FERTILIZER USAGE

PAST EFFECTS AND PREDICTIONS FOR THE FUTURE

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Over the last two decades, our ideas on the use of fertilizers in the tea industry have changed rapidly, and quite clearly are going to change still more within the near future. Economic necessity is forcing us to be far more critical in our assessment of the value of the yield response to fertilizer. Scientific experiments, together with estate observations, produce new evidence year by year that estate yields of tea have not reached their limit and the inference is that ever increasing doses of fertilizer, especially nitrogenous, will be applied in estate practice. This could be an appropriate stage to examine the position, with an eye to our responsibility for the long-term well being of our main assets, the tea bush and the soil.

Dire predictions of disastrous results from ' excessive ' use of fertilizer have always been plentiful, the definition of ' excessive ' varying from one period to another. Deleterious effects of manufacturing properties have often been suggested, but the Institute has always tended to take the stand of demanding proof that this is a real problem. Our own, detailed investigations from fertilizer experiments have so far failed to detect any appreciable relation between quality, in the broadest sense, and extreme fertilizer treatment. All of the familiar trio, NPK, have been tested in this respect. We certainly do not intend to rest on our laurels, and are even now planning to expand our miniature manufacturing techniques to cope with our new programme of experiments. But on estates, what really is the problem ? Could it not be that increasing yields have not always been represented by a good standard of leaf, or that factory capacity has all too often been inadequate to do justice to the leaf ? If so, and our experience leads us to think that these failings have been too common, it is hardly logical to blame the use of high fertilizer doses. Rather, blame the misuse.

Next on the list of dangers often attributed to inorganic fertilizers, especially sulphate of ammonia, is the suggestion that soil organic matter will be depleted, leading to poor soil conditions and eventually serious erosion. We have yet to see any evidence that this need be feared in well-managed tea. It is more likely that a vigorous, solid, cover of tea will add to organic matter reserves and will improve soil structure and stability. There is, of course, no need to assume that we must always aim for an increase in soil organic matter. In so far as this could lead to immobilization of nutrients, nitrogen and phosphorus in particular, we should keep in mind the potential value of organic matter as a nutrient reserve. Tapping such a reserve should only be contemplated with caution, and after very careful scientific study.

The scientists and agriculturists have in recent years agreed on the desirability of aiming for a complete cover of the soil by tea. We are fortunate in that this will also provide a very effective means of weed control thereby lessening cultivation damage to soil structure and carry-off of nutrients in the weed residues. Former practices in weed control are being revised drastically, and we may soon hope to see the time come when good tea requires very infrequent attention either from chemicals or from scrapers. A light weed growth, with the exception of a few persistent perennials, may perhaps come to be accepted, more widely than it is at the present day, as a useful cover crop early in the pruning cycle. Judicious use of

modern weedkillers to control but not to eliminate weeds should enable this to be done. A real breakthrough in weed control will have been achieved when Visiting Agents begin to advise their Superintendents to increase weed growth in some circumstances. A little, dispassionate, consideration of the relation between weeds and vigorous tea will show that this remark is not as facetious as may at first appear.

Closely related to the above is the question of forking, an operation now being rapidly forgotten. Vigorous tea may, by virtue of the volume of root growth and leaf litter, obviate the necessity for mechanical breaking of the surface crust of the soil. Less vigorous tea may present a problem, unless weed covers can be grown and controlled chemically. Weed scraping, more than any other factor, has undoubtedly led to crust formation and if scraping can be stopped we may, on many estates, soon be able to abandon forking. Some estates have, of course, already done so. Scientific caution compels us to say that the scientists are not yet ready to turn a blind eye to a possible future need for some form of mechanical disturbance of the soil profile. Our tea soils have been broken very thoroughly by regular forking for many years past, and although we trust that we shall never again see some of the robust upheavals which were once accepted as good husbandry, we cannot yet predict what may happen in the future if forking ceases.

High levels of fertilizer, almost invariably broadcast and left to lie on the soil surface, have sometimes been blamed for encouraging development of tea roots in the surface layers. The fear is that such root systems would be inadequate to extract sufficient water from the soil profile during drought. We admit that the knowledge of root systems is scanty, but we feel that the form of roots is more likely to be influenced by climatic factors than directly by fertilizers. A vigorous cover of tea could be expected to change the micro-climate at, and just below, the soil surface in such a way that the finer portion of the root system could find suitable conditions for development close to the surface. Unspectacular and painstaking research, on the newly established experiments on our Substations as well as St Coombs, would be necessary to investigate this and to decide whether the findings should influence our recommendations on cultivation and fertilizer placement. This is one of the problems which the scientists will keep in mind, especially with reference to new clearings with their dense cover and generous mulches of leaf litter.

The final section in this abbreviated examination of our fertilizer problems brings us to the behaviour of fertilizers in the soil and their effect on plant nutrition. In practice it is not possible to add a fertilizer which will provide a necessary plant food, and do that alone. In some way or another, all the fertilizers which we could contemplate using will affect the ability of the tea to take up other nutrients from the soil. These side reactions can be complex in the extreme, and so little predictable that we must once again rely on long term study of field experiments to guide us. The Institute, for several years past, has pointed to some of the possible dangers and we need only mention here one of the nutritional problems. This is zinc deficiency. Its occurrence in all districts within a very short period, as recognized by the peculiar and characteristic patterns of leaf distortion and chlorosis, strongly suggested that the fertilizer and cultural practices then adopted had somehow caused zinc reserves in the soil to be inadequate. We do not yet know why this happened, and we are still searching for the reason. We were lucky in that the cure for this problem was simple and cheap ; foliar spraying with zinc compounds. There could be other nutritional problems, deficiency or toxicity, which might not be so easily remedied, and we shall not relax our efforts to root out trouble at an early stage. Our own experiments often carry treatments which seem to the agriculturist to be extreme : there is a purpose in this. If we can hasten the onset of trouble or complication in our experiments, we can thereby advise the Industry of ways of avoiding these pitfalls.

For many years sulphate of ammonia has been the universal nitrogenous fertilizer, in Ceylon tea, and some interest has been raised by the Institute's recent moves to experiment with other forms of nitrogen. Sulphate of ammonia, once it is subject to dissolution in the soil is a strong chemical and if used in the quantities which we predict it is likely to give rise to marked and probably undesirable side effects. We have a choice between using additional fertilizers to control these side effects, or of switching to less damaging forms of nitrogen. To some extent our choice has been guided by the fact that a decision has just been made to manufacture urea in Ceylon. Urea, although a less damaging chemical than sulphate of ammonia, has its own peculiarities. These involve the ease and efficiency of distribution, in the field, and uptake by the tea. Our experiments are now spreading out into the districts and should soon be able to answer the questions which must inevitably arise when a new fertilizer is introduced.

We can look back on encouraging progress in our extensive system of tea growing in Ceylon, and can see the part played by a liberal use of fertilizer in promoting these advances. We now find ourselves in the position of facing a future where intensive cultivation must steadily replace the older, range, system. Fertilizer usage will need to be considered very carefully indeed: which fertilizer, how and when to apply it ? Agricultural science has not yet supplied a magic formula for a quick answer to these questions. We have to rely on very practical experiments, testing our ideas by observing the behaviour of the bush and soil under a range of treatments. Perhaps the most encouraging feature of this section of the Institute's research is the very recent expansion of our field experiments. Given patient care and attention, for results can not be forced out of them in a hurry, these should provide a sound foundation on which the Industry can build its fertilizer programme.