THE VALUATION OF MANURES

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On account of the war, estates have been unable to obtain the standard manure mixtures that have been in constant use over a number of years. Instead they have been offered a variety of substitutes which have frequently been the subject of correspondence with the Institute. This correspondence has shown that manure mixture prescriptions are still something of a mystery in certain quarters, and that the attitude adopted towards them is sometimes not unlike that adopted towards the prescription for a bottle of medicine. It is prescribed by a specialist of one sort, dispensed by a specialist of another sort, and used at the stated dose without further question.

Changes in manurial prescriptions are bound to occur during wartime according to the immediate exigencies of the fertilizer situation. There is thus all the more reason why superintendents and others should have a rudimentary knowledge of the interpretation of manurial recipes, in order that the records kept by estates, which are presumably meant to convey definite information, should remain consistent and intelligible. Perhaps present day conditions will make it clear that '300 lbs. of manure' means about as much or as little as '300 lbs. of coins.' Neither phrase conveys any information about the value of either the manure or the coins.

At any given time the value of a coin depends on how much gold it can be exchanged for. The price of that gold is independent of whether it is contained in ingots or coins or jewelry. An ounce of commercial gold of the 18-carat standard in the form of a bracelet will fetch double the price of an ounce of 9-carat gold in the form of a watch-case simply because the former contains twice as much pure gold. The carat scale commonly used is similar to the percentage scale, but is graduated in twenty-fourths instead of hundredths.

Similarly the real value of manures depends upon the percentage of the nutrient they contain; here the analogy with the coin or jewelry is complete. But unlike articles of commercial gold, the price paid for the essential constituent, *i.e.*, nitrogen, phosphoric acid and

potash, is not independent of the form in which it is sold. For example a higher price will be asked for nitrogen in the form of blood meal than for an equivalent amount of nitrogen in the form of sulphate of ammonia. From this it will be clear that the price comparison of manures must centre round two questions;

(1) How much actual nutrient do they contain, or conversely how much of their bulk is inevitable make-weight?

(2) How much is being paid for a standard amount of the nutrient they contain ?

By way of illustration we may take those fertilizers which are commonly used entirely for the sake of one nutrient. Table I gives a list of these together with their percentage composition with respect to the nutrient required, and the price per ton. For the purposes of this article the prices are merely illustrative and are not meant to reflect exactly prevailing prices, which at times like these are subject to fluctuations consequent on market conditions.

TABLE I.

Composition and Prices of Simple Fertilizers.

Fertilizer	Price per ton Rs.	Percentage composition Nitrogen	Phos. Acid	Potash	Unit Price Rs.
Sulphate of ammonia	206	20.6	—	—	10
Nitrate of soda	192	16.0	—	—	12
Blood meal	190	11.0	—	—	17.3
Castor cake	90	4.0	—	—	22.5
Groundnut Cake	98	7.0	—	—	14.0
Mineral Phosphate	83	—	29.5	—	2.8
Conc. Superphosphate	190	—	42.0	—	4.5
Ordy. ,,	95	—	18.0	—	5.3
Muriate of Potash	185	—	—	50.	3.7

From this table, it is evident that 100 lbs. of sulphate of ammonia contributes much more nitrogen than any of the rest of the nitrogenous manures in the list, as much in fact as 300 lbs. of groundnut cake or 500 lbs. of castor cake. This is the only criterion by which the relevance of '300 lbs. of manure' can be judged. Because of this variability in composition, price per ton is no help in assessing the

value of a manure either plain or mixed. Before such an assessment can be made, it is necessary to reduce the prices to a comparable basis. That in general use is the 'unit price' which is defined as the price of 1/100 ton of the *nutrient* (not 1/100 ton of the fertilizer). The figure 1/100 ton or 22.4 lb. may at first sight seem an awkward one to work with, in comparison with some convenient round figure such as 20 or 100. Actually, it is specially convenient because the unit price is arrived at simply by dividing the price per ton by the percentage composition. In other words, a manure containing five per cent of nitrogen, phosphoric acid or potash contains five units of that element per ton.

The final column of Table I gives these unit prices, *i.e.*, the cost of 22.4 lb. of nitrogen, phosphoric acid or potash in each particular manure. There is considerable variation. At the prices per ton in the list, it pays to buy nitrogen as sulphate of ammonia in preference to any other sort, and to buy mineral phosphate rather than superphosphates. Buyers of fertilizers will have noticed that since sulphate of ammonia was rationed, the balance of nitrogen in mixtures has been made up largely from groundnut cake or nitrate of soda The unit price table supplies the reason for this. Nitrate of soda and groundnut cake have been the cheapest alternatives to sulphate of ammonia, and have been used according as the one or the other was more readily procurable at the time of order.

