Control of Common Bunt of Wheat

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# Control of Common Bunt of Wheat

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## SUMMARY

Common bunt, also known as stinking smut, is a destructive disease of wheat that recently reoccurred, and is increasing in prevalence, in eastern lower Michigan counties. Its control via chemical seed treatments and host plant resistance, and its perpetuation from seed-borne and soil-borne inoculum were evaluated in winter wheat fields in Sanilac and Ingham counties during the 1977-1978 crop season.

The disease was reproduced by planting seed infested with spores of the causal fungus, **Tilletia foetida** (Wall.) Liro, but not by planting clean seed in naturally infested soil. Thus, disinfesting seed and seed handling equipment is an essential control alternative. The additional use of crop rotation to avoid soils that have become bunt-infested may not be necessary.

All of 76 Michigan-adapted wheats tested were susceptible to the disease. However, the cultivar Fredrick and five experimental lines supported low levels of the disease and may offer some low level resistance. Seed treatment chemicals such as maneb, hexachlorobenzene (HCB), pentachloronitrobenzene (PCNB), carboxin and thiram either eliminated the disease or reduced it to manageable levels.

## INTRODUCTION

In January 1978, Bulletin E-1178 from the Cooperative Extension Service, Michigan State University, described the reoccurrence of common bunt of wheat in Michigan, its destructive potential and prospects for its control. This report, which follows, summarizes tests conducted during the 1977-1978 winter wheat season to (a) identify Michigan-adapted wheats with resistance to common bunt, (b) compare the ability of seed-borne vs. soil-borne inoculum of the causal fungus, **Tilletia foetida** (Wall.) Liro to perpetuate the disease and (c) evaluate the efficacies of chemicals used as seed treatments to control the disease in winter wheat grown from bunt-infested seed and/or in bunt-infested soil.

### Test Sites and Methods

In 1977, a field of 'Yorkstar' wheat infested with common bunt was located in Sanilac County. At harvest (July) approximately 30% of the heads in the field yielded only bunt balls. The remaining seed became so contaminated with bunt spores during harvest operations that it was visibly darkened, oderiferous and unsalable.

Between September 30 and October 7, the bunt-infested field and a field free of bunt at East Lansing were conventially tilled (plowed, disked, dragged) and

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planted to Certified 'Yorkstar' wheat and a nursery of 76 Michigan-adapted wheats. All seed to be planted was divided into two lots; one retained clean and the other inoculated with bunt spores (approximately 50% viable) at a rate of 100 mg spores/kg seed. The clean and inoculated lots of 'Yorkstar' seed were further divided for application of various seed-treatment chemicals.

Seed lots amended with chemicals and/or spores were thoroughly mixed to ensure uniform coverage and stored at room temperature a maximum of seven days prior to planting. All seed lots were planted in triplicate or quadruplicate plots at each location. Seeding was 2 inches deep in 7 inch rows at a rate of 60 lb./acre. Minimum plot size was a single 15 ft. drill row (30 to 60 emerged plants). To minimize any cross contamination of seed, spores or chemicals, the drill was cleaned between seed lots and all inoculated seed was planted last.

Resultant symptoms of common bunt were evaluated at harvest (July 1978). A minimum of 30 heads representing a minimum of 20 plants from each plot were collected and carefully examined for bunt balls. Disease levels were recorded as percent bunted heads.

### Infection from Seed-Borne vs. Soil-Borne Inoculum

Common bunt developed in plots sown with bunt-infested seed but not in plots containing only soil-borne inoculum (Table 1). The test, therefore, produced no evidence for the perpetuation of common bunt via soil-borne inoculum.

Samples of soil and straw collected from the infested field after harvest through November 1977 contained bunt spores. The spores were identified in washings made from such samples and up to 40% were able to germinate when placed on agar media.

However, the soil and residue sampling procedure was discontinued in mid-November when it became confounded with increasing numbers of contaminant fungi and other micro-organisms. The prevalence and viability of soil-borne bunt spores appeared to decline as winter approached but their actual longevity was not determined.

