

Dear Director Walters,

Thank you for your letter of 8 June addressing mycoherbicides. Your points were constructive and provide a basis for further dialogue on this important topic. Although you consider the subject to be sensitive, my perspective is that it is primarily a scientific matter and one better left to the scientists than policy makers. In this vein, I have consulted with leading experts and would like to respond fully and completely to each of the significant points you have raised. I apologize if the technical content is daunting for policy makers and politicians, but this is after all a fundamentally scientific matter.

Regarding the current eradication program in Colombia: I think you would agree that our spray eradication experience has demonstrated that the only way spray eradication can be effective is through an aggressive and sustained effort over many years. We in the Congress have supported this strategy because we believe that eliminating the crop is the most effective strategy. However, when we spray vigorously, experience has shown that the growers seek to move beyond the reach of secure spray bases and will slash and burn to start new fields. Furthermore, if we are meeting with success in Colombia the drug organizations will increase coca production in the remote areas of Peru, where spraying is not permitted and government security for manual eradication is extremely limited. Subsequently, if we declare “success” and the U.S. funding commitment decreases, we can expect a retrenchment back into Colombia. This is the cycle of history over the past 25 years.

I must tell you that it is not at all clear how long the American public will remain supportive of an expensive supply reduction spraying policy that has no end in sight and is not significantly affecting the availability of drugs on the street. Nevertheless, the Congress continues to support this approach and associated policy because we have no good alternatives. Finally ONDCP need not worry about the fact that the Congress also seeks advanced technology approaches having longer-term and more cost-effective solutions; this nation is capable of doing both and is indeed taking such an approach in many other venues ranging from counter-terrorism to cancer research.

Before addressing the list of “unanswered questions” about mycoherbicides, it is important for you to realize that the Congress provided major funding and asked the Administration to conduct a program of active research beginning in 1998. We have seen virtually no response to our legislation while the availability of drugs continues about the same. The allocation of some of the funds to the UN for non-US research has enabled the only significant progress to date against poppy, but not coca. Had ONDCP, DOS and USDA sponsored the requested research, we would now be 7 years ahead on the “unanswered questions”. Based on this analysis it could be argued that the Administration has substantially subverted the will and intent of Congress.

Even more to the point, our legislation representing the will of Congress predated 9/11 wherein we have now documented that the Afghanistan poppy industry is providing a significant source of revenue for Al Qaeda. In fact, according to DOS and other sources, approximately half of the 40 U.S. - designated terrorist organizations derive funds from the drug trade. If our greatest nightmare ever occurs – the DHS scenario of a crude U235/238 uranium bomb going off in a major U.S. port city – it will be very likely that the massive amounts of cash required will have come from drug sources. We will not allow this situation to continue to develop unimpeded.

For these reasons we simply cannot continue to neglect the potential of mycoherbicides to help in the fight against drugs and terrorism. To do so, in my opinion and that of many of my colleagues, places our national security at grave risk. As Director of ONDCP you must be willing and able to provide leadership in this critical area – now and with vigor.

With regard to the specifics of your letter I can offer the following sequential comments based upon Congressional input from credible experts in plant pathology and associated fields. My responses have been extended to address both poppy and coca eradication.

Statement: *“First, the fungus is slow acting but an eventual kill rate of 50 to 75 percent was reported after the application of the agent. Chemical control agents such as glyphosate are more effective at killing poppy. The mycoherbicide offers no clear advantage over glyphosate in this regard”.*

Response: It is difficult to understand how ONDCP can be so misinformed. The primary objective of mycoherbicides is to permanently eliminate drug plants so that annual chemical spraying is not required. Once in the ground the fungal pathogen remains in a spore state for periods of decades and is re-activated by specific secretions from the roots of the crop. The fungus not only kills the current coca crop but will also prevent establishment of future coca crops. Furthermore, the results of the natural *Fusarium oxysporum* epidemic in Peru’s Upper



Huallagua Valley demonstrated that growers would leave the fields and relocate once the level of wilt reached about 30 percent. In actuality, the efficacy of the fungus there approached 100 percent. Similarly the USDA Hawaiian field experiments on Peruvian coca demonstrated over 90 percent effectiveness as shown in the photograph below. The row of coca plants on the left was inoculated with the fungus *Fusarium oxysporum* f. sp. *Erythroxyllum*. The row of coca plants on the right is the non-treated control. This picture was taken 3 months after the coca plants were inoculated with the fungus.

These are very promising effectiveness levels, but allow me state my belief clearly: *any eradication method that has effectiveness levels of even 50 percent, with an inherent long-term sustainability, will be adequate to render cultivation commercially unsustainable.* Furthermore there are several alternate methods to improve the efficacy of the pathogen, including the use of carrier seeds to insert the fungus into the soil and proliferate the number of fungi by a million-fold, not just on the plant or on the soil surface. It seems apparent that a properly funded research effort engaging our nation’s best specialists may find even more effective means.

