EVALUATING COMMERCIALLY AVAILABLE TALL FESCUE VARIETIES FOR AIRFIELDS

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INTRODUCTION

Wildlife-aircraft collisions (wildlife strikes) cause serious safety hazards to aircraft and their occupants. Wildlife strikes cost civil aviation approximately $550 million annually in the United States (Cleary et al. [1]). Gulls (*Larus* spp.), waterfowl such as Canada geese (*Branta canadensis*), raptors (hawks and owls), and blackbirds (Icterinae)/starlings (*Sturnus vulgaris*) are the species presently of most concern at airports (Cleary et al. [1], Dolbeer et al. [2]). Most strikes occur under 1000 feet altitude (above ground level) in the vicinity of the airport (Cleary et al. [1], Dolbeer [3]). Wildlife management techniques that reduce the number of birds in and around airports are therefore critical for safe airport operations.

Habitat management is a long-term component of an integrated approach for reducing wildlife use of airports. Species composition of plant communities (the types of plants) on airfield areas might also impact the degree of attractiveness of airfields to hazardous birds and other bird attractants (e.g., insects, small mammals) (Austin-Smith and Lewis [4], Dekker and van der Zee [5], Washburn and Seamans [6]). Ideally, airfield vegetation should possess a variety of desirable qualities. Vegetation used on airfields should be aesthetically pleasing to the public, relatively inflammable, tolerant to vehicle traffic, drought tolerant, and require minimal care and maintenance. In addition, favorable airfield vegetation should provide limited food resources (e.g., seeds, insects) for hazardous birds, provide little cover for small mammals (an attractant to raptors and owls), and resist invasion by other plants that provide food and cover for wildlife (Austin-Smith and Lewis [5], Linnell et al. [7]).

Tall fescue (*Festuca arundinacea*) is a cool-season perennial sod-forming grass that grows well in the U.S. in areas of temperate climate. In recent years, this turfgrass has become very popular and is used widely by the green industry in parks, lawns, golf courses, sports fields, and other areas (Casler [8]). Tall fescue is frequently infested with the fungal endophyte *Neotyphodium coenophialum* that forms a mutualistic symbiotic relationship with the grass. Grasses containing endophytic fungi derive several benefits, such as resistance to both grazing and insect herbivory, increased heat and drought stress tolerance, and increased vigor (Ju et al. [9]). Tall fescue is extremely competitive and develops into solid stands, crowding out other grasses, legumes, and annual weeds (Barnes et al. [10], Washburn et al. [11]) and consequently tall fescue grasslands might be unattractive to wildlife (Mead and Carter [12], Barnes et al. [10]).

Alkaloids (i.e., plant defense chemicals) produced by the endophyte-infected tall fescue have been shown to cause weight loss, reproductive problems, and a variety of diseases in livestock and laboratory small mammals (Schmidt and Osborn [13], Bacon and Hill [14]). Further, research studies suggest wild mammals and birds might be affected by consumption of endophyte-infected tall fescue (Madej and Clay [15], Conover and Messmer [16], Washburn [17]). Recent research conducted at the USDA, Wildlife Services, National Wildlife Research Center has shown that grazing Canada geese do not consume endophyte-infected tall fescue (Washburn et al. [18]). These findings suggest endophyte-infected tall fescues might be favorable turfgrass varieties to use in reseeding and vegetation renovation projects on airfields and other areas where Canada geese are unwanted.

Recently, a large number of "turf-type" tall fescue varieties have been developed for the turfgrass industry. Turf-type tall fescues are bred to maintain deep green color, drought and

disease resistance, and grow to shorter heights than traditional tall fescues. In addition, many of these new varieties have high levels of endophyte-infection (Mohr et al. [19]). Over 160 varieties of turf-type tall fescue are currently available from the turfgrass industry that could be used in airfield revegetation projects. We conducted a series of experiments at numerous airports across the U.S. to evaluate the establishment of several varieties of tall fescue grass, each containing high levels of endophytic fungus. Our study objectives were to: (1) determine if selected turf-type tall fescue varieties will establish on various airfields across the U.S. and (2) provide airport-specific recommendations for tall fescue variety selection.

