## II. INTRODUCTION

The detrimental effects of weeds in crops are well known. They compete with the crop for food, moisture and light, and where any of these factors are limiting in the growth and establishment of the crop, weed competition may seriously reduce yield. Losses incurred by weed competition, exceed the combined losses due to all other agricultural pests. (Robbins, Crofts and Raynon, 1952). Weeds as a limiting factor in tropical agriculture are of greater importance than in the temperate climates. (Pfeiffer, 1957). Thus, elimination of weed competition may result in increases of crop yields in the order of 100% or more. (Ashby et al, 1956). Present day agriculture, therefore, with its specialised crops and methods, its rapid mechanisation and its efficient handling of fungus and insect pests, demand adequate weed control.

Cultivation has been the oldest method of weed control. Though this practice sufficed in the past, the decreasing number of hand labourers and narrowing margins of profit require more efficient methods now sought in the use of herbicides. (Beattie, 1959), the Director of Research, Amchem Products, Inc., reported that: "In the U.S., cost of farm labour has increased by 400% during the past 25 years. Chemical weed control has helped considerably in solving the problems of labour shortage and increasing costs." In the tropical and sub-tropical worlds, especially in areas of increasing industrialisation, a similar situation is reported.

Advantages of chemical weed control over cultural methods have been well recognised. The main ones are the early ability to control weeds in crop establishment without undue disturbance to crop root and labour saving. (Cunningham van Somerer, 1957, Pfeiffer, 1957 and Kasasian, 1962). The use of chemicals is not without disadvantages. Erosion, capping of the surface soil, and accelerated run off may occur as a result of soils, bared from vegetative covers. (Russell, 1957, Williams, 1958). Danger of mono-culture in weed

cover may arise from resistance of a particular species to chemicals. (Beattie, 1959). Progress in better management of soils, and the production of more efficient herbicides are rapidly overcoming these problems. Chemical methods have become an important factor in the mechanisation of agriculture and are likely to have a great future in the tropics.

The demand for more efficient herbicides comes from the farmers who have to pay constantly increasing wages for manual labour. Mechanical weed control and hand weeding are becoming more and more uneconomic. To satisfy this demand, much work in the fields of production of new herbicides screening tests and extensive field experimentation, has been achieved. Research of immediate importance to the tropical world is undertaken by large commercial firms such as Fisons Pest Control, and Plant Protection. Other firms have made valuable contributions.

It is the aim of this paper to assess the value of some of the newer herbicides on weeds in cacao. (Theobroma cacao. L) plantations. The herbicides investigated are selected triazine derivatives: (Geigy Co. of Basle, Switzerland), diuron: (E. I. du Pont de Nemours and Co. U.S.A.), paraquat: (Plant Protection Ltd. U.K.) and fenac: (Amchem Products, Inc. U.S.A.). These are reviewed briefly in the next section of the paper.

This investigation is purely a field evaluation of these herbicides in cacao, a crop that has received surprisingly little attention in the field of chemical weed control. A preliminary assessment of the effect of the herbicides on weed population, crop, shade and intercrops is evaluated. In Trinidad, Bananas (Musa spp.) and Cassava (Manihot utilissima, Pohl) are commonly intercropped with cacao whilst immortelle (Erythrina spp.) is the accepted shade crop.

Cacao, at the time of establishing compete with weeds for

nutrients, water and light. Although in the earlier stages, seedlings send down a deep tap root, the development of lateral and surface feeders benefit from weed control. Trees of two to four years old are treated in this work. As cacao is a valuable crop, the farmers can afford the use of more efficient herbicides.

It is clearly recognised that the use of herbicides alone is not an end in itself. Improved cultural and management practices must be supplementary. Russell emphasised this fact in his address as Chairman of the First East African Herbicides Conference: "This Chemical method can be invaluable but it cannot absolve the farmer from his basic duty of farming well. If weedy land is a result of bad farming and the farmer uses herbicides without improving his standard of farming, he cannot possibly get the most out of these herbicides and may even do himself harm."

The use of a suitable cover crop in cacao offers a possible solution as a supplement to the use of herbicides. In this way, weeds are suppressed until the cacao trees form a complete canopy. Leaf fall and exclusion of sunlight keep the cacao fields relatively free from weeds in older cacao.