

CONFERENCE PAPER

THE MECHANIZATION OF PEASANT AGRICULTURE  
AND THE MAINTENANCE OF SOIL FERTILITY  
WITH BUSH FALLOWS

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Mechanization of agriculture in the tropics must always be considered in relation to the maintenance of soil fertility which, together with actual crop production, is amongst the very first objects of cultivation.

Mechanization in peasant agriculture will probably always have a different significance to that which it has on either the individually-owned and individually-run farm of moderate size or on the company-controlled, large scale estate. The two latter types of organization are in a far better position to maintain the fertility of their lands than are peasants. This will in the main demand employment of artificial fertilizers and the efficient, and therefore economic, use of these will depend upon proper chemical control in conjunction with manurial trials, procedures beyond the scope of all but the most rigidly-run peasant organizations. To a greater extent than is the case with other forms of agricultural organization, peasant farming is practised on latosolic upland soils comprising friable, red and yellow kaolinitic earths on which the use of artificial fertilizers presents numerous difficulties which still very largely await solution (1).

Particularly in areas where cattle trypanosomiasis is prevalent, peasant farmers at present rely, and will have to rely for a long time ahead, on vegetative fallows to maintain the fertility of their lands. Vegetative fallows, particularly bush fallows, besides restoring the nutrient status of the cropping zone, during the course of their growth perform a number of the functions of tillage. They smother weeds of cultivation, especially rhizomatous grasses such as Imperata cylindrica and, by virtue of their root action and the soil fauna they harbour, restore soil structure. They obviate, therefore, the need for tillage by mechanized or any other means. Further, vegetative fallows form one of the surest means of preventing soil erosion.

Experience has shown that bush fallows are superior to herbaceous, especially grass fallows. This point has been emphasized by the team responsible for the report on Soil Conservation and Land Use in Sierra Leone (2). It is also very evident, too, in the southern, humid portion of the Gold Coast where along the seaboard closed forest has been replaced by thicket into which fire savannah is spreading. Aerial reconnaissance here shows how much more favoured the remaining areas of thicket are for farming than is the invading savannah. The preference for bush rather than grass fallows is understandable when the ash constituents of shrubs and grasses are compared: the ash of grasses is low in divalent bases, calcium and magnesium, and high in potassium compared with dicotyledonous shrubs and herbs which, in addition, have markedly higher phosphate contents.

In many tropical countries, and the Gold Coast is a good example, the fuel provided by bush fallows forms a product of considerable importance and value. Thus, in the financial year 1952-53, out of an estimated outturn of timber and fuel amounting to an equivalent of 214 million cubic feet of round timber, some 84 per cent. comprised timber used directly for fuel or utilized in the production of charcoal (3). Most of this fuel would be obtained from bush fallows. The manifold difficulties that have arisen in countries in which deforestation has proceeded so far as to have eliminated bush as well as trees are well known; India and Pakistan are examples.

It is sometimes asserted that bush fallows are extravagant in the use of land when compared with other means of maintaining fertility (4). When the comparison is with a system of mixed husbandry in which permanent fields are dressed with farmyard manure this is only so if cattle are fed on imported foodstuffs, otherwise the crop nutrients available are produced by the vegetation (in this case grass and browse) as with bush fallowing. This conviction, however, has, in areas where tsetse preclude the raising of cattle, led to numerous experiments in which short term leguminous cover crops have been substituted for relatively long term bush fallows. Such a system, were it successful, would lend itself ideally

to mechanization. It would appear on the face of it that it would be unlikely green manuring could achieve in a season or two the work of restoring soil fertility that experience has shown under bush takes several or more years. Such a conclusion is strengthened by the failure of the peasant cultivator to adopt such a system.

Whilst bush fallows may obviate any need for tillage, mechanized or otherwise, this does not mean that mechanization can play no role in a system of peasant agriculture based on bush fallowing. At present the most arduous and labour-consuming work in this type of agriculture is the clearing of bush fallows preparatory to the planting of crops and it is here that mechanization can fulfil a very valuable function.

The cutting of bush fallows does not include eradication of roots and stumps but merely pollarding of the shrubs at ground level so that they can sprout immediately the short period of cultivation is over, provide a cover for the abandoned land and commence its rehabilitation. There is no doubt that this work could be mechanized and carried out by tractor-operated circular knives and saws of somewhat similar construction to sugarcane and hedge cutters. As with the mechanical reaping of sugarcane certain difficulties can be foreseen, e.g. the removal of the leafy and twiggy crowns of the shrubs grown. These need to be left on the ground to be burnt so that their ash can be utilized by the crops later planted whilst the stems themselves need to be left relatively free of side shoots so that they are in a convenient condition for transport and use as fuel. This process of separation in cutting could probably be achieved by cutting at two levels: removing the leafy, twiggy crown first and windrowing this material and then cutting the sticks that remain at ground level and windrowing these separately.

Mechanized cutting of bush fallows could undoubtedly be facilitated by alignment of the shrubs employed and the choice of appropriate spacing. Adjusted spacing would probably be needed to ensure that the sticks were of adequate thickness for use as fuel but thin enough to allow of ease of cutting, e.g. a maximum diameter of

2 to 3 inches. This, of course, would mean the special planting of bush fallows in the first place at least. Such a practice is not entirely unknown amongst peasant farmers. In southern Nigeria, for example, bush fallows of Acioa barteri a rosaceous shrub, and Macrolobium macrophyllum, a caesalpiniaceous bush, are deliberately planted by farmers (5).

The special planting of bush fallows would provide opportunity to select shrubs most efficient at restoring soil fertility since different species characteristically have different ash compositions and therefore tend to retain in circulation particular nutrients or to increase the proportions of them in circulation (6). The ability of certain plants, e.g. lupins, to obtain phosphorus from mineral compounds that some crop plants, e.g. cereals, can not exploit is well known (7).

For mechanization to be economically successful tractors and implements need to be in continuous use. The mechanized cutting of bush fallows, however, would be a seasonal occupation confined to the dry season, or a part of it, in regions with a strictly tropical rainfall regime and perhaps also to the short dry season as well in regions favoured by an equatorial regime characterized by two rainfall maxima. During the remainder of the year tractors could advantageously be employed in the construction and maintenance of rural roads, efficient means of transportation being essential to agricultural progress.

The mechanization of bush fallowing would in practice be most efficiently carried out by bush-cutting units, commercially- or government-operated, working over a defined district and carrying out cutting by contract. This combined with the planting of special shrubs for ease of cutting and for their value as fertility restorers would aid in the stabilization and integration of peasant agriculture which is characterized at present by its fragmentation and incoherence, rendering improvement in standard very difficult.

Experimental investigation of peasant farming based upon mechanized bush fallowing as a means of preserving, and in savannah areas of enhancing, soil

productivity is planned by the Gold Coast Department of Soil and Land-Use Survey during the second Five-Year Plan, 1956-61. Such investigations it is proposed should include: research with suitable types of equipment, into methods of cutting bush with the assistance, it is hoped, of interested manufacturers; research into methods of planting bush, i.e. alignment and spacing; and research into the selection of suitable shrubs on the basis of their ease of cutting and as nutrient restorers. Such researches it is proposed should include, besides experiments in the field, investigations in the laboratory.

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