SEED or ROOT BACTERIZATION FOR BIOLOGICAL CONTROL OF PLANT DISEASE

A. Ramakrishna[1], B. Deepak Reddy[2] and R. Parshuram Naik[3]

[1]Senior Research Fellow, Agricultural Research Institute, Rajendranagar, HYD
[2]Ph. D Scholar, R.P.C.A.U, Bihar and [3]Senior Research Fellow, NIPHM

ARTICLE ID: 86

INTRODUCTION

Seed or root bacterization usually means treatment of seeds or seedling roots with cultures of bacteria that will improve plant growth, such preparations are frequently called bacterial fertilizers.The classical example is treatment of legume seed with *Rhizobium*. Whose value and mode of action is indisputable; preparations are on sale throughout the world.

Seed or root bacterization is also used specifically as a method for controlling root diseases. For success the inoculants must multiply in the rhizosphere and inhibit pathogens either by competition or antibiosis. If the inoculum multiplies around the emerging root but then declines or dies, it is unlikely to give permanent control, but may inhibit pathogens causing seedling diseases. To produce antibiotics, the inoculants must have adequate food, especially carbon substrate, which may be provided by exudates from seed or root, and the quality of the substrate may affect the amount of antibiotic produced.

Weinhold & Bowman found that *Bacillus subtilis* produced more antibiotic when grown on water extract of soybean tissue than of barley tissue. These plant materials added to soil equally supported growth of *B. subtilis*, but difference in antibiotic activity could explain why a soybean cover crop and green manure prevented buildup of potato scab, whereas barley increased disease incidence. An antibiotic can be rapidly inactivated either by adsorption on soil particles or microbial degradation, but may be important for limited periods while the environment favors production.

Most of the problems were discussed at the symposium on Ecology of Soil-borne Pathogens and by Baker. When seed inoculation led to establishment in the wheat rhizosphere of bacteria antagonistic *in vitro* to *Cochliobolus sativus*, disease reactions were not affected. This demonstrated that organisms showing antibiosis *in vitro* were not necessarily those that gave biological control in soil, even when present around roots. However, there were some inoculation successes in non-sterile and partially sterilized soil using organisms antagonistic to pathogens in culture tests. Natural activity of the antagonist in soil is a prerequisite rather similar to natural presence of the bacteria in soil treated with a bacterial fertilizer.

Seed inoculation with *Bacillus subtilis* has given promising results, significantly decreasing wilt of pigeon peas grown in sterile or non-sterile wilt-sick soil. The bacterial suspension was prepared in molasses and groundnut cake, materials that presumably enhanced antibiotic production around the seed coat and in the rhizosphere. Similarly, seedling blight of maize was controlled in pots of sterile or non-sterile soil by coating kernels with a suspension of *B. subtilis* in field trials inoculated kernels of three varieties gave stands comparable to those after treatment with captan or thiram. *B. subtilis* occurred naturally in the rhizosphere of maize and inoculation augmented this population.

In the sterile soil the bacterium was reisolated from samples of seminal and adventitious roots. *Fusarium roseum* f. sp. *cerealis* colonized the pericarp, endosperm, and roots of maize; thus by protecting both pericarp and root, *B. subtilis* was a more effective controlling agent than chemicals that protected only the seed. Circumstantial evidence suggested that control was by antibiosis, but the treatment also significantly increased root emergence, root growth, and height of seedlings, so growth-regulating substances might also be involved.

Mitchell & Hurwitz decreased tomato seedling mortality caused by *Pythium debaryanum* by seed inoculation with *Arthrobacter* species, but not by drenching the soil with a suspension of *Arthrobacter*. Vascular wilt caused by *Fusarium* was also decreased, but only in sterile soil. *Arthrobacter* lysed the mycelium of both pathogens. The organism was present in the seedling rhizosphere, but the population rapidly declined after two to three weeks, and normal microbial equilibrium was reestablished. Rather than use seed treatment, Broadbent *et.al*added *B. subtilis* to soil treated by aerated steam. *Pythium ultimum* was controlled on Antirrhinum, possibly by hindering infection rather than by antibiosis. In the rhizosphere *Bacillus subtilis* multiplied at first but then the population became static. *B.*

subtilis controlled *Rhizoctonia solani* in other experiments by lysing the mycelium, the degree of protection varying with soil and strains of fungi and bacteria.

Use of *B. subtilis* to control *Fusarium* stem rot of carnation cuttings also seems promising. This disease is particularly destructive during propagation so that, provided an inoculant inhibits the pathogen during rooting. Control should also be achieved by dipping cuttings in the inoculant suspension before planting in the propagating medium.

CONCLUSION

Bacterial inoculation of seeds or roots leads to changes in plant growth, sometimes to yield increases and to biological control of some plant pathogens, effects that are probably interrelated. Changes in plant growth are caused by growth-regulating substances, especially those of the gibberellin type, and significant increases in yields of vegetables are almost certainly the result of gibberellin activity.

REFERENCES

Atkinson, T. G., Neal, J. L., Larson, R. 1. 1974. Root-rot reaction in wheat: resistance not mediated by rhizosphere or laimosphere antagonists. *Phytopathology* 64:97-100

Baker, K. F., Snyder, W. C., Eds. 1965. Ecology of Soil-borne Plant Pathogens. Berkeley: *Univ. California Press*. 571 pp.

Baker, R. 1968. Mechanisms of bio1ogical control of soil-borne pathogens. *Ann. Rev. Phytopathol* 6:263-94

Broadbent, P., Baker, K. F., Waterworth, Y. 1971. Bacteria and actinomycetes antagonistic to fungal root pathogens in Australian soils. Aust. J. BioI. Sci. 24:925-44.

Chang, I., Kommendahl, T. 1968. Biological control of seedling blight of com by coating kernels with antagonistic microorganisms. Phytopathology 58: 1395- 1401.

Mitchell, R., Hurwitz, E: 1965. Suppression of Pythium debaryanum by lytic rhizosphere bacteria. Phytopathology 55: 156-58

Olsen, C. M . Baker, K. F. 1968. Selective heat treatment of soil and its effect on the inhibition of Rhizoctonia solani by *Bacillus subtilis*. Phytopathology 58:79-87

Weinhold, A. R., Bowman, T. 1 968. Selective inhibition of the potato scab pathogen by antagonistic bacteria and substrate influence on antiobiotic production. *Plant Soil.* 27: 12-24