# EFFECT OF GRASS SPECIES AND ROW SPACING ON DANDELION ESTABLISHMENT AND GROWTH

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The size of dandelions (*Taraxacum officinale* Weber) growing in intermediate wheatgrass (*Agropyron intermedium* (Host.) Beauv.), crested wheatgrass (*A. cristatum* L.), a northern biotype of bromegrass (*Bromus inermis* Leyss.), a southern biotype of bromegrass, meadow fescue (*Festuca elatior* L.), creeping red fescue (*F. rubra* var. *genuina* L.) and timothy (*Phleum pratense* L.) was effectively reduced by decreasing the row spacing of each grass from 100 cm to 20 cm. Russian wild ryegrass (*Elymus junceus* Fisch.) had only a minor effect on dandelion size regardless of the row spacing at which it was planted. Within any given row spacing between 20 and 100 cm, dandelion density was not affected by grass species. However, as the row spacing decreased the average density of dandelions growing in the seven grass species also decreased.

Le fait de ramener de 100 à 20 cm l'écartement entre les lignes des graminées a réellement provoqué une diminution de la taille des pissenlits (*Taraxacum officinale* Weber) poussant dans des cultures d'agropyre intermédiaire (*Agropyron intermedium* (Host.) Beauv.), d'agropyre à crête (*A. cristatum* L.), d'un biotype de brome du nord (*Bromus inermis* Leyss.), d'un biotype de brome du sud, de fétuque élevée (*Festuca elatior* L.) de fétuque rouge traçante (*Festuca rubra* var. *genuina* L.) et de phléole des prés (*Phleum pratense* L.). L'élyme de Russie (*Elymus junceus* Fisch.) n'eu que relativement peu d'effet sur la taille des pissenlits quelle qu'ait été la largeur de l'interligne. A chacun des écartements de 20 à 100 cm, la densité de peuplement du pissenlit n'a pas varié selon l'espèce de graminée utilisée. En revanche, le rétrécissement de l'interligne a diminué la densité moyenne de peuplement du pissenlit, et cela dans les sept espèces de graminées.

The manipulation of crop species and row spacing has long been recognized as an important method of controlling weeds. Bromegrass (*Bromus inermis* Leyss.) has been reported as an effective agent in controlling quackgrass (*Agropyron repens* (L.) Beauv.) (Wolcott 1951), while crested wheatgrass (*A. cristatum* L.) has been reported to help control field bindweed (*Convolvulus arvensis* L.) (King 1966). In some crop species, row spacing has been shown to reduce weed competition while in others the effect of row spacing on weed competition has not been observed. In experiments at Swift Current, Saskatchewan, Kilcher (1961) observed that intermediate wheatgrass (*A. intermedium* (Host.) Beauv.) and crested wheatgrass grown in rows greater than 30 cm apart became weedy. Increased intermediate wheatgrass yields normally attained with wide (> 30 cm) row spacings were not obtained due to the presence of the weeds. In the case of Russian wild ryegrass (*Elymus junceus* Fisch.) grown in similar row spacings, weed growth did not occur regardless of the distance between the rows. Pankiw et al. (1977) showed that red clover (*Trifolium pratense* L.), alsike clover (*T. hybridum* L.) and birdsfoot trefoil (*Lotus corniculatus* L.)

competed successfully with weeds when seeded in rows spaced 15–30 cm apart but not when seeded in rows spaced 45 to 60 cm apart. Mølgaard (1977) observed that in a mixture of grasses the density of dandelion (*Taraxacum officinale* Weber) decreased as the height and density of the grasses increased.

In many parts of Canada dandelion constitutes a problem in the production of grass crops for seed or hay. In some areas, such as the Peace River region of northern Alberta and British Columbia, herbicides have been inconsistent in their effectiveness in controlling this weed (Darwent 1977). Therefore, the primary objective of this study was to determine the effectiveness of seven grass species, each growing at varying row spacings, in reducing the establishment and growth of dandelion.

## MATERIALS AND METHODS

The experiments were conducted at the Research Station, Beaverlodge, Alberta on a Dark Gray Luvisolic soil. Crested wheatgrass cv. Fairway, bromegrass (northern biotype) cv. Carlton, bromegrass (southern biotype) cv. Red Patch, meadow fescue (*Festuca elatior* L. 'Mimer'), Russian wild ryegrass cv. Sawki, creeping red fescue (*F. rubra* var. *genuina* L. 'Boreal') and timothy (*Phleum pratense* L. 'Climax') were seeded in seven-row plots. The rows in each plot were arranged in a systematic fan-shaped design adapted from systematic designs described by Nelder (1962) and Gross (1972). The row spacing at one end of each plot was 10 cm and increased to 100 cm at the other end. Each row was 9 m in length. The plots were arranged in a randomized block design with four replicates. Crested wheatgrass was seeded at a rate of 117 seeds per meter of row while bromegrass (northern biotype), bromegrass (southern biotype), meadow fescue, Russion wild ryegrass, creeping red fescue and timothy were seeded at 66, 66, 83, 87, 117 and 133 seeds per meter of row, respectively. The experiment was conducted twice with seedings on 26 May 1972 and on 2 June 1973.