METHODS

We conducted this study at 7 civilian or military airfields in the eastern and central United States: 1 in Indiana, 2 in New York, 2 in North Carolina, 1 in Virginia, and 1 in Wisconsin (Table 1). At each airport, we seeded 10–15 tall fescue varieties into 3 replicate experimental plots.

Table 1.
Evaluations of commercially available tall fescue varieties were conducted at 7 airfields in the eastern and central U.S. during 2005 and 2006.

Airfield	State	Number of Varieties	Seeding Date	Mulch applied?[a]	Weed control?[b]
LaGuardia International	NY	10	19 May 2005	No	No
Greater Binghamton Regional	NY	10	5 May 2005	Yes	No
General Mitchell International	WI	10	27 June 2005	No	Yes
Purdue University	IN	15	6 May 2005	No	No
Marine Corps Air Station CP	NC	10	9 Nov 2005	Yes	No
Piedmont-Triad International	NC	10	18 Nov 2005	Yes	No
Washington Dulles International	VA	10	28 April 2006	Yes	Yes

[a]Mulch applied to study plots consisted of hay straw.
[b]Weed control consisted of a single broad-leaf selective herbicide application.

On each facility, a 15,000 ft^2 section of the airfield was prepared for seeding. We seeded each of the tall fescue varieties into 3 separate replicated plots (approximately 500 ft^2 each). Varieties were selected specifically for individual airfields based on information gained from seed companies and local agronomists. All tall fescue varieties were high-endophyte 'turf-type' tall fescues, except for the 'Kentucky-31' cultivar (also high-endophyte) which is the original agronomic tall fescue variety found in the U.S. (Mohr et al. [19]). Turf-type tall fescue cultivars evaluated in this study included: '2nd Millennium', 'Arid 3', 'Blackwatch', 'Bonsai 2000', 'Cayenne', 'Crossfire II', 'Finesse II', 'Grande II', 'Inferno', 'Mustang III', 'Quest', 'Regiment II', 'SR8600', and 'Titan LTD'. We seeded the experimental plots by hand for increased control

of seed application rate; all varieties were seeded at a rate of 8 lbs./1000 ft^2. Following seeding, test plots were raked, "packed", and fertilizer was applied. Mulch (e.g., hay straw) was applied to treatment plots at some airfields at the time of seeding if the location of the plots relative to active aircraft movement areas allowed (Table 1). Broad-leaf specific herbicides were applied at certain locations to reduce weed pressure during the establishment phase (Table 1). We collected soil samples from the existing material and incoming topsoil and had them tested for soil nutrient status.

Establishment and growth of seeded tall fescue varieties was quantified by randomly establishing and sampling 5 0.25-m^2 herbaceous sampling plots in each treatment plot during the first and/or second growing season following seeding. We visually estimated tall fescue cover (%) and height of living vegetation (cm) in each 0.25-m^2 sampling plot (Bonham [20]). Fescue varieties seeded at 6 airfields in spring of 2005 were evaluated in summer 2005 (22 June) or fall 2005 (9 September or 4–15 November) and in fall 2006 (28–30 September), whereas the 2 airfields seeded in fall 2005 were evaluated in fall 2006 (24 September). The airfield seeded in spring 2006 was evaluated in summer 2006 (30 June).

Analysis of variance (ANOVA) techniques were used to test for differences in tall fescue cover and vegetation height among the tall fescue varieties seeded at each airport. Fisher's protected LSD tests were used for multiple comparisons when treatment effects were significant ($P \leq 0.05$).

