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Biological Control of Plants Used to Produce Narcotics in Central Asia.

Plant diseases could be used to eliminate or suppress unwanted plants such as weeds or plants used to produce narcotics. All plants are susceptible to plant diseases, and they are especially vulnerable when they are planted in monoculture in a field containing thousands of identical plants. If an airborne or waterborne microbe (pathogen) lands in a field of a susceptible crop, it can rapidly move from plant to plant causing substantial yield losses. Soil-borne pathogens can move into fields in soil adhered to machinery, on seed or plants, or on the soles of workers feet. Plant disease epidemics can be devastating as evidenced by the Irish potato famine, which resulted from introduction of a fungal pathogen (*Phytophthora infestans*) into Ireland. A crop disease is controlled by: 1) using disease-resistant varieties of that crop, 2) treating seeds or plants with fungicides, or 3) switching to crops that are not susceptible to that particular disease.

On the positive side, many naturally occurring plant pathogenic fungi and bacteria are well suited as biocontrol agents or bioherbicides because they are so target specific (i.e., will only attack a single plant species) and will not harm humans or the environment. Additionally, many can survive for long periods of time in soil and prevent re-establishment or re-cropping of the target plant.

The objective of this proposed project is to deploy already developed bioherbicides that specifically target the opium poppy, the plant used to produce heroin. These bioherbicides could be used to either prevent establishment of an illicit crop or to eradicate an existing crop. This is an opportune time to distribute a poppy bioherbicide in Afghanistan. The Taliban banned opium production last year and virtually all growers obeyed the edict and planted badly needed food crops. However, soon after the September 11th terrorist attack on New York and Washington, D.C., the Taliban reversed this edict. Furthermore, this area of the world might continue to be a supplier of opium Deployment of bioherbicides, specific for the opium poppy, in these areas would prevent the growers from shifting back to opium poppy production. Because such bioherbicides are specific to the opium poppy, they would not harm any food crop.

There are several possible methods to distribute bioherbicides. The first is to provide growers with crop seed (e.g., wheat) that has been coated with a bioherbicide. As the crop germinates and establishes a root system, the bioherbicide will be distributed throughout the soil. The bioherbicide would not affect the food crop but would destroy subsequent crops of opium poppy. In this case, we would recommend labeling the treated seed and allowing the farmer to choose to grow a high quality food crop. The bioherbicide could also be aerially applied over large acreages. The application could target known opium poppy fields or potential poppy fields. Coated seed is dropped from the air using techniques developed to re-seed areas destroyed by wild fires. The seed germinates, and the pathogen is established in the soil. If the seed lands in an illicit poppy field, the pathogen will move from the carrier seed to the opium poppy and destroy the crop.

There are several diseases of opium poppy that have been extensively researched and are currently available for this use. Most of these diseases are naturally present throughout the opium poppy growing areas of the world. In most cases, the pathogen population is low and only causes mild damage to the opium poppy crop. In rare cases, a pathogen population greatly increases and causes a severe disease epidemic. Natural epidemics tend to start at a few focal points and radiate out, but are then limited to that field. Application of bioherbicides mimics this rapid increase in the pathogen population. Widespread epidemics that control targeted unwanted plants are not common because fungi and bacteria are seldom virulent enough to provide the "knockdown" seen with chemical herbicides This general lack of efficacy has been a stumbling block for the widespread commercialization of bioherbicides. Recently our research team, without the use of genetic recombination methods, has developed a straight-forward selection technique for greatly enhancing the virulence of naturally occurring, host-specific plant pathogens, enabling their use as effective biocontrol agents. Concerted use of this safe and ecologically friendly biocontrol technology could prevent re-cropping of opium poppy in this region for years to come.

The research effort enabling this use of mycoherbicides has advanced rapidly. However, support for large-scale production and deployment has not been available. With the appropriate support, bioherbicides could be available by spring, in time to prevent the widespread re-cropping of opium poppy in Afghanistan in 2002. This effort must involve the research groups working on the various bioherbicides and the coordination of agencies of several governments. Naturally, time is of the essence.