An adjacent area containing grass sod but heavily infested with dandelion served as a dandelion seed source for the natural infestation of the two study areas. The only other weed species present consisted of sparse infestations of red and alsike clover. No herbicides were used in either study area. Nitrogen fertilizer was applied in late October of each year (80 kg N/ha).

To determine the effect of grass species and row spacing on dandelion growth and density, two transects, each 10 cm wide and extending the length of the plot, were established in each plot. The transects were located along the middle of the interrow spaces on either side of the center row of grass. Segments 70 cm in length were selected from each transect. The mid-points of these segments were centered at points where the rows were 20, 30, 40, 50, 60, 70, 80, 90 and 100 cm apart. Density was determined by counting all dandelion plants with crowns within or touching the boundaries of each of the 10 × 70-cm segments. The average canopy diameter of these dandelions was determined by measuring and averaging the distance between leaf tips in east-west and north-south directions. Measurements were made on 14 June 1973, 12 June 1974 and 23 June 1975 for the 1972 seeding and on 24 June 1975 and 24 June 1976 for the 1973 seeding.

Analyses of variance were performed on dandelion canopy diameter and density within each row spacing selected. To assess the effects of row spacing within each species of grass or over all species of grasses on dandelion density, data were fitted to curves by means of the polynomial least squares method (Snedecor and Cochran 1967).

## RESULTS AND DISCUSSION

The growth and development of intermediate wheatgrass, crested wheatgrass, the northern biotype of bromegrass, the southern biotype of bromegrass, meadow fescue, creeping red fescue and timothy, as reflected by seed or hay yields, was excellent, regardless of whether seeded in 1972 or 1973 (Elliott, unpublished data). However, the growth and development of Russian wild ryegrass was slow from both 1972 and 1973 seedings, resulting in low seed and hay yields. In the winter of 1973-74 considerable winter injury occurred amongst grasses seeded in 1973 but recovery was rapid.

The canopy diameter of dandelion plants growing within the same row spacing of all grasses varied significantly from year to year. The average canopy diameter of dandelion plants growing in grasses seeded in 1972 was 15.2, 19.4 and 18.2 cm when sampled in 1973, 1974 and 1975, respectively, while the average canopy diameter of dandelion plants growing in grasses seeded in 1973 was 13.8 and 11.2 cm when sampled in 1975 and 1976, respectively. This variation was probably due to factors other than those imposed on the dandelion by the grasses (i.e. initiation of spring growth in relation to the time of sampling, weather conditions, etc.). Because of a lack of any consistent increases or decreases, canopy diameter data for the three sampling years from the 1972 seeding and for the two sampling years from the 1973 seeding were combined to evaluate the effects of grass species and row spacing on the size of the weed.

The canopy diameter of the dandelion was affected by grass species growing within narrow row spacings (Table 1). At row spacings of 20, 30, 40 and 50 cm, the average canopy diameter of dandelion plants growing in Russian wild ryegrass planted in 1972 was significantly greater than in other grasses planted at the same time. Similarly, the average canopy diameter of dandelion plants growing in Russian wild ryegrass planted in 1973 was significantly greater than in other grasses planted in the same year at the 20-cm row spacing. The dandelion canopy diameter was also largest in Russian wild ryegrass seeded in row spacings of 30 and 40 cm, although the differences in size were not always significantly greater than for dandelion plants growing in other grasses seeded in the same row spacings. At row spacings of 60 cm or more, a few significant differences in dandelion size occurred between the grasses in both 1972 and 1973 seedings, but there were no consistent trends from one row spacing to the next.