RESULTS

LaGuardia International Airport:

Growth and establishment of tall fescue varieties seeded at the LaGuardia International Airport were assessed during the first growing season (2005) after seeding. Overall, tall fescue cover was 6% (range 1 to 18%) when averaged across the tall fescue varieties 2 months after seeding on 22 June 2006 (Table 6). Tall fescue cover was not different ($P \geq 0.05$) among the 10 tall fescue varieties. 'Cayenne' had the highest tall fescue cover during the evaluation.

Climatic conditions and soil nutrient levels appeared to be adequate for tall fescue establishment. The plots received relatively normal amounts of rainfall. Analyses of the soils from the study plots at the LaGuardia International Airport suggest they are sandy in texture with a pH of 6.4 and 2.3% organic matter. Nutrient levels in study plot soils were: 7 lbs./acre of Phosphorus (P), 255 lbs./acre of Potassium (K), 232 lbs./acre of Magnesium (Mg), and 1,990 lbs./acre of Calcium (Ca).

During the latter months of summer in 2005, a very large amount of bread-leaf weeds, annual grasses, and other unwanted vegetation grew into all of the experimental plots. We believe the seed source for this vegetation, which was not present on other areas of the airfield, was the topsoil material placed into the experimental plots as part of the renovation process. This heavy weed cover likely reduced the establishment of tall fescue. The experimental plots were reseeded in fall of 2005 and thus no data was collected during the second growing season (2006).

Greater Binghamton Regional Airport:

We assessed the growth and establishment of tall fescue varieties seeded at the Greater Binghamton Regional Airport during the first growing season (2005). Overall, tall fescue cover was 29% (range 18 to 34%) when averaged across all tall fescue varieties 4 months after seeding (Table 2). Some variation in tall fescue establishment among varieties was evident; the 'Finesse II' and 'Kentucky-31' cultivars had lower fescue cover ($P < 0.05$) than the other 8 varieties.

During the second growing season (2006), all tall fescue varieties increased in coverage. Overall, tall fescue cover was 54% (range 44 to 65%) when averaged across the tall fescue varieties 17 months after seeding (Table 2). Tall fescue cover varied ($P < 0.05$) among the tall fescue varieties; the 'Kentucky-31', 'Grande II', and 'SR8600' cultivars had the highest amounts of tall fescue coverage during 2006.

Climatic conditions and soil nutrient levels appeared to be adequate for the establishment and growth of tall fescue. The plots received adequate amounts of rainfall, particularly during the seed germination period. Analyses of the soils from the study plots at the Greater Binghamton Regional Airport suggest they are clayey in texture with a pH of 6.0, 4.0% organic matter, and a CEC of 11 meq/100g. Nutrient levels in study plot soils were: 9 lbs./acre of P, 230 lbs./acre of K, 323 lbs./acre of Mg, and 2,970 lbs./acre of Ca.

Table 2.
Mean tall fescue cover (%) and mean vegetation height (cm) during the first (2005) and second (2006) growing seasons after tall fescue varieties were seeded into experimental plots at the Greater Binghamton Regional Airport, Binghamton, NY.

	2005[a]		2006[b]	
Variety	Tall Fescue (%)[c]	Height (cm)[c]	Tall Fescue (%)	Height (cm)
2nd Millennium	30 **	6.0 **	50	8.3 **
Blackwatch	33 **	6.0 **	52 **	8.1 **
Bonsai 2000	34 **	7.5 **	53 **	7.9 **
Cayenne	40 **	6.7 **	37	6.7
Crossfire II	25 **	6.8 **	55 **	7.6
Finesse II	22	6.0 **	44	7.3
Grande II	31 **	6.9 **	62 **	7.7 **
Kentucky-31	18	5.8 **	65 **	8.9 **
SR8600	28 **	5.5	62 **	7.3
Titan LTD	24 **	6.8 **	58 **	7.6

[a]Plant community measurements were conducted on 9 September 2005.
[b]Plant community measurements were conducted on 28 September 2006.
[c]Means in the same column marked with asterisks were not different ($P > 0.05$) from the tall fescue variety with the highest cover or height value.

