing fewer, so that the English critics of the system urge that in a few years the staff of chemists will have nothing to do, and will be thrown on the wide world unprovided for. Had we in Norfolk an agricultural station of this nature, with a skilled naturalist, qualified botanists, and chemists, should the analytical test work fall off, can you imagine the Technical Education Committee of your County Council being unable to find these scientists occupation? How many are the problems of animal and vegetable physiology that remain to be solved, and which might be so well attacked by those not worried by matters of profit and loss? How many obscure questions are offering and will offer themselves in the future in practical agriculture? And should original research ultimately fail to demand their attention they could even be so sent to demonstrate at the various educational centres in the county. The educational results that would follow the adoption of a scheme similar to that already fully established in the foreign countries I have named would, I believe, be most salutary. The economic effects would not be inferior. A quarter of a century ago England was the only country where artificial manures were consumed. In 1867 Germany imported only 16 tons of nitrate of soda, and last year 460,000 tons. The chemists of France, Germany, and the United States of America bewailed only fifteen years ago the stupidity of their countrymen in not increasing their scanty crops by the use of phosphates, potash, and nitrogen, as England was doing. A revolution has followed the estab-