Plant Spacing for Seed Production of Creeping Red Fescue

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Introduction

Creeping red fescue has been grown for seed production in the Peace River region of Alberta and British Columbia for over 50 years. Although the land area in production of creeping red fescue seed varies greatly from year-to-year, as much as 100,000 hectares has been harvested in some years. Most of the production is of common seed although approximately 10% of the crop may receive pedigreed status. Most of the seed is exported to the USA, and is used for amenity purposes on sports fields, golf courses and lawns, for set-aside areas, and for the production of herbage for ruminant livestock. A knowledge of the responses to plant spacing is a fundamental requirement for any grass seed crop, as it can influence strongly the productivity and longevity of the stand.

Objectives

To conduct a study in the Peace River region of north-western Canada in order to determine whether the seed yield of creeping red fescue can be optimized, for one or more consecutive seed crops, by manipulating the population density and spatial arrangement of plants at the time of crop establishment.

Experimental Details

Seeds of 'Fortress' creeping red fescue were germinated in late May and individual seedlings were transferred to root trainers. Prior to transplanting into the field plots in mid-to-late July, the seedlings were placed in a greenhouse exposed to natural light and then hardened in a screen house. The seedbed received 150 kg/ha each of 11-55-0 and 0-0-5-17S and the transplants were irrigated to ensure good establishment. The plant density treatments were based on between-row spacings of 20, 40 and 80 cm and within-row spacings of 5,10, 20, 40 and 80 cm. Various combinations of these within- and between-row spacings were included in the trial so that seven plant density treatments could be compared, namely 1.6, 3.1, 6.3, 12.5, 25, 50 and 100 plants/square metre. Each treatment was replicated four times and the replicates were each oriented in a different direction to eliminate the effect of row orientation on crop performance. Observations on plant productivity, plant development, and seed quality were recorded for three successive production years (1991 to 1993) on 12, well-bordered, individual plants per treatment plot. Throughout the study, weeds and volunteer grass seedlings were removed by hand and/or hoeing, and an annual application of 200 kg/ha of 34-0-0 N fertilizer was made each October. The soil moisture during the study was about normal for the region in 1990 and 1993, and drier than normal in 1991 and 1992. The annual moisture deficit (precipitation minus pan evaporation) for 1990 to 1993, respectively, was 101, 146, 131, and 106% of the long-term average.

