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DEVELOPMENT OF METHODS FOR REMEDIATION OF TECHNOGENOUS POLLUTED SOILS AND IMPROVEMENT OF SOILS FOR ECOLOGICALLY CLEAN AGRICULTURAL PRODUCTION SYSTEMS

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Background. Development of weapons of mass destruction. Methods for agricultural plant disease prevention. Maintenance of high quality, sanitary food production. Genetic development and introduction of prospective agricultural plant materials that have drought tolerance and high nutritive value. Soil remediation, soil improvement and ecologically wise land protection.

Present Activities. Creation of biological preparations. Developing a scientific basis for environmental monitoring. Development of fruit and viticulture production technologies with environmental protection. Geo-ecological investigations of natural and anthropogenic geosystems.

Scientific theme for potential cooperation with foreign researchers:

- maintenance and improvement of ecologically clean agricultural production
- systems on anthropogenically polluted soils.

The purpose of the research: Development of methods for the remediation of technogeneously polluted soils and the improvement of polluted lands to ecologically clean agricultural production.

The main zones of fruitful production are situated in the southern and southeastern regions of Kazakhstan near large cities that have active industrial enterprises. In these areas, much of the environment has been polluted by industry-generated heavy metals. Soil, water, air and agricultural products have heavy metal concentrations that are 2 to 100 times the natural background levels. Therefore, the local human population is supplied with substandard, unhealthy agricultural products. Consumption of these products may cause active diseases, increased infant mortality and adverse effects on human genetic material. The polluted geosystem problems must be solved using scientific investigations. Scientific solutions will improve the environment and human health.

The following tasks will be implemented in this project to achieve viable practical solutions:

- To determine the priority pollutants, their ecological pathways, and sources of origin.
- To form a supervised environmental monitoring data bank throughout the various geosystem conditions.
- To evaluate the degree of the biogeosystem pollution and the influence on the health of the local human populations.
- To establish agricultural plant tolerance levels to the priority pollutants.
- To calculate the standard concentrations of the priority pollutants for main agricultural plant groups.

- To develop a soil remediation methodology incorporating the structural, functional geosystem features.
- To establish a territory zone division methodology in consideration of the degree of component pollution, plant tolerance to pollutants, plant production conditions, and human health.
- Scientific grounding of the soil remediation proposals and agricultural plant material introductions with soil pollution levels and relative plant tolerances to pollutants.

Technological Means, Methods, and Approaches Final proposed solutions will be based upon geosystem and ecosystem approaches and methodologies. The complex ecological valuation methods of the polluted territories will be used in this investigation. Also, laboratory culture in vitro, application work, and multi-factor field experiments will be conducted. The results will be statistically analyzed using appropriate methods.

Expected Results Complex biogeochemical technogeneous province assessment according to primary pollutant concentrations. Development of agricultural plant tolerance levels relative to the priority pollutants. Assessment of newly introduced plant materials that may possess variable levels of pollution tolerance. Remediation technologies for polluted soils based on the principles of antagonism and synergism. Division zone methodology for polluted territories. Soil remediation methodologies to facilitate agricultural plant introductions and successful plant production in improved agricultural lands.

Foreign cooperators Thomas J. Rice, Ph.D., Department Chair and Professor of Soil Science, Soil Science Department, California Polytechnic State University, has agreed to be a cooperator. He will serve as a consultant, may conduct necessary laboratory analyses using modern analytical equipment, and may assist in other spheres. (San Luis Obispo, CA 93407, USA. Phone: (805) 756-2420, or (805) 756-2261. FAX: (805) 756-5412. Internet: trice@calpoly.edu). Tomohisa Yano, Dr. Agr. Sci., Professor of Tottori University Arid Land Research Center, Japan, has expressed interest in these project investigations and has agreed to be a cooperator. (1390 Hamasaka, Tottori 680, JAPAN. Phone: (857) 21-7032. FAX: (857) 29-6199. Internet: yano@center.tottori-u.ac.jp).