General Mitchell International Airport:

Growth and establishment of tall fescue varieties seeded at the General Mitchell International Airport were assessed during the first growing season (2005). Overall, tall fescue cover was 68% (range 61 to 79%) when averaged across all tall fescue varieties 5 months after seeding (Table 3). Some variation in tall fescue establishment among varieties was evident; the 'SR8600', 'Bonsai 2000', and '2nd Millennium' cultivars had lower cover ($P < 0.05$) than the other 7 varieties.

During the second growing season (2006), all tall fescue varieties increased in coverage and were completely established by September. Overall, tall fescue cover was 98% (range 96 to 100%) when averaged across the tall fescue varieties 15 months after seeding (Table 3). Tall fescue cover varied ($P < 0.05$) among the tall fescue varieties; all 10 varieties had established a high quality turfgrass stand, consisting of all tall fescue and no other plants.

Climatic conditions and soil nutrient levels appeared to be adequate for the establishment and growth of tall fescue. Although the study plots received relatively little rainfall throughout the first few months after seeding, much needed rain fell during fall of 2005. This moisture allowed for the establishment and excellent growth of the grasses during September and October. Analyses of the soils from the study plots suggest they are silty in texture with a pH of 7.1 and 4.2% organic matter. Nutrient levels in study plot soils were very high: 90 lbs./acre of P, 218 lbs./acre of K, 1,328 lbs./acre of Mg, and 4,107 lbs./acre of Ca.

Table 3.
Mean tall fescue cover (%) and mean vegetation height (cm) during the first (2005) and second (2006) growing seasons after tall fescue varieties were seeded into experimental plots at the General Mitchell International Airport, Milwaukee, WI.

	2005[a]		2006[b]	
Variety	Tall Fescue (%)[c]	Height (cm)[c]	Tall Fescue (%)	Height (cm)
2nd Millennium	62	10.5	98 **	24.5
Blackwatch	69 **	8.0	100 **	23.1
Bonsai 2000	61	13.2 **	96	27.9
Cayenne	77 **	10.0	100 **	25.5
Crossfire II	70 **	10.9	96	26.3
Finesse II	66 **	9.7	99 **	25.7
Grande II	68 **	11.5	98 **	26.5
Kentucky-31	79 **	14.3 **	100 **	30.6
SR8600	50	9.6	98 **	24.3
Titan LTD	77 **	11.5	96	25.0

[a]Plant community measurements were conducted on 15 November 2005.
[b]Plant community measurements were conducted on 28 September 2006.
[c]Means in the same column marked with asterisks were not different ($P > 0.05$) from the tall fescue variety with the highest cover or height value.

Purdue University Airport:

We assessed the growth and establishment of tall fescue varieties seeded at the Purdue University Airport during the first growing season (2005). Overall, tall fescue cover was 24% (range 18 to 34%) when averaged across all varieties 6 months after seeding (Table 4). Although some tall fescue varieties had lower cover ($P < 0.05$), overall the establishment of tall fescue cultivars was slow.

During the second growing season (2006), all tall fescue varieties increased in coverage. Overall, tall fescue cover was 27% (range 22 to 33%) when averaged across the tall fescue varieties 17 months after seeding (Table 4). Tall fescue cover varied ($P < 0.05$) among the tall fescue varieties; the 'Inferno', 'Grande II', 'Bonsai 2000', 'Finesse II', and 'Regiment II' cultivars had slightly higher amounts of tall fescue coverage during 2006.

Climatic conditions during 2005 appeared to have been less than adequate for tall fescue establishment. Drought conditions, with little rainfall, persisted during the months following seeding, creating unfavorable conditions for tall fescue during the first growing season. Analyses of the soils from the study plots at the Purdue University Airport suggest they are very clayey in texture with a pH of 7.8 and a CEC of 14.7 meq/100g. Nutrient levels in study plot soils were: 33 lbs./acre of P, 142 lbs./acre of K, 726 lbs./acre of Mg, and 4,618 lbs./acre of Ca.

