Perennial Ryegrass Seed Production

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Abstract

Perennial ryegrass seed production has increased dramatically in the past five years in Manitoba from less than 10,000 acres in 2003 to approximately 55,000 acres in 2007. Projections are for a continued potential for increase in acres as the traditional growing area is experiencing pressures from higher value crops. This species is used primarily as a forage and turfgrass in the temperate areas of the world, is an excellent feed and pasture grass and has exceptional wear-stress tolerance and seedling vigour compared to other turfgrass species used. This crop is grown in Manitoba as an under-seeded crop with spring wheat, where the perennial ryegrass then over-winters as a small plant with the wheat stubble acting as a snow trap. It may also be fall seeded. Perennial ryegrass is generally taken out after the first harvest. Recommended fertility is 75 kg N/ha in the fall after the wheat harvest. Plants over-winters best as relatively small plants (crowns located just at or below soil surface), as larger plants are more susceptible to winter injury. Seed yields range from 500-1200 kg/ha. Fertility can be problematic with N levels appearing low in spring (lime-green foliage), necessitating additional N application of up to 40 kg N/ha to ensure proper inflorescence emergence and development. This crop is swathed at approximately 40-45% moisture (as shattering begins) and ideally is combined at 12% moisture. Research on fertility to maximize seed productivity and post-production crop removal are warranted at this time.

Perennial ryegrass (*Lolium perenne* L.) is predominantly used in the temperate regions of the world as a forage grass and a turfgrass. This species provides excellent feed and it may be used for pasture or hay. Perennial ryegrass is also utilized as a turfgrass species and provides excellent wear tolerance and is a relatively fast establisher when compared to the other turfgrass species used in Canada. This species also allows for a wide range of mowing heights with rages for m ¼ inch to 3 inches. Therefore it may be used for areas such as golf course tees to re-vegetate the areas as damage is ongoing throughout the growing season. One of the primary problems with this species and its use in Western Canada is its winterhardiness. This species is subject to winter damage and it can be damaged most winters. The plant tends to survive better as a small plant where the crown is located below or just at the ground surface. As the plant matures the crown is raised up and this appears to lead to a reduction in its winter survival.

Flowering culms (those supporting inflorescences) are 30-100 cm in height (cultivar dependent). There are 3-14 florets per spikelet. The inflorescence type is a spike. Seeds range in size from 5-8 mm in length and 1-1.5 mm in width and there are 415,000-530,000 seeds per pound. (Warringa 1997, Alberta Agriculture 2004).

In 2006 Oregon Seed Certification Service (**OSCS**) recognized 647 perennial ryegrass cultivars and at least 271 were grown for seed in 2006 (were inspected for seed certification). A total of 349 perennial ryegrass cultivars have fluorescence levels listed by the US National Grass Variety Review Board. Fluorescence is used to distinguish between perennial ryegrass (minimal fluorescence of seedlings) and annual ryegrass (*Lolium multiflorum*, seedlings readily fluoresce) allowing for a test of variety and seedlot purity.

The primary area for perennial ryegrass seed production is the Willamette Valley of Oregon. Production appears to be being pushed out due to a number of factors. These factors include land prices ($15,000 an acre), the crop has become a commodity, the price is set by the Perennial Ryegrass Bargaining Agreement (PRBA) and more lucrative crops are becoming available due to changes in other growing area (e.g. California). In 2007, the price to growers as set by the PRBA was $0.65 initially and $0.67 this fall. The base price in 2008 will be at least $0.70 a pound.

