

Nitrogen Fixation in the Wheat Root Zone

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Summary

When root zones (roots and soil) of wheat (Western Plant Breeders Number 906) were sampled and tested for nitrogen fixing ability we found nitrogen fixation occurred only when sugar was added to the root-soil samples. Several strains of nitrogen fixing bacteria were isolated from these samples and were tentatively identified as members of the bacterial genus *Klebsiella*. These data and bacterial strains are very similar to those obtained from wheat rhizospheres and soils in South Dakota, Florida, Nebraska, Holland and at other locations. From our data and those of other workers, it appears that the unavailability of a source of energy prevents these nitrogen fixing bacteria in the rhizosphere and adjacent soils from using atmospheric nitrogen.

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The possibility that a population of nitrogen fixing bacteria may grow in the root zone of cereal crop plants and supply the crop with its needed nitrogen has intrigued agronomists since the turn of the century. This has been shown to occur for a few cultivars of only a couple of genera of grasses. Reports of very sporadic fixation in the rhizosphere of wheat and some other grasses are in the literature. This work is part of an ongoing study to determine what conditions will allow such nitrogen fixation. These studies were conducted on material taken from small grain varital test plots on the Russell Schlittenhart farm near Eloy. Mr. Schlittenhart and Mr. John M. Harper, Pinal County Extension Agent, cooperated in this study.

A small soil corer was used to take soil and soil-root samples. These samples were taken from about 2-3 cm below the crown of wheat plants and below the surface of adjacent non-rhizosphere soils. The samples weighed about 2.25 gm. They were placed in 10 ml serum vials. Some of the samples had 0.5 ml of water and some 0.5 ml of 1% glucose solution added to them. These were then sealed with serum stoppers and the air atmosphere replaced with 90% N₂ and 10% acetylene.

The vials were incubated for several hours at room temperature. One ml samples of the atmospheres were taken and analyzed by gas-liquid chromatography for the presence of ethylene. The production of ethylene from acetylene is evidence of nitrogen fixation activity. The data from several such experiments show little or no nitrogenase activity in unamended soil or rhizosphere soil but marked acetylene reduction when soil or root-soil samples were amended with glucose.

Enrichment cultivation techniques yielded nitrogen fixing bacteria from these soils. These organisms were active nitrogen fixers when grown anaerobically in a medium containing minerals, sugar, a buffer and no fixed nitrogen.

It is concluded that these nitrogen fixing bacteria are not directly involved in supplying these plants with nitrogen.