Table 4.
Mean tall fescue cover (%) and mean vegetation height (cm) during the first (2005) and second (2006) growing seasons after tall fescue varieties were seeded into experimental plots at the Purdue University Airport, Lafayette, IN.

	2005[a]		2006[b]	
Variety	Tall Fescue (%)[c]	Height (cm)[c]	Tall Fescue (%)	Height (cm)
2nd Millennium	14 **	9.3 **	29 **	18.5 **
Arid 3	12	8.2 **	25	16.7
Blackwatch	10	7.8	29 **	16.5
Bonsai 2000	14 **	7.7	31 **	16.3
Cayenne	17 **	7.6	30 **	15.2
Crossfire II	14 **	8.3 **	26	16.7
Finesse II	9	8.1 **	30 **	16.5
Grande II	18 **	9.3 **	31 **	14.1
Inferno	17 **	7.7	33 **	16.7
Kentucky-31	19 **	9.1 **	23	20.7 **
Mustang III	16 **	8.6 **	23	16.8
Quest	9	7.8	22	19.5 **
Regiment II	14 **	8.1 **	30 **	16.6
SR8600	13 **	7.7	27 **	16.1
Titan LTD	12	8.7 **	22	17.9

Table 4. (con't)

[a]Plant community measurements were conducted on 4 November 2005.
[b]Plant community measurements were conducted on 30 September 2006.
[c]Means in the same column marked with asterisks were not different ($P > 0.05$) from the tall fescue variety with the highest cover or height value.

Marine Corps Air Station Cherry Point:

Growth and establishment of tall fescue varieties seeded at Marine Corps Air Station Cherry Point were assessed during the first growing season (2006) following seeding. Overall, tall fescue cover was 34% (range 20 to 57%) when averaged across all tall fescue varieties 10 months after seeding (Table 5). Considerable variation in establishment among the tall fescue varieties was evident after the initial growing season; the 'Crossfire II', 'Cayenne', and 'SR8600' cultivars had higher fescue cover ($P < 0.05$) than the other 7 varieties. Although tall fescue plants dominated the experimental plots during the spring of 2006, a diversity of other plants (e.g., warm-season grasses, broad-leaf weeds) grew into the plots during the summer months.

Climatic conditions and soil nutrient levels appeared to be adequate for the establishment and growth of tall fescue. The plots received adequate amounts of rainfall and air temperatures were above normal, particularly during the seed germination period. Analyses of the soils from the study plots at the Marine Corps Air Station Cherry Point suggest they are sandy loams with a pH of 7.4, 1.0% organic matter, and a CEC of 18.6 meq/100g. Nutrient levels in study plot soils were: 3 lbs./acre of P and 23 lbs./acre of K.

Piedmont-Triad International Airport:

Growth and establishment of tall fescue varieties seeded at the Piedmont-Triad International Airport were assessed during the first growing season (2006). Overall, tall fescue cover was 36% (range 24 to 53%) when averaged across all tall fescue varieties 10 months after seeding (Table 6). Some variation in tall fescue establishment among varieties was evident; the '2nd Millennium', 'Cayenne', 'Crossfire II', and 'Bonsai 2000' cultivars had lower cover ($P < 0.05$) than the other 7 varieties. Slender lespedeza (*Lespedeza virginica*) was a dominant component of the plant communities in the experimental plots at this airport and likely provided competition for the establishing tall fescue.

Climatic conditions and soil nutrient levels appeared to be adequate for the establishment and growth of tall fescue. The plots received adequate amounts of rainfall, particularly during the seed germination period. Analyses of the soils from the study plots at the Piedmont-Triad International Airport suggest they are sandy loams with a pH of 4.9, >0.1% organic matter, and a CEC of 4.4 meq/100g. Nutrient levels in study plot soils were: 1 lb./acre of P and 50 lbs./acre of K.

