NEWS AND NOTES

FIELD NOTES

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Measure for Measure

If some one tells me a stand has about 1200 trees per acre, a basal area of 160 square feet, and a net annual increment of 145 cubic feet per acre, I can make a fair stab at visualising the stand. Most foresters have a few useful statistics tucked away in their memories, such as that 6 x 6 feet spacing gives 1210 trees an acre. But were I told that the stand has 2965 trees a hectare, 36.8 square metres of basal area, and an annual increment of 10.15 cubic metres a hectare, it would leave me blank.

This is unfortunate, not only because much of the world's literature in forestry and ecology uses the metric system (F.A.O. publications for example), but international cooperation and contact are increasing rapidly. It is nice to know what colleagues from other lands or in other disciplines are talking about and to be able to translate our units into terms they can understand. Frequently I have had to fumble with rapid mental arithmetic to answer some foreign visitor's query about an experiment and this experience is probably common.

Foresters are unfortunate because theirs is a border science that demands a working knowledge of the many and varied units used by surveyor, engineer, chemist, biologist, hydrologist, *et al.* Canadian foresters are doubly unfortunate because, although officially Canada uses mainly the Imperial system, the appreciably different United States volumetric measures have so penetrated everyday life, that thorough understanding of more than one set of units is now essential if such commonly met measures as the bushel, gallon, quart, and fluid ounce are to have any precision. Woe betides the unhappy cook who confuses the Imperial or American tablespoon or the 20-ounce Imperial and 16-ounce American quart — even the fluid ounces themselves are slightly different. And the British Hoppus cubic foot always confuses me although I have looked it up repeatedly.

The purpose of this preamble is twofold. First, it is a plea for Canadian foresters to become more familiar with the use of metric units in forestry — it is not unlikely Canada may find itself the odd man out if and when Britain joins the Common Market. A useful and courteous way of doing this would be to include metric equivalents for the main statistics in professional papers. Second, it is to draw attention to a handy publication for such conversions (which was reviewed briefly in the March '63 issue of the *Forestry Chronicle*), P. J. Rennie's 'Measure for Measure.'

This publication reveals, incidentally, just how complicated the British and American systems are. But if we foresters feel abused, just think of the poor F.A.O. statistician. In trying to compile rice yields, for example, he has to grapple with Chinese catties per mow, Japanese kokus per cho, Malayan gantangs per acre, Thai piculs, Philippine cavans, American bushels, British

Guianan bags (which differ in weight throughout the country), Egyptian feddans, and so on.

On Fertilising

Most North American forest managers probably think fertilising in the forest unpractical on this continent. In the main they are probably correct, although the literature is making it evident that under some circumstances fertilising plantations and natural forest is not only practical but essential if forestry is to be profitable. But what started this peroration was my coming across two iconoclastic articles on fertilising.

Few foresters would think of fertilising mature stands. Even where its practicality is allowed, orthodoxy would have it that fertilising is a means to aid establishment of plantations, to break check in a stagnant crop, or to promote vigorous growth in a pole-sized stand. A Norwegian investigator, Alf Brantseg, takes the opposite view. According to Brantseg (1962):

"A fertilisation of forest stands on mineral soil should only take place at the end of the the rotation. With the fertilisers available today, and with the probabilities of having to use repeated applications, owing to the short duration of the fertiliser effects, the possibilities are limited that fertilisation of young, or younger, forests will give a reasonable return of interest on the capital invested."

These conclusions are based on an experiment started in 1945 in a 99-year-old stand of Scots pine growing on a podsolised soil on a river terrace. Two fertilisers — calcium nitrate (15.5% N) and a complete fertiliser (15% N, 5.2% P, and 16.2% K) — were tested at four levels of application, with three regimes (by yearly arrangement) of application for each.

A yearly application of 300 kg. per hectare (*ca* 225 lbs. per acre) maintained from 1945 to 1948 inclusive led to a dramatic increase in annual increment that began in 1946 and lasted until 1952, when the annual increment fell back to the level of the control plots. The calcium nitrate alone led to an increase in growth rate of 49 per cent compared with a 36 per cent response to the complete fertiliser, suggesting that nitrogen and possibly calcium were the elements chiefly responsible for the increased rate of growth on both groups of treated plots. The calcium nitrate treatment gave a return of 18 per cent a year on the cost of the fertiliser and its application.

This is an isolated experiment with Scots pine on one particular site with a soil that may have been particularly low in nitrogen and calcium. But we don't lack pine—or spruce for that matter—on poor soils. Who knows—it may be worthwhile to lay the fertiliser on thick for three or four years when the stand seems to have stopped growing and be ready for the axe.

The second article was by a Dr. Hugh Nicol (1962), who surely must be the angry man among agronomists. His thesis is that the NPK theory of plant nutrition is based upon pretending that nutrients are entities capable of existing in their own right, together with the idea that fertilisers can exert effects corresponding to whatever nutrient or group of nutrients is uppermost in the experimenter's mind. Consequently, fertilisers that contain say nitrogen, are discussed and compared as if they were no more than carriers of different percentages of nitrogen. This pernicious theory is fostered by statisticians who

would have difficulty in handling the interactions were the influence of all other ions considered. To quote Dr. Nicol:

"Could anything in this scientific age be more absurd, or after almost a century of chemistry coordinated in every other sphere, more archaic?"

Nicol argues that since plant nutrition proceeds exclusively by uptake of ions, every fertilizer and manure without exception not only ionises in the soil, but is effective in promoting or inhibiting plant growth only insofar as it does ionise. Every salt consists, by definition, of an anion and cation; yet in nutrition research there is a tendency to regard fertilizers as sources of major nutrients only and ignore the effects of coupled ions such as $-\text{SO}_4$, $-\text{Cl}$, etc. All ions have an effect on soil moisture tension and many of the disregarded ones are also nutrients in their own right.

He asserts that since soils usually contain no soluble non-electrolytes, the wilting point of soils may be expressed as a total concentration of ions measured in a water extract of soil and expressed as the negative $\log_{10}$ of its specific electrical conductivity. This expression is called pC. In terms of pC, wilting point for most crops is pC 1.7. If all nutrients are present, optimum growth occurs at pC 3.3-3.5. pC can be objectively joined to pH in one expression for the ionic state of a water extract of the soil, i.e., $2\text{pH}-\text{pC}=\text{pL}$ where pL is a characteristic of the soil.

pC is the function of the concentration of all ions; pH indicates how H^+ and OH^- ions are distributed under the influence of other ions. An index of the distribution of other solute ions is needed to complete the picture. G, the distributional parameter, is the ratio by weight of all anions to all cations in a simple physiological salt such as the chlorides, sulphates, etc., of the usual nutrient bases. Most successful nutrient solutions have a G of about 2.5.

The requirements of a typical temperate crop plant (angiosperm) are: pC about 3-5 and preferably not below 2.7; pH about 6; pL as high as possible, but never more than 12 or conditions like saline soils will exist; and G not less than 2.4.

According to Nicol, one cannot devise a nutrient solution that contains all major nutrients, has the correct G, and yet provides an excess of any of those elements of uncertain nutrient status. The supposed toxic effects of excess sodium, chlorine or potassium, etc., are really the effects of disturbing G and usually of lowering it below the optimum value for the particular crop.

He sounds convincing!

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