Row spacing in intermediate wheatgrass, the two biotypes of bromegrass, meadow fescue, creeping red fescue and timothy had a pronounced influence on the canopy diameter of dandelion (Table 1). The maximum canopy diameter of dandelion plants growing in all of these grasses occurred at row spacings between 80 and 100 cm, while the minimum canopy diameter of the dandelion plants occurred at a row spacing of 20 cm. In timothy seeded in 1972, the average dandelion canopy diameter over the 3-yr sampling period was 80% greater between rows spaced 80–100 cm apart than between rows spaced 20 cm apart. In all other grasses seeded in 1972, except Russian wild ryegrass, the average dandelion canopy diameter was 60% or more greater between rows spaced 80–100 cm apart than between rows spaced 20 cm apart. In contrast, in Russian wild ryegrass seeded in 1973, the 3-yr average canopy diameter of dandelion plants growing between rows spaced 80–100 cm apart was less than 25% greater than the 3-yr average canopy diameter of those growing between rows spaced 20 cm apart. The effect of the grasses seeded in 1973 on dandelion canopy diameter was similar to the effect of those seeded in 1972.

Grass species within each of the selected row spacings, seeding years and sampling years did not significantly affect the density of the dandelion. However, dandelion density was affected by row spacing (Fig. 1). The average density of dandelion plants growing in all 1972 seeded grass species was 59, 29 and 24% less at the 20-cm row spacing than at the 100-cm row spacing when sampled in 1973, 1974 and 1975, respectively. Similar increases in density were observed in 1975 and 1976 among dandelion plants growing in grasses seeded in 1973. Dandelion counts in grasses seeded in 1973 were not made in 1974 because very few plants were present.

The pattern of dandelion establishment into grasses seeded in 1972 varied from the pattern of dandelion establishment into grasses seeded in 1973 (Fig. 1). In the 1972 seeding, the major invasion of dandelion plants occurred during the first year and was followed by small increases in 1974 and 1975. In the 1973 seeding, the virtual lack of any dandelion invasion in 1974 was followed by major increases in the weed's

Table 1. Effect of grass species and row spacing on the canopy diameter (cm) of dandelion. Dandelion canopy values from grasses seeded in 1972 are the average from samplings made in 1973, 1974 and 1975 while those from grasses seeded in 1973 are the average from samplings made in 1975 and 1976†

| | Spacing between rows of grasses (cm) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| | | | | | *Grasses seeded in 1972* | | | | |
| Intermediate wheatgrass | 8.5 *ab* | 9.5 *a* | 11.5 *a* | 12.5 *a* | 17.5 *a* | 16.4 *a* | 18.1 *ab* | 20.8 *ab* | 21.1 *a* |
| Bromegrass (northern biotype) | 7.0 *a* | 9.1 *a* | 12.5 *ab* | 14.7 *a* | 18.1 *a* | 18.3 *ab* | 17.2 *a* | 19.4 *a* | 22.7 *a* |
| Bromegrass (southern biotype) | 6.2 *a* | 6.8 *a* | 11.2 *a* | 12.9 *a* | 14.5 *a* | 19.7 *ab* | 21.7 *abc* | 20.7 *ab* | 21.6 *a* |
| Meadow fescue | 7.4 *a* | 10.8 *ab* | 14.8 *ab* | 13.2 *a* | 19.4 *b* | 20.0 *ab* | 20.3 *ab* | 25.0 *b* | 20.8 *a* |
| Russian wild ryegrass | 19.4 *c* | 20.0 *c* | 21.6 *c* | 22.4 *b* | 24.7 *b* | 19.6 *ab* | 23.0 *bc* | 23.1 *ab* | 25.3 *a* |
| Creeping red fescue | 12.1 *b* | 15.3 *b* | 17.1 *b* | 14.6 *a* | 24.3 *b* | 23.2 *b* | 28.8 *d* | 26.0 *b* | 24.1 *a* |
| Timothy | 4.7 *a* | 11.6 *ab* | 16.4 *b* | 15.3 *a* | 25.7 *b* | 19.8 *ab* | 26.2 *cd* | 21.0 *ab* | 23.2 *a* |
| | | | | | *Grasses seeded in 1973* | | | | |
| Intermediate wheatgrass | 5.3 *a* | 6.2 *a* | 6.0 *ab* | 6.7 *a* | 9.9 *a* | 10.0 *a* | 12.1 *a* | 11.4 *a* | 13.5 *a* |
| Bromegrass (northern biotype) | 6.7 *a* | 9.6 *a* | 7.4 *ab* | 10.3 *ab* | 9.2 *a* | 12.6 *a* | 15.8 *a* | 16.7 *ab* | 20.6 *b* |
| Bromegrass (southern biotype) | 7.5 *a* | 8.2 *a* | 8.5 *ab* | 8.9 *ab* | 15.2 *ab* | 12.5 *a* | 16.5 *a* | 17.6 *ab* | 20.8 *b* |
| Meadow fescue | 7.4 *a* | 11.9 *ab* | 8.9 *ab* | 14.3 *b* | 19.0 *b* | 13.6 *a* | 16.7 *a* | 16.8 *ab* | 20.7 *b* |
| Russian wild ryegrass | 17.3 *b* | 16.8 *b* | 12.5 *b* | 14.3 *b* | 11.3 *a* | 15.7 *a* | 17.3 *a* | 19.2 *b* | 19.2 *ab* |
| Creeping red fescue | 5.4 *a* | 7.6 *a* | 5.4 *a* | 10.2 *ab* | 12.8 *ab* | 17.4 *a* | | 20.8 *b* | 17.9 *ab* |
| Timothy | 4.6 *a* | 5.6 *a* | 5.3 *a* | 7.9 *a* | 9.9 *a* | 13.6 *a* | 15.7 *a* | 20.2 *b* | 14.6 *ab* |

