Root Rot Disases of *Panax ginseng* and Their Control in Korea

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ABSTRACT

Korea ginseng, *Panax ginseng* Meyer, has long been used as traditional oriental medicine. As many pharmacological activities of ginseng has been recognized. its demand has increased year after year. Now newly planted acrages of ginseng in Korea are approximately 3,700 ha for main field and 560 ha for seed bed in 1987, respectively.

Disease problem is one of the most important limiting factors for ginseng cultivation since its cultivation was attempted through propagation of wild ginseng in 1122. Among the root rot diseases, which is known as a complex disease and possible factor of replanting problem of ginseng, caused by several fungi, bacteria and nematodes, resulted in 20-59% of yield losses. The 40.8% of main field for red ginseng has been annually abolished before they reached 6 year old during 1970-1985.

Therefore, ginseng farmers in Korea have focused on the control of root rot complex disease from the very beginning. They have established a present cultivation system which is principally based on a biological control with try and error method from generation to generation.

The present researches for control of root rot have mainly involved, (1) identification of root rot pathogens in accordance with appropriate symptoms. (2) use of possible cultivation method to decrease the disease, (3) soil amendments, (4) verifing the mechanism of suppressive and condusive soil, and (5) treatment with various antagonistic microbes in soil.

Pathogens known to be the causal organism of root rot are *Cylindrocarpon destructans*., *Fusarium solani* f. sp. *panacis*., *Alternaria* sp., *Phytophthora cactorum*, and *Sclerotinia* sp., potato rot nematode, *Ditylenchus destructor* is also included in the category.

The most attractive control method of the root rot disease and other soil-borne pathogens of ginseng plant might be use of biological control program. Mycelial growth of *F. solani*, *Rhizoctonia solani*, *P. cactorum* and *Sclerotinia* sp. was markedly inhibited on soil extract agar from suppressive soil to ginseng root rot and the suppressiveness of the soil could be nullified by heat treatment.

Ten promising species of microorganisms from the soil were selected with *in vitro* trials, i.e. *Arthrobacter* sp., *Chaetomium globosum*, *Gliocladium virens*, *Penicillium frequentas*, *Trichoderma konmgii*, *T. harmatum*, *T. harzianum*, *T. viride*, *Bacillus subtilis*, and *Pseudomonas fluorescens*. Potential populations of the antagonists inducing 50% inhibition of mycelial growth or germination of the major root rot fungi in soil were 5×10^9 CFU/g soil with bacteria and 4×10^5 CFU with fungi, respectively. In field trials, incidence of root rot was considerably reduced by the mixture of various antagonistic microbes. Dressing the root stocks with the antagonists resulted in the minimum incidence of root rot and effectiveness was greatly increased when they were applied together with rye straw. Soil amendment with rye straw increased considerable amounts of colony forming unit number of the cell wall lytic bacteria and Actinomycetes against *F. solani*. Soil amendment with crab shell, cow bone etc. also increased the population of

Actinomycetes in the range of 10−25 times over that of non−amended soil whereas the pupulation of *C. destructans* was reduced to about 50−70% as compared with the control.

In this respect the use of biological control as an integrated management program for the soil borne pathogens in ginseng production is a challenging. Now it might be valuable to verify relations experimentally between present knowledge of plant pathology and the classic cultivation method developed by Korean farmers through try and error for over 800 years in field to minimize root rot diseases without fungicides.