

Coal compared to peat as a carrier of Rhizobia

Sumario. La supervivencia de *Rhizobium* en inoculantes preparados en bases de carbón o de turba se determinó usando el método de infección de plantas con diluciones. La turba mostró la mejor supervivencia, con una población de *Rhizobium* de 1.2×10^9 por grano después de seis meses de almacenamiento. Uno de los tres carbones en la prueba tuvo supervivencia aceptable pero no se puede recomendar como material excipiente para inoculante porque se agregó y compactó durante el almacenamiento y además opuso cierta resistencia al humedecimiento en el momento de inoculación de las semillas.

Introduction

VULNERABILITY of *Rhizobium* to adverse storage conditions, compounded with the high risk of encountering such conditions in transit to, and prior to use in, a developing country makes domestic production of high quality legume inoculant an essential prerequisite for full exploitation of biological nitrogen fixation. Finely milled peat is widely accepted as the most satisfactory carrier for rhizobia organisms (3). Non availability of peat within many countries, or variable and unpredictable quality of existing deposits is prompting evaluation of alternative carriers. Although there are many peat deposits in Colombia only one out of nine tested exhibited satisfactory survival of rhizobia for use as an inoculant base (Graham pers. comm.). The inconvenient location of this peat deposit and a preoccupation over quality variability within the deposit (4) was the motive for this comparative evaluation of peat with coals from three local mines.

Materials and methods

Three anthracite coals from the Bohemia, Merced, and Fragua mines close to Cali, Colombia and a peat from Rionegro, near Medellín were milled to pass a 100 mesh (British Standard) sieve. Peat was air-dried to a water content similar to the coals (2-4%). Initial pH and organic matter content are given in Table 1. The pH of each was adjusted to pH 6.5 with finely divided CaCO_3 .

Broth culture of *Rhizobium trifolii* strain CIAT 61 with a total count of 1.83×10^{10} cells/ml was added (1 ml/g) to the milled supports. After thorough mixing, the inoculants were packed in 0.04 mm Polythene bags, and stored at room temperature ($23 \pm 3^\circ\text{C}$) throughout the experiment. At 0, 3, 7, 14, 28, 56, 84, 126, and 184 days the most probable number (MPN) of rhizobia in each carrier was determi-

Table 1. Properties of prospective carrier materials before amendment.

CARRIER	pH	% ORGANIC MATTER
Coal - Bohemia	5.0	78
Coal - Merced	6.2	74
Coal - Fragua	6.2	66
Peat - Rionegro	5.1	40

ned by plant dilution method (1) using *Trifolium repens* as host. For each carrier, a tenfold dilution series was prepared in quadruplicate then 1.0 ml of suspension inoculated into four sterile seedling per dilution beginning at the 10^0 dilution. The MPN was determined using the tables of Fisher and Yates (2).

Results and discussion

Rhizobia survived better in peat than in any of the coals (Fig. 1). Assuming the relatively low figure of 10^6 rhizobia/g as a minimum standard for inoculant, only one of the coals (Bohemia) was acceptable after six months. A second coal (Merced) would be acceptable if the expiration date was specified as four months after manufacture. Although less satisfactory than peat, Bohemia coal was adopted as the basis for inoculant production in our laboratory because of the convenience and expected consistency of further acquisitions from the same mine. However, it has recently been withdrawn because of two undesirable characteristics. When stored undisturbed for as little as six weeks, coal particles cemented together forming hard lumps inside the package. Lumpiness and difficulty in wetting the particles caused problems in inoculation, and especially the pelleting of small seeded legumes. Survival of rhizobia on seed inoculated with coal or

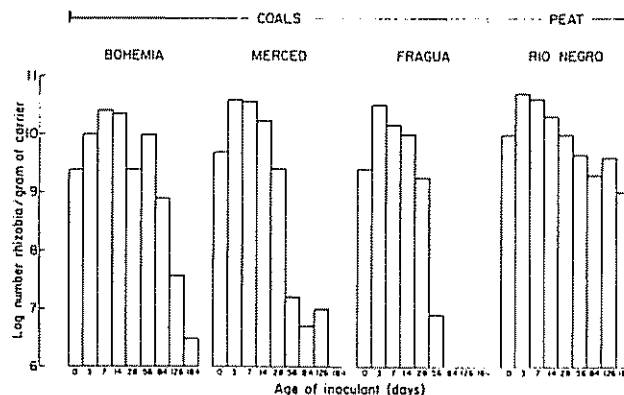


Fig. 1. Survival of rhizobia in four prospective carriers.

peat inoculant was not a part of this study, but it would be worthwhile to test whether coals exhibit the post-inoculation protective qualities attributed to peat (5).

Summary

The survival of rhizobia in coal—and peat—based inoculants was determined by plant dilution method. Peat afforded best survival, having 1.2×10^9 rhizobia/gram of inoculant after six months storage. One of the three coals tested supported acceptable survival of rhizobia but could not be recommended as an inoculant base due to a tendency to aggregate into hard lumps during storage and to resist wetting at the time of seed inoculation.

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