SYSTEMIC FUNGICIDES

for control of fusarium corm rot of

A. O. PAULUS · S. BESEMER · F. SHIBUYA · J. NELSON

Benomyl and thiabendazole fungicides reduced the number of diseased plants and increased the number of flowers harvested when used to treat Fusarium-infected corms of gladiolus. In one trial, a 1-minute dip of benomyl was equal to a 20-minute dip of thiabendazole when comparing number of flowers harvested.

FUSARIUM YELLOWS AND BASAL ROT, caused by the fungus *Fusarium oxy sporum* f. *gladioli* Snyd. and Hans., is generally recognized as the most serious disease of gladiolus. Until the development of the hot-water treatment of dormant cormels by the University of California Plant Pathology Department, there was no commercial method for developing pathogen-free planting stock. This treatment significantly increased the number of healthy corms, and subsequent flowers produced on susceptible varieties. Contaminated soils should be fumigated with methyl bromide-chloropicrin mixtures to reduce incidence of the disease further. Even with these precautions, recontamination of the corms may occur during succeeding growing cycles and larger corms are usually killed by the hot-water treatment. Recently the benzimidazole fungicides have become available for use and experiments reported here were run to evaluate them for Fusarium control.

Preliminary trials, 1969

In two field trials benomyl, thiabendazole and folpet were tested as fungicidal dips for the control of Fusarium corm rot. Benomyl was obtained from Du Pont as Benlate 50W, thiabendazole from Merck as Mertect 160 60W, and folpet from Chevron Chemical Company as Phaltan 50W. Treatments were the same in both trials and consisted of: Benlate 50W at 1 and 0.5 lb, Mertect 60W at 1 and 0.5 lb, Phaltan 50W at 3 lb, and a nontreated check. Fungicides were mixed in 100 gallons of water and the corms were dipped for five minutes. Valeria variety corms were used in one trial and Big Time in the other, and both were treated May 9. Valeria corms were planted May 10 and Big Time, May 13. Approximately 1500 corms per treatment were used in the Big Time trial and 1000 corms in the Valeria trial. The numbers of diseased plants were recorded during the course of the experiment. Results are shown in table 1.

TABLE 1. EFFECT OF CORM TREATMENT ON NUMBER OF DISEASED GLADIOLUS PLANTS

Treatment	Rate	Valeria	Big Time
	lb/100 gals	No. diseased plants	
Thiabendazole, 60W	1.0	32 a*	33 a
Folpet, 50W	3.0	32 a	35 a
Benomyl, 50W	0.5	34 a	39 a
Benomyl, 50W	1.0	41 a	27 a
Thiabendazole, 60W	0.5	25 a	76 b
Untreated check		81 b	106 b

** Significant 1% level—treatments with differing letters are significantly different.*

All fungicidal treatments of Valeria corms were significantly better than the check treatment in reducing the number of diseased plants. Big Time corms produced significantly less diseased plants when treated with benomyl 0.5 or 1 lb, thiabendazole 1 lb, or folpet 3 lbs per 100 gallons of water.

Comparison of dipping interval

An experiment was undertaken to compare benomyl 1 lb and thiabendazole 1 lb per 100 gallons of water using corm dipping times of 1, 10 and 20 minutes. Corms were dipped August 7, 1969. In these tests 240 jumbo size corms of the variety Spic and Span were used per treatment and replicated four times. Corms were planted on August 13. Results are shown in table 2.

Stand counts of emerging plants were made August 26 and September 5 with no significant differences found between any treatments. Disease development was severe in the checks; many plants showed typical browning, yellowing and complete collapse. All fungicidal treatments were significantly better than the check in number of diseased plants observed October 1 and benomyl treatments were significantly better than thiabendazole on October 29. Benomyl in all dipping schedules and thiabendazole 20-minute dip were significantly better than all other treatments tested in total number of flowers harvested. All thiabendazole treatments were significantly better than the check in number of flowers harvested. Corms were dug December 5 and benomyl produced significantly higher weights of harvested corms than any of the other treatments. Although the data are not shown, the number of rotted corms was significantly less in the benomyl treatments. *Fusarium oxysporum* f. *gladioli* was consistently isolated from corms in the nontreated check.