The unit value principle can be applied in respect of individual nutrients to fertilizers containing more than one nutrient such as the combined nitrogen and phosphoric acid fertilizers shown in Table II. In this group the unit prices of phosphoric acid have been chosen for determination.

TABLE II.

Composition and Prices of Compound Fertilizers.

Fertilizer	Price per ton Rs.	Percent Nitrogen	Percent Phos. Acid	Unit price of phosphoric acid based on N as :— S/Am.	N/Soda	G.N.C.
Bone Meal	90	3	22	2.7	2.45	2.2
Fish Guano	140	7	6	11.7	9.3	7.0
Crushed Fish	90	4	4	12.5	10.5	8.5

Part of the value of these manures is due to the nitrogen and part to the phosphoric acid they contain. Before evaluating phosphoric acid, therefore, the value of their nitrogen must be determined

and then deducted from the price per ton. In the first place let us value the nitrogen as we normally should, in terms of the cheapest form we might use as a substitute. Now one ton of bone meal (N. 3 per cent) contains three units of nitrogen. Valued as sulphate of ammonia this is worth three times the unit price of nitrogen in sulphate of ammonia given in Table I, viz. Rs. 30. The cost of the phosphoric acid per ton in bone meal is accordingly Rs. 90 – 30 = Rs 60 and the unit price of phosphoric acid one twenty-second of this, *i.e.*, Rs. 2.7.

If instead of valuing the nitrogen at its price as sulphate of ammonia, we had valued it as nitrate of soda, the unit price for phosphoric acid would have decreased to Rs. 2.45. Similarly on the basis of nitrogen as groundnut cake, the unit value of phosphoric acid in bone meal would be Rs. 2.2. The basis on which to value the complementary nutrient before calculating the unit price of phosphoric acid will depend on circumstances. At the present time when our choice of nitrogenous manures is limited, it is of little use taking the sulphate of ammonia figure. The choice of nitrogen as sulphate of ammonia is academic, because of the quota imposed on sulphate of ammonia. The chief point is that bone meal phosphoric acid can compare with mineral phosphate phosphoric acid in value no matter what alternative sources of nitrogen we might turn to in order to replace the nitrogen of bone meal. It will be impossible to use bone meal entirely to make good the nitrogen deficit caused by the sulphate of ammonia quota, because this would lead to mixtures with unreasonably high phosphoric acid contents, but the fact remains that in bone meal we get our phosphoric acid cheaply without paying an exorbitant price for our nitrogen also. In the case of fish guano and crushed fish, the unit price of phosphoric acid is definitely unattractive. A much more economical way of supplying the same quantities of nutrient would be to use a mixture of mineral phosphate with any of the three quoted nitrogenous manures.

When mixtures providing equivalent nutrient levels vary in constituents they frequently vary also in bulk, which affects transport charges. In general, if the choice lies between a more bulky fertilizer with low unit cost, and a less bulky fertilizer with a higher unit cost, the advantage usually lies with the former. It is generally convenient to compare costs of fertilizers in such a way that the comparable figures take into account differences in bulk and transport costs. The final criterion is naturally what the fertilizers will cost on the estate. Such a comparison can be made on the basis of the cost per acre. Three mixtures for demonstration are given in Table III.

TABLE III.

Alternative Mixtures of Varying Composition.

	Mixture A lb.	Mixture B lb.	Mixture C lb.
Sulphate of Ammonia ...	80	80	80
Nitrate of Soda ...	80	80	80
Groundnut Cake ...	150	—	—
Whale Guano ...	—	150	—
Blood Meal ...	—	—	100
Saphos ...	100	70	100
Muriate of Potash ...	40	40	40
Total ...	450	420	400
Nitrogen ...	39.78	39.78	40.28
Phosphoric Acid ...	29.50	29.65	29.50
Potash ...	20.00	20.00	20.00
Price per ton Rs. ...	*139*	*158*	*162*

Assuming that the cost of transport is Rs. 20 per ton, the cost per acre for the quantity given in the prescription is arrived at by a simple calculation of which the following is an example :—

$$\text{Mixture A} \quad \frac{(\text{Rs. } 139+20)\ 450}{2240} = \text{Rs. } 31.95$$

The corresponding costs for B & C mixtures are Rs. 33.4 and Rs. 32.5 respectively. These prices agree with the general rule quoted above, since the bulkiest mixture A is nevertheless the cheapest on the estate because its constituents have favourable unit prices.

To sum up, a knowledge of unit values enables those concerned to prescribe mixtures of suitable composition at the most reasonable costs, and to compare and, if necessary, modify alternative prescriptions.