In spite of our findings (Table 1), the possibility of transmission of common bunt to successive wheat crops through soil in Michigan is an important controversial question that warrants additional study. Michigan's moist, warm, autumn soil conditions may cause spores to germinate precociously or, by other means, destroy their activity as inoculum. In other Midwest states, soil-borne inoculum is infectious; especially when field conditions remain dry between the harvest and planting of successive winter wheat crops.

### Michigan-Adapted Wheats as Sources of Resistance to Common Bunt

The nursery of Michigan-adapted wheats, like the 'Yorkstar' plantings (Table 1), responded to bunt inoculum on seed but not to inoculum in soil. All 76 nursery entries, which included advanced experimental lines and the cultivars Abe, Arthur, Beau, Downey, Fredrick, Genesee, Ionia, Tecumseh and Yorkstar, developed bunt symptoms. The average frequency of bunted heads among the various entries ranged from 1 to 66%. The cultivar Fredrick and experimental lines B4028, B4135, B4285, B5258 and B5266, supported less than 6% bunted heads and may possess low levels of resistance to the disease.

**TABLE 1. Incidence of common bunt in 'Yorkstar' wheat grown from bunt-infested and noninfested seed in bunt-infested and noninfested soil.**

| Seed | Soil | Percent Bunted Heads |
|---|---|---|
| Clean (a) | Noninfested (c) | 0 |
| | Bunt infested (d) | 0 |
| Bunt infested (b) | Noninfested | 44 |
| | Bunt infested | 25 |

(a) Certified 'Yorkstar' seed
(b) Inoculated with 100 mg spores (50% viable)/kg seed
(c) No history of common bunt in wheat crops
(d) Supported 30% bunted heads in 'Yorkstar' wheat the previous season

### Common Bunt Control via Chemical Seed Treatment

Several seed treatment chemicals provided excellent control of common bunt and prevented associated yield reductions (Table 2). For 'Yorkstar' wheat without benefit of chemical disinfestation of seed, an average of 38% of the heads were bunted at harvest and yields averaged 24 bu./acre. When bunted heads were reduced to less than 2% by seed treatment chemicals, yields approximated 60 bu./acre.

Hexachlorobenzene (HCB), maneb, thiram, pentachloronitorbenzene (PCNB) and carboxin were effective bunt control chemicals (Table 2). They are currently registered for use on wheat in Michigan, and their use should be advantageous.

If seed to be planted is known or suspected to have originated from a bunt-infested field or if it has contacted infested seed handling equipment, chemical treatment is mandatory. Truck boxes, storage bins and elevators are sources of seed contamination that most assuredly have contributed to the increase of common bunt in Michigan.

The use of Michigan Certified wheat seed, because it originates from fields that are inspected and maintained bunt-free, should also be advantageous. However, because low levels of field infection are difficult to detect and spore dispersal on seed is so efficient, growers must be alert to the quality and cleanliness of any seed they choose for planting.