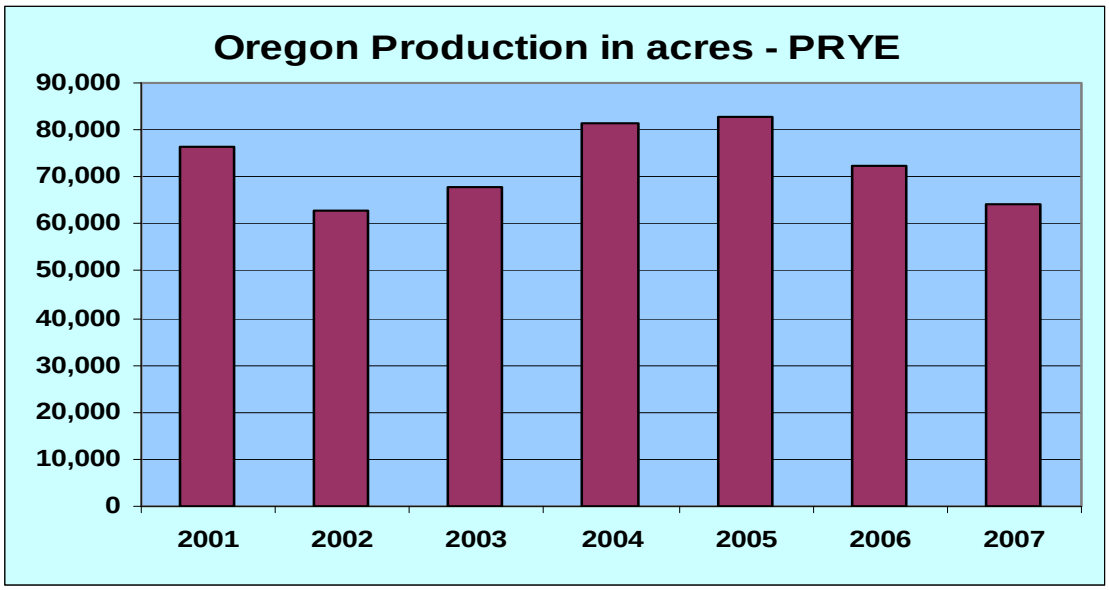

Figure 1. OSCS perennial ryegrass acres inspected in Oregon. (multiply acres by 2 to get estimated total perennial ryegrass acres in Oregon).
Data from Oregon Seed Certification Service Website (see address in references).

There were approximately 130,000 acres of perennial ryegrass produced n Oregon in 2007 (Figure 1). The acreage generally follows a cyclical pattern generally peaking in the year of or after the establishment of the National Turfgrass Evaluation Program trial (2004 was the latest NTEP perennial ryegrass trial initiated). These trials have generally been on a 4-5 year cycle but should be going to a 6 year cycle in the future. These trials have in large part contributed to the proliferation of turfgrass cultivars.

The acreage of perennial ryegrass grown for seed production in Manitoba has shown a large increase since 2003 with production acreage of approximately 55,000 in 2006 and 2007 (Figure 2). Figure 3 shows the increase in production in Manitoba for both perennial and annual ryegrass in Manitoba. The 2005 harvest was impacted by adverse weather conditions in 2005. The perennial ryegrass production in 2006 in Manitoba was approximately 41 million pounds.

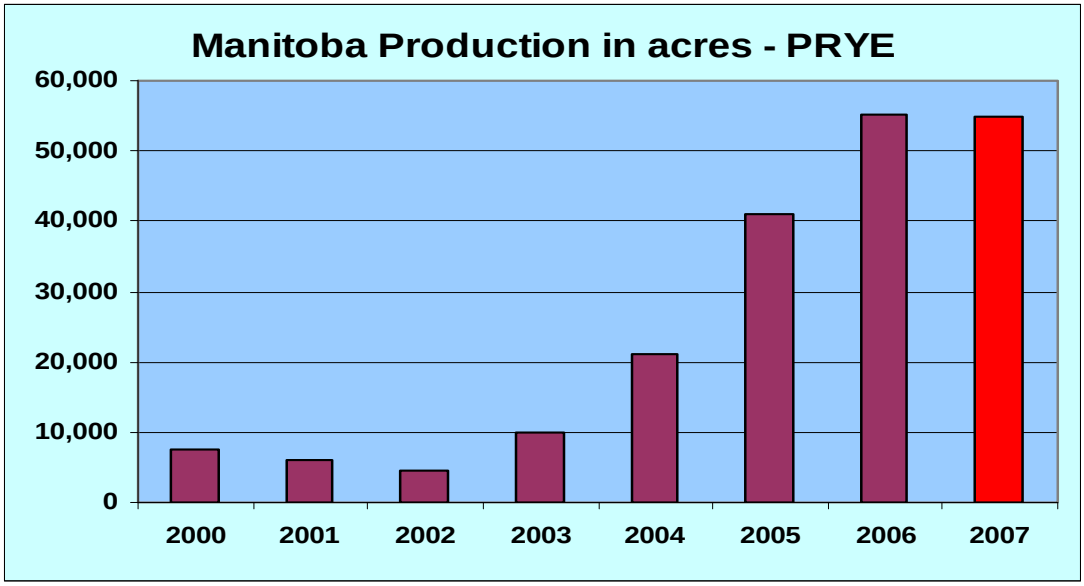

Figure 2. Recent perennial ryegrass acreages in Manitoba.