Table 5.
Mean tall fescue cover (%) and mean vegetation height (cm) during the first growing season (2006) after tall fescue varieties were seeded into experimental plots at Marine Corps Air Station Cherry Point, Havelock, NC.

	2006[a]	
Variety	Tall Fescue (%)[b]	Height (cm)[b]
2nd Millennium	20	8.3
Bonsai 2000	31	20.1 **
Cayenne	49 **	5.0
Crossfire II	57 **	5.5
Finesse II	25	7.1
Grande II	25	15.0 **
Kentucky-31	23	14.2 **
Regiment II	33	7.1
SR8600	46 **	8.1
Titan LTD	33	12.7 **

[a]Plant community measurements were conducted on 24 September 2006.
[b]Means in the same column marked with asterisks were not different ($P > 0.05$) from the tall fescue variety with the highest cover or height value.

Table 6.
Mean tall fescue cover (%) and mean vegetation height (cm) during the first growing season (2006) after tall fescue varieties were seeded into experimental plots at Piedmont-Triad International Airport, Greensboro, NC.

	2006[a]	
Variety	Tall Fescue (%)[b]	Height (cm)[b]
2nd Millennium	26	6.2 **
Bonsai 2000	24	6.4 **
Cayenne	27	6.7 **
Crossfire II	28	7.4 **
Finesse II	53 **	7.6 **
Grande II	43 **	6.7 **
Kentucky-31	45 **	7.3 **
Regiment II	44 **	7.6 **
SR8600	39 **	6.9 **
Titan LTD	37 **	7.0 **

[a]Plant community measurements were conducted on 8 September 2006.
[b]Means in the same column marked with asterisks were not different ($P > 0.05$) from the tall fescue variety with the highest cover or height value.

Washington Dulles International Airport:

We assessed the growth and establishment of tall fescue varieties seeded at the Washington Dulles International Airport during the first growing season (2006). Overall, tall fescue cover was 46% (range 36 to 56%) when averaged across all tall fescue varieties 2 months after seeding (Table 7). Some variation in tall fescue establishment among varieties was evident; the 'Regiment II' and 'SR8600' had lower cover ($P < 0.05$) than the other 8 varieties. Although the initial establishment of tall fescue was very good, most of the tall fescue grass seedlings had died by the end of the first growing season. Initially, the experimental plots received adequate amounts of rainfall, particularly during the seed germination period. However, 14 inches of rain fell during a 3-day storm event in early June, followed by a long period of above normal air temperatures and drought conditions. Further, a large amount of broad-leaf weeds grew into the experimental plots during early summer. The tall fescue plants likely died as a result of the combination of extreme climatic conditions and competition from the weeds.

Soil nutrient levels appeared to be adequate for the establishment and growth of tall fescue. Analyses of the soils from the study plots at the Washington Dulles International Airport suggest they are sandy loams with a pH of 5.4 and a CEC of 6.3 meq/100g. Nutrient levels in study plot soils were: 4 lbs./acre of P, 116 lbs./acre of K, 307 lbs./acre of Mg, and 803 lbs./acre of Ca.

Table 7.
Mean tall fescue cover (%) and mean vegetation height (cm) during the first growing season (2006) after tall fescue varieties were seeded into experimental plots at Washington Dulles International Airport, Dulles, VA during 2006.

	2006[a]	
Variety	Tall Fescue (%)[b]	Height (cm)[b]
2nd Millennium	46 **	3.8
Bonsai 2000	54 **	4.3
Cayenne	40 **	3.3
Crossfire II	50 **	4.5
Finesse II	40 **	3.9
Grande II	51 **	3.5
Kentucky-31	49 **	5.3 **
Regiment II	36	3.6
SR8600	36	3.5
Titan LTD	56 **	4.1

[a]Plant community measurements were conducted on 30 June 2006.
[b]Means in the same column marked with asterisks were not different ($P > 0.05$) from the tall fescue variety with the highest cover or height value.

