

ENDOPHYTE CONTENT OF SEEDS HARVESTED
FROM SPACE-PLANTED TALL FESCUE¹

R.E. Welty and M.D. Azevedo²

INTRODUCTION

Endophytic fungi in tall fescue grass have recently been the subject of intense research. Interest was stimulated by the discovery that Acremonium coenophialum (Epichloe typhina) was associated with "fescue toxicosis" in cattle grazing plants infected with the fungus. The problem has also been incorrectly called "summer syndrome" because it is most severe in the summer months in Southeast USA.

The fungus is commonly referred to as an endophyte because it grows entirely within the grass host and rarely shows external signs or symptoms of infection. The only known mode of spreading the endophyte is by sowing infected seed. Resowing pastures with endophyte-free seed or with seed having low levels of endophyte (less than five percent) offers the least-expensive method of control. Seedborne infection can be reduced by seed-treatment fungicides, heat treatments, or storage.

In 1983, Oregon established standards for endophyte testing in seed lots of grasses and established a voluntary regulatory testing program. Seed lots containing five percent or less endophyte-infected seed are issued an endophyte tag by the Oregon Department of Agriculture for attachment to bags of Oregon-produced seed. In 1983-1985, 509 seed lots of tall fescue representing 11,813,887 pounds (5,358,744 kilograms) of seed were tested by ODA, and 94 percent were found to contain five percent or less endophyte. Levels of endophyte infection in seed of tall fescue from these seed lots are especially low when compared with seed lots from other production regions.

The studies reported here were done to determine if endophyte-free plants would remain free of endophyte when

-
- 1 Cooperative investigations of the USDA-ARS and Oregon Agricultural Experiment Station; progress report for Central Oregon Agricultural Experiment Station.
 - 2 Research plant pathologist and research assistant, Agricultural Research Service, U.S. Department of Agriculture, National Forage Seed production Research Center, Oregon State University, 3450 S.W. Campus Way, Corvallis, OR 97331-7102.

Use of trade name does not imply endorsement of the product by either the authors or the supporting institutions.

interplanted with endophyte-infected plants. Growers question if the percentage of endophyte-infected seeds can increase in seed fields planted with a variety that is endophyte-free or one that contains a low level of endophyte infection. The studies were done at seven experiment stations to provide information on the effects of location.

MATERIALS AND METHODS

Seedlings of G1-307 tall fescue infected with the endophyte fungus (Acremonium coenophialum) and endophyte-free Forager were grown in the greenhouse. Leafsheath tissue was removed from each plant, fixed, stained, and examined with the microscope for the presence of hyphae typical of the endophyte fungus. Twenty seedlings of Forager were interplanted with 10 seedlings of G1-307 at each of seven experiment stations - Redmond, Corvallis, Pendleton, Hood River, Medford, Klamath Falls, and Union. Seeds were harvested in 1984 (except at Redmond, Klamath Falls, and Union), 1985, and 1986 and assayed for endophyte.

For the endophyte assay, seeds were collected from each plant of each entry (G1-307 or Forager) and combined. For each sample, two grams of seed were thoroughly mixed, subdivided, and digested overnight in five percent NaOH and 0.1 percent trypan blue. The samples were stained with lactophenol and trypan blue, and up to 200 seeds per subsample were examined microscopically for the presence of endophyte hyphae in the seeds.

RESULTS AND DISCUSSION

Endophyte infection ranged from 83-99 percent in seeds harvested from endophyte-infected G1-307; seeds harvested from endophyte-free Forager were free of endophyte at all locations except Pendleton (Table 1). At Pendleton, endophyte infection in the bulked seeds was eight percent in 1984 and three percent in 1985. To determine which plants contained endophyte, 2 grams of seeds from each of the 20 plants of Forager (1985) were subsequently assayed. One plant was identified as contributing the endophyte-infected seeds in the bulked-seed sample.

In 1986, seeds from the endophyte-infected Forager plant, identified in 1985, were assayed for endophyte; 47 of 50 seeds (94 percent) contained the endophyte. Seeds from the remaining 19 Forager plants free of the endophyte in 1985 were bulked and 200 seeds were assayed as previously described. None of the seeds from these 19 plants contained endophyte.

These experiments were established to determine if endophyte-free plants became infected in the field when interplanted with endophyte-infected plants. No endophyte transmission occurred at six of seven locations. The results at Pendleton suggest this as a possibility, however, the rate of field transmission is very low. The study was not designed to test how transmission might occur.

In the spring of 1986, five studies were established at Pendleton with endophyte-free and endophyte-infected seedlings to evaluate mechanical transmission of the endophyte from infected to non-infected plants. Seed will be harvested for the first time in the summer of 1987.

In a related study at the Oregon State University Botany and Plant Pathology Field Laboratory in Corvallis, ten 50-foot rows of tall fescue were established. Paired rows were previously found to contain a similar level of endophyte infection. Thus, five paired comparisons could be made after one row was burned with a kerosene torch burner while the other row remained nonburned. Seeds were harvested in 1986 from single rows, bulked by row, and thoroughly mixed. Fifty seeds from each paired comparison (burned vs. nonburned) were digested, stained, and examined for the endophyte, as previously described. Endophyte infections in seeds from the five comparisons for nonburned vs. burned were 72 vs. 80, 26 vs. 40, 0 vs. 0, 0 vs. 6, and 88 vs. 92 percent, respectively. These results indicate the effect of burning on endophyte content of seeds is minimal. Since the sample size is small, the results are variable and may be misleading.

Table 1. The level of endophyte in tall fescue seed harvested from endophyte-infected plants of G1-307 and apparently endophyte-free plants of Forager. Seedlings were transplanted at seven locations in Oregon and harvested in three years

Experiment Station location	Percent endophyte in G1-307 ^a			Percent endophyte in Forager		
	1984	1985	1986	1984	1985	1986
Hyslop	98	88	83	0	0	0
Pendleton	91	92	92	8 ^b	3 ^b	0 ^c
Hood River	89	95	98	0	0	0
Redmond	--	96	95	-	0	0
Medford	95	94	94	0	0	0
Klamath Falls	--	95	96	-	0	0
Union	--	95	99	-	0	0

a Seeds from 10 plants were combined and 2 grams of seed sampled; seeds were examined for endophyte.

b Seeds from 20 plants were combined and 2 grams of seed sampled; 109-200 seeds were examined for endophyte.

c Seeds from 19 plants were combined and 2 grams of seed sampled; 200 seeds were examined for endophyte. Ninety-four percent of the seeds (47 of 50 examined) from an infected Forager plant contained endophyte.