

Nitrogen Fertility for Seed Production of Tall Fescue



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Introduction

Nitrogen (N) nutrition is an important aspect of seed production for any grass crop because it stimulates the production and development of new vegetative and reproductive tillers. Tall fescue is grown extensively in the USA for amenity purposes on sports fields, golf courses and lawns and for the production of herbage for ruminant livestock. In the early 1990s, evaluation trials at Beaverlodge, Alberta, indicated that it was feasible to grow tall fescue for seed in the Peace River region. Studies were subsequently initiated to develop agronomic information for growers interested in diversifying their farming operations.

Objectives

To conduct a study in the Peace River region of north-western Canada to investigate the effects of the method, rate, and time of application of N fertilizer on the yield and quality of seed of tall fescue.

Experimental Details:

A study on the method, rate and time of application of N fertilizer on seed yield and quality of tall fescue was seeded, on 30-cm rows, at four sites in the vicinity of Beaverlodge during mid-to-late May of two consecutive years, 1993 and 1994. For each trial, seed yield and quality observations were made on two consecutive seed crops. Each site had good base levels of P, K and S, and 200 kg/ha of 11-55-0 fertilizer was worked in to the seedbed. Nitrate-N concentration in the soil at the four sites was in the range of 30 to 70 kg/ha. There were 18 N fertilizer treatments: all the combinations of two methods (surface-broadcast, granular, ammonium nitrate 34-0-0 and soil-injected 28-0-0 solution beside each row with a spoke-wheel injector at 20 cm spacing), three times (early- to mid-September, early- to mid-October, and early- to mid-April prior to the first seed harvest), and three rates (50, 100 and 150 kg/ha N) of application of N. The growth of the second seed crop was supported by a uniform application of 200 kg/ha of 34-0-0 applied in mid-September in order to assess the residual effects of the previous treatments.

Results and Discussion

The results are summarized in Table 1. Seed yield and quality were not affected by the time of N application to the first crop, so there is considerable flexibility in when N fertilizer may be applied in the growing conditions of the Peace region. When compared with broadcast application, soil-injection of N fertilizer significantly reduced whole-plant DM yield and seed yield per seed head by 7 and 9%, respectively, but the two methods of N application had no differential effect on seed yield per hectare, fertile-tiller density, harvest index, 1000-seed weight, specific seed weight, germination, or seed dockage. When compared with N at 50 kg/ha, whole-plant DM yield was increased by 6 and 8%, and seed yield per seed head by 15 and 14%, with the 100 and 150 kg/ha rates of N, respectively. Seed yield per hectare, fertile-tiller density and seed quality characteristics were unaffected by the rate of N application. The first- and second-year seed yields averaged 1319 and 952 kg/ha, respectively, for the 1993 seeding year, and 1630 and 716 kg/ha, respectively, for the 1994 seeding year. The cumulative seed productivity over the two production years was similar for the two seeding years, being 2271 kg/ha for 1993 and 2346 kg/ha for 1994. Each seed crop of tall fescue requires an available N supply from the soil in the range of 100 to 150 kg/ha N to maximize seed yield; the actual amount of N effectively utilized by the crop is likely to vary with the availability of soil moisture during the growing season.

Table 1. The effect of method, rate and time of nitrogen fertilizer application on the yield and quality characteristics of tall fescue grown for seed (means for two seeding years, each harvested for two consecutive production years at four sites)

Factor ^z	Whole-plant DM yield kg/ha	Clean seed yield kg/ha	Clean seed yield mg/seed head	Fertile tiller density #/m ²	Harvest index %	Thousand -seed wt. g	Specific seed wt. kg/hL	Germination %	Clean seed %
Method (M)									
Broadcast	5077	1207	188	720	22.3	2.02	29.3	89.9	70.2
Injected	4702	1141	172	721	22.6	2.02	29.2	89.7	70.3
Significance	**	NS	*	NS	NS	NS	NS	NS	NS
Rate (R)									
50 kg/ha	4658	1132	164	738	22.6	2.03	29.4	89.6	70.2
100 kg/ha	4958	1199	189	692	22.6	2.02	29.2	90.0	70.6
150 kg/ha	5052	1194	187	732	22.1	2.02	29.1	89.6	69.9
Significance	*	NS	*	NS	NS	NS	NS	NS	NS
Time (T)									
September	4824	1191	189	716	22.9	2.01	29.3	89.5	71.0
October	4932	1183	173	745	22.5	2.01	29.3	89.6	70.0
April	4912	1150	179	701	21.9	2.04	29.1	90.1	69.7
Significance	NS	NS	NS	NS	*	*	NS	NS	NS
Interaction significance									
M x R	NS	NS	NS	NS	NS	NS	NS	NS	NS
M x T	NS	NS	NS	NS	NS	NS	NS	NS	NS
R x T	NS	NS	NS	NS	NS	NS	NS	NS	NS
M x R x T	NS	NS	NS	NS	NS	NS	NS	NS	*

NS, *, ** Not statistically significant, and statistically significant at P=0.05 and P=0.01, respectively.

^z N fertilizer treatments applied prior to the first seed harvest. The second seed crop received a broadcast application of 68 kg/ha N in the fall.

Tall fescue seed crop in late July, 1994



Conclusions

1. Under the conditions of this study, seed productivity and quality from two consecutive crops of tall fescue were not significantly influenced by the method, rate and timing of the application of N fertilizer for the first seed crop.
2. There was no agronomic benefit from the soil-injection of solution N fertilizer over the surface-broadcasting of N (as 34-0-0) for seed productivity of tall fescue. Possibly, the close distribution pattern from broadcasting outweighs the wider point-placement of solution N in the soil-root zone.
3. The annual productivity of tall fescue, based on two seeding years each with two consecutive production years at four sites in the Peace River region, averaged 1155 kg/ha of clean seed @ 12% moisture. The characteristics of this production were a whole-plant yield of 5000 kg/ha, 180 mg of clean seed per seed head, a fertile tiller density of 720 per square metre, a harvest index of 22%, a thousand-seed wweight of 2 g, a specific weight of 29 kg/hL, and a germination capacity of 90%.
4. Tall fescue requires an available N supply from the soil in the range of 100 to 150 kg/ha N to maximize seed yield and quality in the first production year.
5. In this northerly latitude, further research is required to determine the specific N fertility requirements for optimizing yield and quality of the second and subsequent seed harvests from a tall fescue stand.

Acknowledgement

The financial assistance of the Canadian Seed Growers' Association and the analytical services of Norwest Labs of Edmonton facilitated this study.

