THE EFFECT OF BLACK LOCUST ON ASSOCIATED SPECIES WITH SPECIAL REFERENCE TO FOREST TREES

by

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Introduction

For a number of centuries, it has been known among agriculturists that such crop plants as beans, peas, and clover lead to increased yields of certain other crop plants following in the rotation; but it remained for modern investigators to demonstrate that nodule formation on roots of leguminous species is due to infection by nitrogen-fixing bacteria and that through the activity of these bacteria the nitrogen content of the soil is increased. In 1888 Beijerinck isolated and cultured the organism and named it Bacillus radicicola; Prazmowski, in 1889, changed the name to Bacterium radicicola; and later the Society of American Bacteriologists placed the Bacterium radicicola in the genus, Rhizobium, that commonly in use at present. In 1932, Fred, Baldwin, and McCoy listed all leguminous species, whose nodule bacteria have been studied, in sixteen groups on the basis of interinoculation; thus, each species within a group may successfully be inoculated with bacteria from the nodules of any other species within the category. The bacteria, inoculating roots of species in any one group, are deemed distinct enough from those inoculating other groups to be considered as a separate species. Black locust (Robina pseudoacacia L.) alone comprises “Group XII.

Although foresters have reported, during the last decade, their recognition of the importance of this tree legume as a benefactor to associated tree species, their data represent studies on comparatively few plantations with associated species, primarily catalpa. In 1922, Ferguson, from studies of adjacent black locust and catalpa plantings at College Farm, State College, Pennsylvania, showed small but consistent decreases in total nitrogen content of the soil at increasing distances from the locust planting. Also average heights and diameters of the catalpa trees were shown to decrease as distance from the locust increased. McIntyre and Jeffries, in 1932, reported recent studies of soil nitrogen in relation to height and diameter growth on two catalpa plantings adjacent to black locust at the Pennsylvania State College, State College, Pennsylvania. Their results in general were similar to those of Ferguson.

Black locust may become established under widely varying combinations of site factors. Cuno, 1930, suggests that the range of black locust may have been originally restricted to the Appalachian Mountains from Pennsylvania to Georgia, and to parts of western central Arkansas and eastern central Oklahoma. He further states that the best development of the species occurs on the western slopes of the Appalachians in West Virginia. Black locust was introduced into Europe in 1601 and has been considered the most successful of the tree species introduced from America. Although established locust is often found on badly eroded, rocky, high rates of growth usually occur only in the natural stands on well drained silty loams.

The writer found from observations that the states of Ohio and Indiana, during the summer and 1932, that the black locust-catalpa combination was the usual one from which comparative measurements may be obtained. Suitable plantations were, however, where data on the relation of locust to growth of white ash, tulip poplar, black and oakes were collected.

The purpose of the present investigation was to obtain more critical data to demonstrate that black locust affects the soil nitrogen content and growth rate of associated species. Studies confined to plantings of species adjacent to the states of Ohio and Indiana and recently established in the Botanic Garden at the Ohio State University.

Plantations

Six plantings have been included in the present investigation, one in Highland County in Clermont County, Ohio; and four in Clermont, Indiana. Several other plantings in various counties of Ohio have been supplemented for less detailed study. All of these have been established twenty years.

METHODS:— Rectangular plots were representative parts of the plantations adjacent to black locust. In every case, the trees were regular intervals in the rows paralleling the locust, and the widths of the plots were six to twenty trees in each row. Height and diameter of the trees were calculated from the trees.

Total nitrogen determinations were made by boric acid modification of the Kjeldahl method. Samples collected at regular intervals of distance from the locust in the plots. Also hydrogen-ion concentrations were obtained from the several soil samples by a quinhydrone potentiometer.

Comparisons were made from increment of the growth rates for the first ten-year and the last ten-year periods for trees near to and at a distance from the locust in six Ohio catalpa plantings.

During the summer of 1931, observations on relative degree of nodulation were made on Fiftieth year.