Winter trial, 1969–1970

Previous trials were conducted during the warm summer growing season when Fusarium yellows is favored. A large-scale commercial test was conducted in the winter to compare the effectiveness of fungicides under cooler temperatures less favorable to *Fusarium* spp. The following fungicides were used: thiabendazole 60W, 1.5 lb; benomyl 50W 0.5 lb; pentachloronitrobenzene 75W, 1 lb plus cyano (methylmercuri) guanidine 2.2%, 1.7 pt; and the untreated check. PCNB was obtained from Olin as Terraclor 75W and the cyano (methylmercuri) guanidine as Morosdren 2.2% from Nor-Am. Fungicides were diluted in 100 gallons of water and the corms given a 5-minute dipping time. Captain Bush, Snow Velvet, and Valeria varieties were

TABLE 2. COMPARISON OF BENOMYL AND THIABENDAZOLE WITH 1-, 10-, AND 20-MINUTE DIPPING INTERVAL

Treatment and dipping interval	No. diseased plants Oct. 1	No. diseased plants Oct. 29	No. flowers harvested	Total corm wt (lb)
Benomyl, 50W 1 lb				
20-min. dip	5.3 a*	10.0 a	35.3 a	9.3 a
10-min. dip	5.6 a	16.5 a	34.5 a	8.8 a
1-min. dip	6.8 a	18.8 ab	32.5 ab	8.4 ab
Thiabendazole, 60W 1 lb				
20-min. dip	9.5 a	27.8 bc	25.5 abc	6.5 bc
10-min. dip	10.3 a	31.8 bc	23.0 bc	6.3 bc
1-min. dip	10.5 a	29.8 bc	19.8 c	5.3 bc
Untreated check	83.8 b	....	0.0 d	0.08 d

** Significant 1% level—treatments with differing letters are significantly different.*

GLADIOLUS

Healthy gladiolus plants, to left, had been treated with TBZ dip for 10 minutes at 1 lb rate. Dead plants in row to right were not treated for Fusarium corm rot.

used in these tests. Corms were dipped December 9 and 11,860 corms were planted per treatment, December 10. Diseased plants were counted March 24, 1970 and flowers harvested were counted April 24. Significant differences among treatments was only evident with the variety Captain Bush. The results are shown in Table 3.

TABLE 3. EFFECT OF FUNGICIDE CORM DIP ON A WINTER GLADIOLUS PLANTING

Treatment	Plants diseased	Flowers harvested
	%	%
Thiabendazole, 60W 1.5 lb	4.3 a*	60.5 a
PCNB, 75W 1 lb plus Mors. 2.2% 1.7 pt	4.8 a	54.6 a
Benomyl, 50W 0.5 lb	5.1 a	61.6 a
Untreated check	13.1 b	22.2 b

* Significant 1% level—treatments with differing letters are significantly different.

Results of these trials indicate that benomyl and thiabendazole are effective against *Fusarium*, and with added effectiveness against *Stromatinia* and *Botrytis*, are a possible replacement for the mercurials. In general, benomyl appears to be more effective than thiabendazole when compared on an active ingredient basis.

Albert O. Paulus is Extension Plant Pathologist, University of California, Riverside; Seward Besemer is Farm Advisor, Agricultural Extension Service, San Diego county; and F. Shibuya and Jerry Nelson are Extension Technicians, Agricultural Extension Service, University of California, Riverside.

New Publications

Single copies of these publications—except Manuals and books—or a catalog of Agricultural Publications may be obtained without charge from the local office of the Farm Advisor or by addressing a request to: Agricultural Publications, University Hall, University of California, Berkeley, California 94720. When ordering sale items, please enclose payment. Make checks or money orders payable to The Regents of the University of California.

EFFECTS OF NITROGENOUS FERTILIZERS ON CALIFORNIA RANGE AS MEASURED BY WEIGHT GAINS OF GRAZING CATTLE. Bul. 846. This report summarizes the results of 54 field experiments designed to evaluate the effects of nitrogenous fertilization of California rangeland as measured by weight gains of grazing cattle.

•

IDENTIFICATION AND BIOLOGY OF THE FACE FLY. Leaflet 207. A description and discussion of the face fly. Helps the stockman to distinguish between the face fly and several others that it resembles at first glance. Color photographs and diagrams.

•

VIRUS DISEASES OF SMALL FRUITS AND GRAPEVINES. Handbook. $7.50. Facilitates detection and identification of virus diseases. Intended as an aid to growers and to advisory and regulatory personnel in the recognition and control of diseases. Also of value in the expanding field of small fruit virus research.

•

STUDIES IN THE POPULATION DYNAMICS OF THE WESTERN PINE BEETLE, DENDROCTONUS BREVICOMIS LE CONTE (COLEOPTERA: SCOLYTIDAE). Paperback. $5.00. Includes papers on the development of sampling techniques and data analysis procedures; and on mortality factors and their interactions. For professional workers concerned with control of the pine beetle.

•

LADINO CLOVER SEED PRODUCTION IN CALIFORNIA. Cir. 554. This circular describes what Ladino clover is, and what you should know about certification of seed. It also describes what varieties offer what advantages to growers; how to prepare land and manage crops for maximum yields; basic principles of weed control; and how to recognize major diseases and important insect pests. Harvesting and post-harvesting techniques are discussed and illustrated, and major pests are pictured for easier identification.