Environmental factors can affect the successful establishment of an effective symbiosis between rhizobia and their hosts at any or all of three stages. They may: (1) affect the occurrence, growth, and survival of the root-nodule bacteria; (2) modify nodule formation; (3) affect the functioning of the formed nodule.

Failure to separate the stage at which establishment of the symbiosis has been blocked or modified has been responsible for a good deal of uncertainty concerning the operation of environmental factors. Particularly, investigators have often failed to determine whether rhizobial survival was involved; partly reflecting difficulties in methodology. Too large a part of the work that has been done is of a kind that sows seed, with or without inoculation, varies conditions and records presence or absence of nodules. This does not, of course, distinguish between factors modifying the occurrence of rhizobia, and factors that control the more intimate acts of invasion and nodule maturation.

In this chapter the aim will be first to deal with a range of environmental factors and to distinguish, as far as possible, the stages at which they operate. Consideration will be restricted to effects that are specific to the legume-rhizobium association so as not to extend the account unduly in the direction of general plant physiology and nutrition. The second half will consider the practical question of legume seed inoculation. To keep the article to a reasonable size, no attempt will be made to cover the developing literature of the nonleguminous nitrogen-fixing plants (but see several recent accounts: Allen and Allen, 1958; Bond, 1958; Norris, 1962). Quoted literature will be selective, rather than comprehensive, particularly where the information has already been covered in classical accounts (Fred, Baldwin, and McCoy, 1932; Wilson, 1940) and general reviews (Allen and Allen, 1950, 1958; Nutman, 1956). More specialized reviews have also been utilized (Nutman, 1958; Vincent, 1954a, 1962a), including those that have paid particular attention to the problems of the tropical legumes (Andrew, 1962; Bonnier, 1960; Bryan, 1962; Henzell and Norris, 1962; Norris, 1956, 1958a, 1959b, 1962).