†Values within each column and time of seeding followed by the same letter are not significantly different at $P = 0.05$.

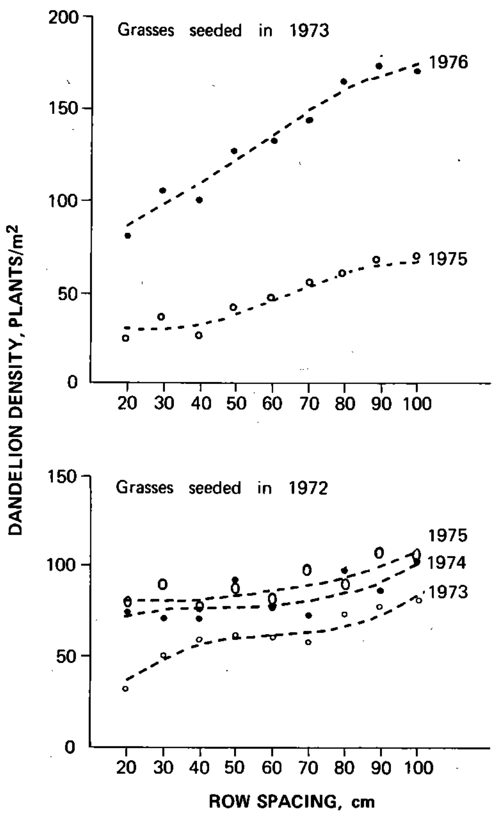


Fig. 1. Average density of dandelion growing in seven grass species. Dandelion plants growing in grasses seeded in 1972 were sampled in 1973, 1974 and 1975 while dandelion plants growing in grasses seeded in 1973 were sampled in 1975 and 1976.

density in both 1975 and 1976. Consequently, the final density of dandelion growing in grasses seeded in 1973 was greater than that in grasses seeded in 1972.

The density of dandelion (Fig. 1) was higher than observed in commercial grass fields (Darwent 1977). A large portion of this variation can be attributed to differences in techniques employed in the two studies to measure dandelion density.

Mølgaard (1977) observed that increased grass ground cover, partly by its direct effect and partly by its shading effect, reduced the rate of dandelion establishment and growth. Thus, in our study the growth of dandelion in vigorously growing grasses, such as intermediate wheatgrass, crested wheatgrass, the two biotypes of bromegrass, meadow fescue, creeping red fescue and timothy, was reduced, presumably because grass ground cover increased, i.e. as the spacing between rows of grass declined. Because Russian wild ryegrass established and developed slowly it was unable to provide adequate competition against dandelion, regardless of the row spacing at which it was seeded.

The effect of intermediate wheatgrass on dandelion establishment and growth (Fig. 1) was similar to the effect observed by Kilcher (1961) for that grass species on weed growth at Swift Current, Saskatchewan. However, in Kilcher's (1961) study Russian wild ryegrass virtually prevented any weeds from establishing while in our study it had little effect on dandelion establishment and growth. This difference in competitive ability can probably be attributed to the better performance of the Russian wild ryegrass in Kilcher's (1961) study than in our study.

Several features relating to the control of dandelion have been revealed in this study. Intermediate wheatgrass, the two types of bromegrass, southern bromegrass, meadow fescue, creeping red fescue and timothy when seeded in narrow row spacings (30 cm or less) were able to compete vigorously with dandelion and presumably minimize its detrimental effects. In these grasses, row spacing can be considered as an important method of dandelion control. Russian wild ryegrass, on the other hand, had only a minor effect on the dandelion, regardless of row spacing. For this grass, as well as for the other grasses seeded in row spacings greater than 30 cm, tillage, herbicides and other methods of control must be considered. Further, since this study has shown that dandelion is capable of invasion throughout the life of any of the grass stands, repeated control measures are essential to keep the weed population at a low level.

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