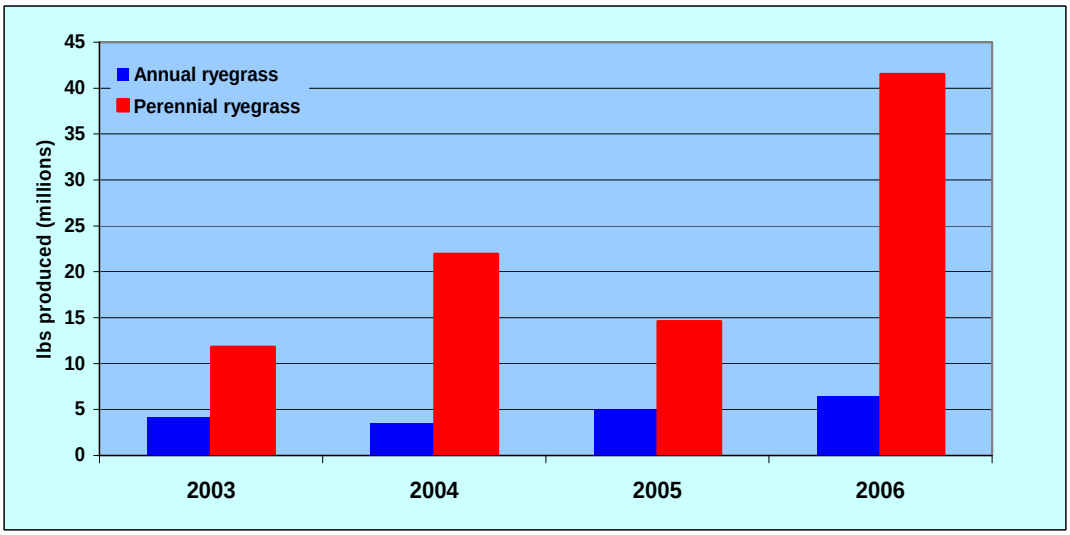

Figure 3. Production in Manitoba in pounds for perennial and annual ryegrass (2003-2006).

Cultural Recommendations

The basic recommendations for the establishment and production of perennial ryegrass have been set out in a publication by Alberta Agriculture and Food and I will highlight the basic recommendations and add where I feel we need to change to improve on production (http://www1.agric.gov.ab.ca/$departmetn/deptdocs.nsf/all/agdex8345).

Seeding Rate:	8-10 kg/ha
Row Spacing:	15-30 cm at an angle to crop
Establishment:	under seeded to spring wheat
Fertility:	75 kg N/ha in fall after wheat harvest (probably low)

A small plant is ideal heading into the winter (4-8 tillers). This allows for good winter survival and helps maximize yield. The field is generally taken out after a single harvest as older plants are less winter tolerant and volunteers can be problematic. The post harvest regrowth can be grazed. A six inch stubble height is needed for good trapping of snow to help insulate the crown of the plant throughout the winter.

Flowering of the Plant

The inflorescence of perennial ryegrass sheds pollen over approximately a two week period. Anthesis begins at the central spikelets and proceeds towards the base and apex simultaneously (Warringa 1997). Within a spikelet, anthesis begins at the lowermost florets and proceeds towards the tip (Figure 4). The total length of flowering for an individual cultivar will depend on the make-up of the cultivar and will be impacted somewhat by the environmental conditions at the time of flowering (heat and drought tending to reduce the overall period of anthesis). Seed maturation will follow the same pattern as anthesis and terminal florets tend to be the least fertile. These florets are also most likely to fall off (shatter). Therefore the use of shattering as the signal as when to swath can be misleading. Therefore, % moisture of the seed is the best gauge of the time to swath. The range listed in the Alberta Agriculture publication is a little high (40-45%), with a lower % being better, approximately 35% moisture (Klein and Harmond 1971, Elgersma 1990, and standard Oregon practice).