Finally, ONDCP errs by posing the matter as an “either – or “ proposition. This is most certainly not the case as the mycoherbicide formulations can be mixed with Roundup or other chemical agents and sprayed together.

Statement: *“Second, since poppy is an annual and can easily be replanted after eradication, persistence in the soil of the killing agent would be an advantage that mycoherbicides could hold over chemical agent applications. But the research to date offers a picture of actual soil persistence that varies considerably...this suggest that mycoherbicides could be defeated by farmers replanting after an appropriate period following application. Additionally fungicides could be applied by farmers to treated fields, rendering the mycoherbicides ineffective in even shorter periods of time.”*

Response: Again it is difficult to understand the ONDCP response based upon existing research, not to mention the prospects of future research. Field measurements of other *forma specialies* of *Fusarium oxysporum* have documented in-situ life times of at least 40 years. Much depends on the specific ecological details, but a key factor is that the fungus becomes well established by vigorous expansion, such as in a poppy or coca field. There are several well-known techniques for selecting mycoherbicides against environmental factors to promulgate strains that are highly resistant to temperature, moisture and altitude effects. This is a simple optimization problem. The fungicide argument offered was addressed in the earliest days of mycoherbicide research. First, fungicide treatment of soil is expensive and ineffective. The fungicide treatment would have to penetrate deeply and uniformly into the soil to completely eradicate the pathogen. Seed coatings of fungicide might protect the plant for several weeks but would not protect the plant throughout its lifecycle. Another solution would be to select specific strains of the biocontrol fungus that were resistant to fungicides. For example, one strain might be effective against aromatic fungicides while another would be selected against benzimidazole fungicides. The actual tactical formulation is a mix of the various types so that the mycoherbicide has a very robust response to chemical countermeasures.

Statement: *“Third, it must be noted that the kill rates and limited persistence were observed under idealized laboratory conditions. Whether such minimally positive results would be realized in actual field conditions, after scaling up both production and delivery to real-world magnitudes, remains undemonstrated. As the Chairperson’s Summary indicated, “further work will be required to improve the system of producing spores for large-scale production.” This “further work” could represent a difficult and time-consuming development effort. Moreover, the somewhat limited effects of mycoherbicides that were found in laboratory conditions during the Tashkent study were applicable to environmental conditions substantially unlike those that would be presented in tropical environments.”*

Response: Under separately funded work the Tashkent team also conducted field tests that were quite effective for kill rate and persistence. There is no technical basis to assume that scale-up would result in a loss of effectiveness of the agent; to the contrary it is possible to add additional capabilities such as ultra violet resistance, integral nutrients, increased environmental resistance and special packaging for storage and transport. Large-scale production facilities already exist. That research and development may represent a “difficult and time-consuming development effort” is certainly nothing to be feared. Nor should environmental specific conditions give cause for concern – one begins the process by obtaining cultivars and fungal pathogens from their native habitat and then selecting for effectiveness. The approach will always be to select

for the particular environment where the mycoherbicide is to be employed. This is the nature of the technology. Given vigorous funding and the participation of top U.S. plant pathologists it is to be expected that the *feasibility* demonstrated in Tashkent can be translated to a *robust technological superiority*. We have wasted almost 7 years with second-guessing by policy analysts. Quite frankly, it is your responsibility to lead in this matter and not to cite the lack of research - which might have been accomplished by this time - as a reason to defer any action.

Statement: “*There are additional research hurdles to be overcome. Questions remain about environmental impact on other plant species in the targeted environment, potential mutagenicity of the agent, potential human toxicity, and the need to replicate the results from Tashkent by an independent investigation.*”

Response #1 (impact on other plant species in the targeted environment): Studies of plant specificity are appropriate when a mycoherbicide is introduced into a non-indigenous environment; they are not required when it is selected from an in-situ environment. In all nations where drug crops are found, there will also be found the naturally occurring plant pathogens that have co-existed in the environment for millennia. It cannot be claimed that these natively occurring fungi will cause damage to other crops. For example, the strains of *Fusarium oxysporum* that occurred in the Peru UHV epidemic had no adverse effect on the environment contrary to the claims of one “investigative reporter”. It is well known that local wilt disease has also occurred in Colombia, so these pathogens could easily be collected, isolated and reproduced. The same is true of three known poppy growing areas in Afghanistan. This is in fact not a very time consuming or expensive process at all – it simply requires ONDCP and DOS to exert the effort under knowledgeable scientific guidance for the collection protocol. It is vital to recognize that the all data from in-situ epidemics, field tests and lab tests demonstrate that the coca pathogen only attacks and kills *Erythroxylum*. It will not attack any other plant species including opium poppy. Conversely, the available data on the opium poppy pathogen only attacks *Papaver*.