**TABLE 2. Control of common bunt in 'Yorkstar' wheat with seed treatment chemicals and effects on yield.**

| Treatment | | Percent Bunted | Yield | |
|---|---|---|---|---|
| Chemical | Rate | Heads | bu/acre | kg/ha |
| None | | 38 | 24 | 1613 |
| *#Granox N-M (maneb + HCB) | 1 oz/bu | 0 | 57 | 3837 |
| *Vitavax-200 (carboxin + thiram) | 4 fl oz/100 lb | 2 | 55 | 3710 |
| PCNB + Vitavax (pentachloronitrobenzene + carboxin) | 1 + 1 oz/bu | 1 | 62 | 4153 |
| | 2 + 2 oz/bu | 0 | 59 | 3977 |
| *Terraclor LT-2 (pentachloronitrobenzene-24%) | 2 oz/bu | 0 | 60 | 4032 |
| Furavax (liquid) | 3 fl oz/100 lb | 14 | 47 | 3166 |
| (powder) | 6 oz/100 lb | 3 | 61 | 4086 |
| BAS 389 | 2 oz/100 lb | 1 | 44 | 2965 |
| | 4 oz/100 lb | 0 | 45 | 2990 |
| BFN 7855 | 4 oz/112 lb | 20 | 40 | 2668 |
| 7856 | 4 oz/112 lb | 23 | 34 | 2292 |
| TAN 150 FS | 0.5 oz/100 lb | 4 | 55 | 3685 |
| | 0.25 oz/100 lb | 1 | 55 | 3710 |
| | 1.5 oz/100 lb | 0 | 65 | 4345 |
| *Arasan (thiram) | 4 oz/100 lb | 3 | 53 | 3547 |
| ME144 | 1 fl oz/100 lb | 16 | 51 | 3404 |
| | 3 fl oz/100 lb | 10 | 49 | 3303 |
| Mertect 30 LSP (TBZ) | 1.67 fl oz/100 lb | 9 | 53 | 3534 |
| | 3.34 fl oz/100 lb | 1 | 54 | 3609 |
| ME144 + Mertect 30 LSP | 1 + 1.67 fl oz/100 lb | 6 | 54 | 3609 |
| DPX-14-2 | 1 g/kg | 2 | 54 | 3647 |
| | 1.5 g/kg | 0 | 58 | 3915 |

Yield = 57.25 − 0.69 (% bunted heads), r = 0.78

*Currently registered for use on wheat in Michigan

#Manufacture discontinued, availability subject to existing supplies


# Outlying Field Research Stations

**These research units bring the results of research to the users. They are geographically located in Michigan to help solve local problems, and develop a closeness of science and education to the producers. These 15 units are located in important producing areas, and are listed in the order they were established with brief descriptions of their roles.**

**(1) Michigan Agricultural Experiment Station. Headquarters, 101 Agriculture Hall. Established 1888. Research work in all phases of Michigan agriculture and related fields.**

**(2) South Haven Experiment Station, South Haven. Established 1890. Breeding peaches, blueberries, strawberries, cherries. Small fruit management.**

**(3) Upper Peninsula Experiment Station, Chatham. Established 1899. Beef, dairy, soils and crops. In addition to the station proper, there is the Jim Wells Forest.**

**(4) Graham Horticultural Experiment Station, Grand Rapids. Plots established 1919. Varieties, orchard soil management, spray methods, orchard physiology.**

**(5) Dunbar Forest Experiment Station, Sault Ste. Marie. Established 1925. Forest management.**

**(6) Lake City Experiment Station, Lake City. Established 1928. Breeding, feeding and management of beef cattle and aquatic studies.**

**(7) W. K. Kellogg Biological Station Complex, Hickory Corners. Established 1928. Natural and managed systems: agricultural production, forestry and wildlife resources. Research, academic and public service programs.**

**(8) Muck Experimental Farm, Laingsburg. Plots established 1941. Crop production practices on organic soils.**

**(9) Fred Russ Forest, Cassopolis. Established 1942. Hardwood forest management and forest genetics.**

**(10) Sodus Horticultural Experiment Station, Sodus. Established 1954. Production of small fruit and vegetable crops. (land leased)**

**(11) Montcalm Experimental Farm, Entrican. Established 1966. Research on crops for processing, with special emphasis on potatoes. (land leased)**

**(12) Trevor Nichols Experimental Farm, Fennville. Established 1967. Studies related to fruit crop production with emphasis on pesticides research.**

**(13) Saginaw Valley Beet and Bean Research Farm, Saginaw. Established 1971, the farm is owned by the beet and bean industries and leased to MSU. Studies related to production of sugar beets and dry edible beans in rotation programs.**

**(14) Kalamazoo Orchard, Kalamazoo. Established 1974. Research on integrated control of grape, cherry and apple pests.**

**(15) Clarksville Horticultural Experiment Station, Clarksville. Purchased 1974. Plots established 1978. Research on all types of tree fruits, small fruits, vegetable crops and ornamental plants.**



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