RESEARCH REPORT SUBMITTED
TO
OREGON PROCESSED VEGETABLE COMMISSION
VIA
AGRICULTURAL RESEARCH FOUNDATION
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TITLE: Genetic Transformation of Beans

PROJECT LEADERS: David Mok and Machteld Mok, Horticulture, OSU

PROJECT STATUS: First of five years

PROJECT FUNDING FOR THIS PERIOD: $18,000

Funds were used to purchase equipment, chemicals and wages for undergraduate student assistants.

OBJECTIVES:

1. To devise regeneration systems in beans adaptable to transformation using *Agrobacterium* infection.

2. To design and optimize conditions to deliver DNAs using particle bombardment.

PROGRESS:

Background:

Specific traits in plants can be modified by inserting either foreign genes or altered native genes (the process of delivering genes is called transformation). In plants, two general approaches are employed to obtain transformation although specific conditions of either approach vary greatly between species. The first approach utilizes the bacterium, *Agrobacterium*, which infects plants and inserts a piece of its own DNA (T-DNA) into the host chromosomes. If a foreign gene is spliced into the T-DNA, the foreign gene can be incorporated into the plant. This approach works well in conjunction with regeneration of plants from tissue culture (selection of transformed cells and plants derived from single cells to avoid chimeras). The second approach employs a "gene gun" which delivers DNA coated tungsten or gold particles directly to the growth points of the plant. Seeds are then obtained from treated plants to select for transformed progeny in subsequent generations. Methods to successfully transform beans (as well as other large-seeded legumes such as soybean) has yet to be devised.

An important consideration is which genes should be targeted for change. In recent years, many genes controlling a number of traits have been isolated from plants as well as other organisms. Regardless of the source of origin, these genes can be modified and transformed into plants. In beans, perhaps one of the most obvious ojective is high level of general resistance to

fungal and bacterial diseases. A number of genes encoding disease defense enzymes such as glucanase and chitinase have been isolated. In test plants such as tobacco and *Arabidopsis*, highly expressed genes of this type confer resistance. The utilization of such genes to increase disease resistance of beans will be the eventual goal of the project.

Progress:

The project began about five months ago and the initial experiments employed *Agrobacterium* infection. T-DNAs with selectable markers were used. These include antibiotic resistance, herbicide resistance and color formation. The selectable markers are necessary to test the success of transformation. For example, specific antibiotics are used to eliminate the bacterium after infection (with minimun effects on plant cells), herbicides contained in the medium to eliminate non-transformed cells and finally, the color (blue, as the result of a bacterial gene, GUS) serves as a marker for anatomical studies. Meristem region of seedlings were infected and shoots formed subsequently are being treated with antibiotic (Timentin) to remove the bacterium and herbicide (Bialaphos) to select resistant tissues.

SIGNATURES:

Project Leaders:

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