Response #2 (other environmental and ecological consequences): Finally let me remind you that the current glyphosate approach has absolutely no specificity – it kills all emergent growth, even food crops. Additionally, the continuing cycle of slash and burn, followed by extensive use of high-nitrogen fertilizers, pesticides and fungicides has destroyed vast areas of forests and polluted extensive regions of the Amazon headwaters. In contrast, Mycoherbicides offer a potential environmental and ecological solution because they do not attack other plants, cannot be easily killed by chemicals, and can be deployed by long-range aircraft anywhere in the world before new growth becomes productive.

Response #3 (potential mutagenicity): This is a red herring introduced by a NORML - affiliated biologist with an undergraduate degree whose sole contribution to science was the study of hallucinogenic mushrooms. The facts are quite different: although *Fusarium oxysporum* species have evolved in many different directions (they are prevalent in soils worldwide) the reality is that they have co-evolved over the millennia with their host plants. Evolutionary DNA studies have demonstrated that individual pathogenic strains have generally selected for very narrow Vegetative Compatibility Groups (i.e., for asparagus, or tulips, or *Papaver* (poppy) or *Erythroxylum* (includes coca)). The strains used for mycoherbicides are quite specific, although they may indeed kill some closely related strains (such as a few local varieties of *Erythroxylum*).

Response #4 (potential toxicity): This is another red herring introduced during efforts to defeat the Colombian coca eradication proposal. It is true that a minute amount of toxin is produced in the coca plant; however, to appreciate the magnitude of the distortion, consider the fact that

Peruvians and Colombians have chewed coca for hundreds of years. No ill effects, such as the postulated toxicity have been identified. The concentrations are simply below the level of concern. Another distortion is the claim that 67% of those infected with *Fusarium oxysporum* have died. Again this is a gross distortion as the victims were all immune-suppressed hospital patients suffering from AIDS or cancer (they would have the same level with Staph or other infectious microorganisms). The valid technical basis for addressing this matter is to conduct the standard EPA toxicity tests with fish and animals – a portion of any U.S. development program.

Response #4 (The African Contribution – A Model for the Future): It is a curious fact that while a contentious debate ensues over the use of one *Fusarium oxysporum* strain to eradicate approximately 200,000 hectares of coca in South America, in sub Saharan Africa another strain of *Fusarium oxysporum* is being field tested to eradicate up to 50,000,000 hectares of Striga. Better known as ‘witch weed’, Striga invades fields of cereal crops such as sorghum, depleting the nutrients and decimating the crop. Farmers are forced to give up and move to the cities, increasing the problems of urbanization (and drugs) while also having to turn to imported grains for sustenance. Researchers at McGill University in Montreal have recently achieved major successes in the control of Striga and have received international recognition for their contributions. From a scientific standpoint there is no significant technical difference in the two initiatives. Certainly the overall ‘risk’ associated with coca is far less, both because of the relatively small area to be treated and the significantly greater body of data that has been acquired. The Striga work is proceeding along an established methodological approach for testing and qualification of a new mycoherbicide and has peer acceptance in the plant pathology community. It has political and policy support and should contribute significantly to the global challenges of sustainable food in the new Millennium. Is the coca and poppy research any less valuable? Will it receive comparable political and policy support?

Statement: *“Finally, we believe that the possible availability of mycoherbicides should not serve as a driver of U.S. policy. Misperceptions of the goal of a putative mycoherbicide campaign could have severe implications for the many large counter narcotics programs ably managed by the Government of Colombia and the United States.”*

Response: I concur that misperception can be a significant problem, but make no mistake: this is no putative action: the U.S. Congressional intent is to move forward at a prudent rate. Nor is there any current plan for a mycoherbicide eradication campaign: the necessary research has yet to be conducted. It is therefore incumbent on ONDCP, DOS and other government organizations to work together to counter those misperceptions. This might be most effectively accomplished by forming a media and educational group consisting of both policy and technical specialists. The embassies and host nation organizations should be equipped to deal with the inevitable and well-funded attempts to counter this technology. The stakes are high and this initiative will not be successful without such a coherent organizational approach. This may ultimately be an NSC matter if ONDCP is unable to exert the required leadership, management, and interagency integration and coordination.

In summary, I believe that the preponderance of scientific data indicates that mycoherbicides are a safe and effective tool to eradicate the coca and opium poppy. Congress is directing ONDCP to comply with our legislation. We expect you to bring together a group of the nation’s leading plant pathologists to evaluate the status and future course of research in mycoherbicides. Certain

other technical specialists in the areas such as ecology, environment and fungal pathology can supplement the review, but the primary intent is to determine if the science is viable and what program of research and technology should be performed in order to proceed in an expeditious fashion. We are not asking for immediate deployment of any mycoherbicide. It is incumbent on you as the Director of ONDCP to develop an objective and professional scientific and technical implementation plan devoid of policy and politics. We encourage you to supplement your staff with the needed expertise.

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