Breeding for Disease Resistance and Higher Rubber Yield in Hevea, Guayule, and Kok-Saghyz

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ALTHOUGH thousands of plant species in both temperate and tropical regions contain rubber, only a few have proved worthy of cultivation for the commercial production of rubber. Of this small number, *Hevea brasiliensis*, the principal plantation rubber tree; *Parthenium argentatum*, the desert shrub guayule; and *Taraxacum kok-saghyz*, the Russian rubber-bearing dandelion, have been intensively studied by the U. S. Department of Agriculture during and since World War II.

Actually, only the Hevea is now used extensively for commercial rubber production; but the other two, with further improvement, offer promising sources of natural rubber within the United States in times of emergency and the possibility of competitive peacetime crops in suitable areas. In spite of vast improvement of rubber substitutes (the so-called "synthetic rubbers"), about 25% of our total rubber requirements, especially in an emergency, must, according to defense authorities, consist of natural rubber. Therefore, these two "domestic" sources are of strategic importance for supplementing our expensive and apparently indefinitely continuing stockpile of imported Hevea rubber.

Selection in indigenous areas of Hevea in the Amazon basin and guayule in Mexico, and breeding for disease resistance and increased yields of all three crops have constituted major objectives. In this brief paper, we present some of the important problems, methods employed, and extent of progress on these long-term projects.

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Improvement of Hevea

Since June 1940, the Department of Agriculture cooperated with some 11 Latin-American Republics on a program of research and technical guidance for a thoroughly economic and self-sustaining producing industry in tropical America. This is now regarded as the pioneer Point IV type of aid to underdeveloped countries.

Both the extent of cultivation and the improvement of Hevea have proceeded concurrently with automotive transportation which still requires nearly two-thirds of all rubber produced. In common with many of the older cultivated crops, the initial improvement of Hevea took place in regions (specifically Southeast Asia) far removed from its native habitat in the Amazon valley. The major pests and diseases did not accompany introduction of the tree nor have they since spread to that distant region; therefore, breeding and selection in the United States can now be carried out without taking them into account.

The original source of the Far Eastern plantation was along the Tapajos River of Brazil. Unfortunately, trees from this limited area have been found to possess the least resistance to South American Leaf Blight (caused by *Dothidella ulei*) of all collections of the same or other species throughout the vast Amazon basin. Earlier attempts to produce rubber in the United States were based upon the returned plantation "strain" which met only with disaster because of this blight disease.

In the beginning of our Latin American rubber program, valuable experience and plant material were derived from those early plantation failures. The pioneer "Fordlandia" and "Belterra" plantations of the Ford Motor Company...