Photograph of Sesbania rostrata plants grown with and without inoculation and with and without fertilization with urea.

Closeup view of inoculated plants to show vigor.

Nitrogen Fixation by Desert Legumes. This issue of *Desert Plants* includes a provocative article on the legume genus *Sesbania* by H. M. Abdel Magid in the Department of Soil and Water of King Saud University. The article speaks of the "drought stricken fragile ecosystems of arid and semi-arid regions" and the potential suitability of *Sesbania* for improving the fertility and utilization of poor desert soils. *Sesbania* species are capable of providing forage, green manure, firewood, gum, pulp and paper, edible leaves and flowers.

The legume plants with which temperate agriculturists are most familiar are the annual species of beans, peas, vetches, clovers, lespedeza, alfalfa, soybeans and similar crops which are grown for a season and which restore soil fertility for other crops.

Many *Sesbania* species grow to great size in the tropics and subtropics, even within a few months. Professor Abdel Magid reminds us of the "awesome imminent crisis and challenge in finding fuelwood that might face the world by the year 2000 A.D." In the report on *Firewood Crops* by our National Academy of Sciences, *Sesbania bispinosa* is characterized as producing high yields of firewood in six months. A yield of 15 dry tons per hectare has been reported for a field in Italy. Production could be even higher in the tropics where more than one crop might be harvested per year.

Legumes make good crops because they can gain a "captive" nitrogen supply from root nodule bacteria. Students of desert plants naturally see a parallel with succulent plants which are able to gain a "captive" water supply and the usually associated CAM-plant condition whereby there is also a "captive" carbon dioxide supply. A captive nitrogen supply is important not only in heavily cropped fields where available nitrogen is transitorily low due to organic material having repeatedly been removed from the system (making it something of an artificial desert), but also in natural deserts where available nitrogen is low simply because of aridity. Nitrogen available in soil derives both from decay of organic material within soil and from rain-borne nitrogenous compounds produced by lightning. Arid soils are naturally nitrogen deficient because of their low organic content and their source of water being from irrigation rather than rain.

Desert legumes promise to provide a fruitful area for scientific investigation. Since repeated annual cropping of organic material from traditional temperate farming soils tends to desertify such soils temporarily with respect to nitrogen, legume crops have been adapted by man to fill a very important niche—that of restoring the fertiility in a rotation of crops. Whereas legume crops have been molded to this desertified niche only for the few thousand years that man has been involved, the natural desert legumes obviously have become adapted to natural deserts literally over eons of time. We suspect that they may have developed some physiological pathways and adaptational mechanisms of potential interest in helping us further mold plants both to the transitory agricultural desertification of cropland (which is cured by suitable rotational schedules) and to the more insidious desertification that involves loss of organic material from land for which there is as yet no solution.

Bogs represent extremely wet situations which are deficient in nitrogen simply because of pH relationships of excessive organic material and excessive water. Necessity is the mother of invention. Carnivorous plants are generally unique to such boggy situations and represent adaptations for obtaining nitrogen. They merely digest protein of insects and small animals, breaking the proteins into amino acids and available nitrogen. The opposite extremes of low nitrogen because of deficient organic material and deficient rainfall have molded the arid counterpart of the carnivorous plant: the legume. We have already learned to use legumes in countering low nitrogen in soil due to repeated agricultural removal of organic material. This involved many generations of temperate zone agriculturists. Now we look ahead to the prospect of learning about legumes for their value in deserts and desertified situations where organic material is deficient because rainfall is low. Has nature molded something which, although now obscure, will prove to be a seed of some great good? We think so. The Boyce Thompson Southwestern Arboretum is planning a program of desert legume research to be led by Dr. R. P. Upchurch.—F. S. Crosswhite and C. D. Crosswhite