DISCUSSION

The findings from this study suggest commercially available high-endophyte tall fescue cultivars might be favorable turfgrass varieties to use in reseeding and vegetation renovation projects on airfields and other areas. Overall, tall fescue varieties established and grew on the 7 airfields utilized as part of this study. These airports were located in various parts of the eastern and central United States and represent a diversity of soils, climates, and other local conditions. Although all of the tall fescue cultivars seeded at each airport provided at least some tall fescue cover after one or two growing seasons, not unexpectedly, variation in performance among tall fescue cultivars did occur (i.e., some cultivars established and grew better than others). This variation was much more prominent at some airfields (e.g., Marine Corps Air Station Cherry Point) than others (e.g., General Mitchell International), which is likely a function of differences in local climate and growing conditions.

Abiotic factors, such as climatic conditions and soil nutrient levels, and biotic factors (e.g., weed competition) have strong influence on the rate of establishment of turfgrasses and other plants seeded as part of an airfield renovation or revegetation project. Further, these abiotic and biotic factors can vary greatly among airports, depending on the geographic location of those airports and the local geology and soil conditions. Some factors, such as weather, cannot be controlled or predicted, and thus these influences are not in the control of airfield managers. In contrast, other factors can be monitored and amended, using methods such as soil testing and fertilization, using good quality turfgrass seed, and applying appropriate chemical control (e.g., herbicides) to reduce weed competition. For example, in this study tall fescue establishment was consistently higher on airports where we were able to apply straw mulch (due to distance from runways and taxiways).

Performance information of high endophyte tall fescue cultivars provided by this study will be useful for airfield managers, grounds and maintenance personnel, and other individuals that are interested in selecting turfgrass varieties for seeding or vegetation renovation projects on or near airfields. Our experimental trials provide airport-specific recommendations regarding tall fescue cultivars for the 7 airports where we conducted this study. In addition, this information could be used to make selections of tall fescue varieties for other airports and facilities. Tall fescue cultivars that established and grew at individual airports would likely be useful at other facilities within the same geographic region with similar soils, climate, and other local conditions.

Other sources of information regarding the utility of different tall fescue cultivars, such as the findings released by the National Turfgrass Evaluation Program (e.g., National Turfgrass Evaluation Program [21]), can be of assistance to airfield managers and other individuals interested in selecting turfgrass cultivars that might successfully establish and grow on airfields. However, caution is warranted when interpreting this information as the standard methods of turfgrass management (e.g., heavy irrigation, fertilization, and mowing) utilized in these studies (e.g., Asay et al. [22], Asay et al. [23]) are very different than the low to no maintenance vegetation establishment and management methods used on airfields (e.g., seeded and “left alone”).

FUTURE RESEARCH NEEDS

In addition to the 10-15 tall fescue varieties evaluated in this study, there are many other commercially available tall fescue cultivars that contain high endophyte infestation rates that could be useful for vegetation renovation and reseeding projects on airfields. We recommend that additional tall fescue variety trial experiments evaluating additional tall fescue cultivars be conducted on airports in other parts of the United States (e.g., the southern U.S., western coastal areas) to determine which high endophyte tall fescue varieties might be useful in different physiographic regions of North America.

In addition to tall fescue, other turfgrasses have fungal endophytes (e.g., perennial ryegrasses, fine fescues), are commercially available, and might also be potential plants for use on airfields. However, many questions need to be answered before recommendations can be made as to what is the best plant or group of plants to manage for on airfields in the various ecotypes found in North America. Future research is needed to provide regionally specific recommendations for desirable airfield vegetation types and management regimens that minimize or eliminate the attractiveness of airports to hazardous wildlife.

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