Control of Covered Smut of Oats by Seed Treatment with an Antibiotic[1]

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The possibility of controlling plant diseases caused by seed-borne pathogens by seed treatment with antibiotics has been explored in a few instances in the laboratory (*1–4*), and reduction in severity of disease by this means has been reported (*2*).

In order to determine if field control of important seed-borne pathogens could be achieved by seed treatment with antibiotics, experiments were performed at the University of Alberta in 1950 with two known antibiotics, actidione and streptomycin, and certain smut fungi causing covered smuts of wheat, barley, and oats. Infested seed used was naturally smutted and was obtained from Alberta farmers.

Actidione proved promising, particularly for the treatment of oats for the control of covered smut caused by *Ustilago kolleri* Wille. At the concentration used—10 ppm in water—it gave almost complete control of covered smut of oats without injuring the seed significantly, whereas streptomycin at a much higher concentration—1,000 ppm—failed to control this smut. In the case of barley, actidione reduced covered smut significantly without appreciable injury to the seed, but streptomycin gave no reduction in the amount of smut of this grain. Least promise from treatment with these antibiotics was shown in the case of wheat, mainly because of injury to the seed. Both caused significant reduction in emergence, and streptomycin produced very serious seed injury. Complete control of covered smut of wheat was obtained with actidione, but the severity of infection in check plots was low (2–4%). The results with oats only are presented in Table 1. Data for a number of commercial fungicides are also included. It is noteworthy that covered smut of oats is a major disease of an important crop and that it is one of the covered smuts most difficult to control successfully by seed treatment.

It may be seen from the table that the antibiotic actidione compared favorably with the mercurials Ceresan M and Panogen 8[2] and with formaldehyde in the control of covered smut of oats. The fact that formaldehyde failed to give complete control of the smut in these tests suggests that the sample of oats used carried a rather persistent type of infection. As measured by emergence, the actidione treatment appeared to effect control of covered smut of hulled oats without serious toxic action on the seed. No yield data were taken, but the general condition of the plants from seed treated with actidione appeared as satisfactory as that of the plants from seed treated with the mercurial fungicides.

TABLE 1

COMPARATIVE RESULTS OF SEED TREATMENT WITH ACTIDIONE, STREPTOMYCIN, AND COMMERCIAL FUNGICIDES IN THE CONTROL OF COVERED SMUT OF HULLED OATS

Chemicals used in treatment of seed	Concentration or amount	Time treated	Av emergence*	Av percentage of smutted plants*
Actidione	10 ppm	4 hr	128.0	0.2
Streptomycin sulfate	1,000 ppm	4 "	126.5	12.9
Ceresan M	½ oz/bu	—	137.5	0.0
Panogen 8	.12 cc/50 g seed	—	133.8	0.0
Formaldehyde	1: 320	2 min	139.0	3.7
None (Ck†) dry	—	—	137.8	10.8
None (Ck†) wet	—	4 hr	151.5	16.6
L.S.D.	—	—	n.s.	4.3

* Obtained from field plots each sown with 200 seeds and consisting of a 12-ft row. Treatments were replicated 4 times and randomized.

† Ck = Check: dry check was untreated, and wet check was soaked in water for 4 hr.

The results demonstrate that field control of an important plant disease caused by a seed-borne fungus is possible by seed treatment with an antibiotic. The fact that the treatment with actidione in these experiments controlled covered smut of oats in a naturally smutted sample indicates that it might be expected to give a similar degree of control under farm conditions. The treatment as used is not one for immediate practical application, however. It does appear sufficiently promising to warrant further experimental work in the treatment of seed with actidione and other antibiotics.

[1] Financial assistance from the National Research Council of Canada is gratefully acknowledged.

[2] Kindly supplied January 4, 1950, by the Upjohn Company, of Kalamazoo, Mich., through the courtesy of J. H. Ford.

References

1. ARK, P. A. *Phytopathology*, **37**, 842 (1947).
2. GOODMAN, J. J., and HENRY, A. W. *Science*, **105**, 320 (1947).
3. TIMONIN, M. J. *Sci. Agr.*, **26**, 358 (1946).
4. WALLEN, V. R., SUTTON, M. D., and SKOLKO, A. J. *Phytopathology*, **40**, 156 (1950).

W. H. Minshall, botanist, Division of Botany and Plant Pathology, Ottawa, has been transferred to the new Science Service Laboratory of the Dominion Department of Agriculture at London, Ontario.

The **Saratoga Experimental Gardens** opened January 1 in Saratoga, Cal., on the western side of the Santa Clara Valley. Research will be undertaken on the selection and propagation of the best available strains of shade trees and native shrubs of California. Maunsell Van Rensselaer, director of the Santa Barbara Botanic Garden for 16 years, will be director. His assistants will be Thomas Marken and Dudley Phelps.