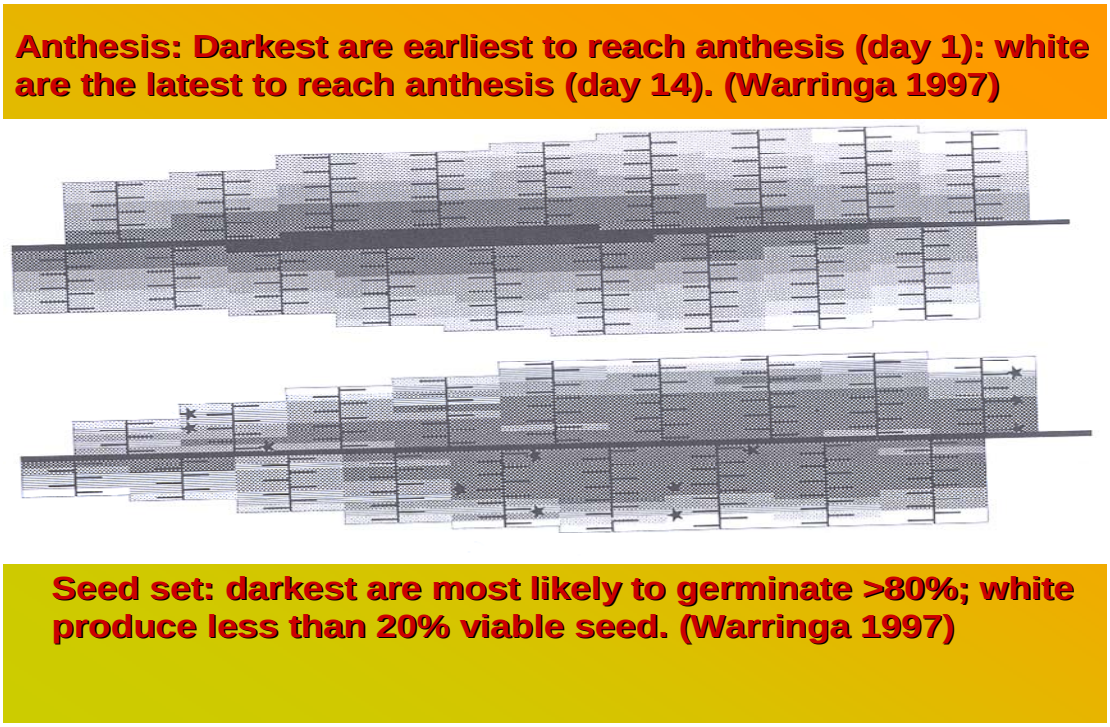

Figure 4. Flowering of a perennial ryegrass inflorescence and relative fertility of florets (Warringa 1997).

Seed maturation as mentioned above follows a pattern similar to the shedding of pollen and Figure 4 shows the relative fertility of the florets. Note that the terminal florets on most spikelets are missing and that of those that are remaining the terminal florets are less likely to contain a

viable seed (Warringa 1997). Seed size within a cultivar will vary with smaller seeds being found nearer the tip of the spikelet (later to flower and therefore less time to mature). Additionally, Elgersma (1990) noted that up to 50% of viable seed produced may be left in the field, leading to a potential volunteer problem.

Combining should take place when the seed is at 12% or less moisture, or dried to this level. This is required for seed storage, with the potential for survival of the seed decreasing with increasing seed moisture and storage temperature (Table 1, UK Ministry of Agriculture, Fisheries and Food 1979). Improper storage conditions will impact seed viability regardless of % seed moisture (red font) while low moisture and good storage is required for seed to last greater than 2 years in storage (black font).

Table 1. Storage of perennial ryegrass seed as related to seed moisture and storage temperature.

Estimated maximum storage (weeks) of PRG with regard to germination (UK Ministry of Agriculture, Fisheries and Food 1979)								
	Moisture Content (Wet Basis %)							
Storage Temperature	10.5	11	12	13	14	15	17	20
25°C	40	30	20	13	7	4	2.5	1
20°C	80	55	38	26	15.5	8	4.5	2
15°C	160	110	70	45	26	15	7.5	3.5
10°C	350	230	150	95	55	30	16	6
5°C	700	480	300	200	60	30	12	3

Seed Yields

Yields reported in Manitoba have been in the 500 to 1100 lbs/acre range. Lower yields have been attained due to a number of factors including poor establishment and climatic conditions, as is seen in all crops. Some research in Manitoba (Heard and Heisinger 2000) has shown yield potential of 1400 lbs/ac. These were achieved with fertilizer applications of 150 lbs/ac. Not noted was the cultivar on which this yield was achieved as cultivar will greatly impact yield potential. As mentioned earlier, there are over 600 cultivars recognized by OSCS and there is a great deal of variation in yield potential. More recent releases, many bred for new disease tolerances are being bred outside of the seed production area as the end use area (where the diseases of concern or prevalent) are serving as the selection sites. The next generation of cultivars with the disease tolerances should have better yield potentials. For example, some newer cultivars are yielding in the 700-1000 lbs/ac range in Oregon where yields of greater than 2,000 lbs/ac can be achieved. Rust diseases appear to be most prevalent constraint on yield in some of the newer cultivars.

Nitrogen fertility, according both to the research (Heard and Heisinger 2000) and field production advisors (personal communication) can be lacking in Manitoba fields, possibly due to inadequate fertilization or nutrient loss. Therefore a spring application of an additional 45 lbs/ac

has generally been recommended. Lighter green colour (lime-green) of the crop in spring can be an indicator of inadequate N fertility levels and are considered an indication of the need to fertilize.

Research Needs

Fertility research under Manitoba conditions is required to establish guidelines for recommendations. Additionally timing of applications may be important for the realization so the yield potential. Cultivar identification is necessary to get a good fell for yield potential under our conditions. Another area of research required is volunteer management and re-cropping to reduce the potential of interference with succeeding crops.

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