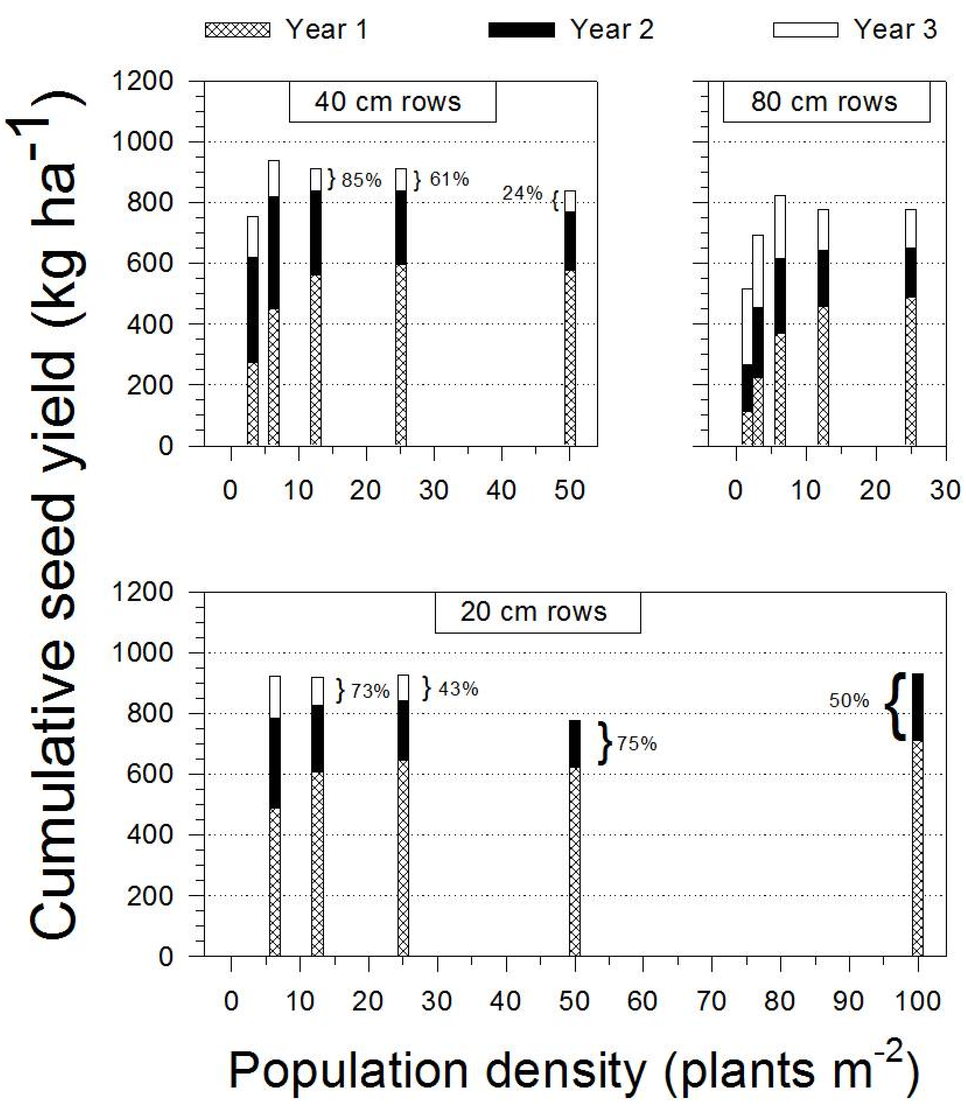
Results and Discussion

Heading commenced on 20 June, 28 May and 5 June in the first, second and third production years, respectively. It was delayed by up to 7 days as plant population density increased. The time of seed maturity occurred between 15 and 22 July in each year and, in the first year, was delayed by 2 to 4 days with densities of 6 plants/square metre or lower. The seed yield per plant was at a maximum of 16 g for the lowest plant density in the third production year; it decreased as plant density increased for each production year and with each row spacing. The number of seedheads per plant decreased as plant density increased and, at equivalent densities, the pattern of response was similar for each row spacing. The pattern of response to increasing density for seed heads/square metre was similar for each row spacing. In the first year, the number increased with density to a maximum of about 1200 at 100 plants/square metre whereas, in the second and third years, numbers generally decreased as density increased. The numbers were markedly lower in the third year at each row spacing and at all but the lowest densities. The 1000-seed weight deceased as plant density increased, particularly in the first year when it ranged from 1.54 to 1.20 g.

Results and Discussion continued

The specific seed weight varied among years from 16 to 24 kg/hL and decreased as density increased. The germination capacity of the seed was unaffected by plant density but differed among production years. Averaged over the three years, seed dockage increased exponentially from 18 to 40% as plant density increased. The effect of plant population density on seed yield, for each of the three row spacings in each production year, is shown in Figure1. Within each year, the seed yield response to increasing plant density was similar for each row spacing, but the shape of the response in the first year differed from that in the subsequent two. In the first year, seed yield increased with density up to about 10 plants/square metre and remained constant at the higher densities. In the subsequent two years, seed yield was highest when the initital density was less than 10 plants/square metre and either remained constant or decreased at the higher densities.

Figure 1. Seed yield of creeping red fescue over three consecutive production years, as affected by the initial plant population density at row spacings of 20, 40 and 80 cm. *When the probability of producing seed is less than 100%, the value is indicated adjacent to the applicable yield bar.*



Conclusions

1. Stands of creeping red fescue should be established to provide an initial density of 12 to 25 plants/square metre in rows no wider than 40 cm to optimize seed yield for each of two consecutive years. Based on an average 1000-seed weight of 1.37 g and 100% seedling establishment, a seeding rate of 0.17 to 0.34 kg/ha should provide this density of plants. In practice, excellent stands are normally achieved by broacasting 2.2 kg/ha of seed, or by drilling 1.1 kg/ha of seed in rows spaced 30 cm apart.

2. To maximize seed yield in the first production, 12 to 100 plants/square metre are required if rows are spaced 20 cm apart, or 12 to 50 plants/square metre are required if rows are spaced 40 cm apart.

3. It is doubtful whether it is economic to retain a stand of creeping red fescue for a third crop year without reducing the tiller and plant density.

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