Meeting Potassium Needs for Pacific Northwest Grass Seed Production

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Perennial grass seed production is a major industry in parts of Oregon and Washington. When grass seed is harvested, considerable amounts of straw remain in the field. Management of the grass straw following seed harvest is an important consideration in maintenance of the stand and for achieving high seed yields. For many years, burning was the most common practice of straw management and removal. The practice of field burning eliminates straw residues and helps rid fields of weeds, insects, and diseases (**Figure 1**).

In the past decade, regulations in Oregon and Washington state have severely restricted burning of grass fields. This action has occurred in response to health concerns and to address potential air quality problems related to burning. The change in crop residue management practices has prompted a re-evaluation of the nutrient requirements for seed production.

Most grass straw is now baled and removed from production fields. Since 1997, export tonnage of grass straw from Oregon increased 78%, to 588,862 t/year. Interestingly, each of the major Asian export markets prefers a specific type of grass. Japan utilizes most of the perennial ryegrass straw, Korea imports most of the tall fescue, and Taiwan focuses on bentgrass straw. In addition, some grass seed straw is used locally for animal feed. Growers not only save time and effort dealing with straw removal, they also

With recent restrictions on straw burning, removal of straw in grass seed production has greatly increased nutrient removal from the field. Grass has a fairly constant potassium (K) demand throughout the growing season and soil K should be maintained above 100 parts per million (ppm).

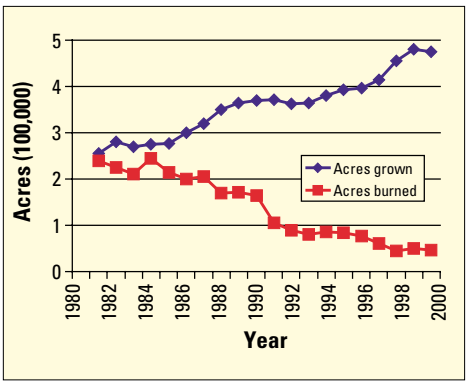

Figure 1. Grass seed production acreage and field burning acreage in the Willamette Valley, Oregon.

Grass seed crops are swathed and dried in the field for later threshing with combines. Baling and removing straw increases nutrient removal.

TABLE 1. Estimated average nutrient content for perennial ryegrass seed production. The amount of straw assumed is 3 t/A and a 1 t/A seed yield.

Perennial ryegrass	Nutrient, lb/A N	P_2O_5	K_2O
Straw	60	16	72
Seed	40	16	14
Total	100	32	86

TABLE 2. Potassium concentrations and removal amounts in perennial ryegrass straw in three farmer fields.

Aboveground biomass, lb/A	Tissue K, %	K in straw, lb K_2O/A
6,300	1.5	117
7,000	1.7	143
8,000	1.7	163

receive a small payment for the straw that is sold.

Relatively few nutrients are removed while harvesting only grass seed. Burning the straw recycles most of the K and several other nutrients used by a crop. However, the transition from burning to baling and straw removal has prompted a re-examination of nutrient needs of grass.

Measurements were made over a 3-year period for two fields each of perennial ryegrass and tall fescue in Linn County, Oregon. During each year, 32 plots were harvested from the fields. The average straw yield for tall fescue was 4.0 t/A and the average seed yield was 1,400 lb/A. Perennial ryegrass seed yield averaged 1,600 lb/A and straw yield averaged 2.75 t/A.

Nutrient removal rates in the harvested seed were relatively low. On average, the seed of these grasses contains approximately 2% nitrogen (N), 0.35% phosphorus (P), and 0.6% K. A ton of seed contains approximately 40 lb N, 16 lb P_2O_5, and 14 lb K_2O. However, when straw and seed were both removed from the field, nutrient removal increased substantially (**Table 1**).

Table 2 shows K concentrations and removal amounts in perennial ryegrass straw in three farmer fields.

Unlike seed, where the K concentrations are relatively constant, the K concentration in perennial ryegrass straw increases as soil test K increases (**Figure 2**).

The relationship between soil test K (extracted with 1 M ammonium acetate) and tissue K concentration provides support for the use of 100 to 125 ppm K as the soil test range below which K fertilizer application is recommended (**Figure 2**). The data suggest a straw tissue concentration of approximately 1.25% when the K soil test is greater than 125 ppm, which is sufficient for maintenance of maximum yields.

To avoid depletion of soil K by perennial ryegrass, in fields where the soil test K falls between 100 and 150 ppm, K fertilizer

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As the combine harvests orchardgrass seed in the Willamette Valley, the full straw load is left in the field.

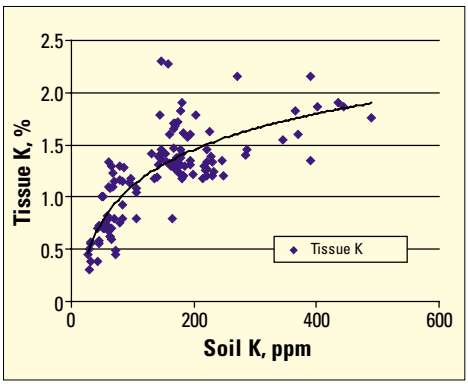

Figure 2. Influence of soil test K on K tissue concentration of perennial ryegrass straw at harvest (fitted with a log function).

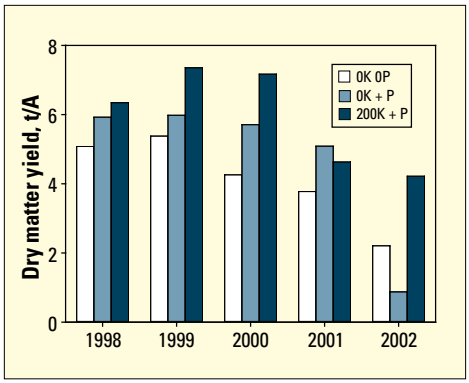

Figure 5. Yield as influenced by P and K fertilization of selected treatments. See **Figure 4** heading for definition of the treatments.

In the first 4 years of the study, the 0K plus P plots had yields comparable with the 200K plus P plots; both of these treatment groups consistently out-yielded the plots receiving no fertilizer (**Figure 5**). Due to the loss of plants in the 0K plus P plots, yields were low at the first and second forage harvests of 2002. These plots were abandoned at the third and fourth harvests because of low plant populations and weed invasion. Yield of the 0K plus P plots in 2002 were actually lower than yield in plots receiving no fertilizer for five years. The plant populations in the 0K 0P plots are still economical and yield determinations will continue into 2003.

Clearly, nutrient imbalance (adding P without K) has more severe consequences for alfalfa survival than we had anticipated. **Regarding alfalfa persistence and total yield over the life of a stand, producers should soil test and apply P and K as recommended to meet yield goals set for their alfalfa stand.** BC

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application rates should be adjusted to replace the amount removed in the straw.

In addition to meeting the total seasonal nutritional requirements, an adequate nutrient supply must be available for uptake to meet periods of peak demand. As a result of intensive plant sampling, both biomass and tissue K accumulation were found to be fairly constant during the growing season (**Figure 3**). This is in contrast with N accumulation, where the majority of the nutrient was taken up in the first half of the growing season. As adequate nutrient supply is essential for top yields, it must be present at both the correct time and in the proper quantity for the plant.

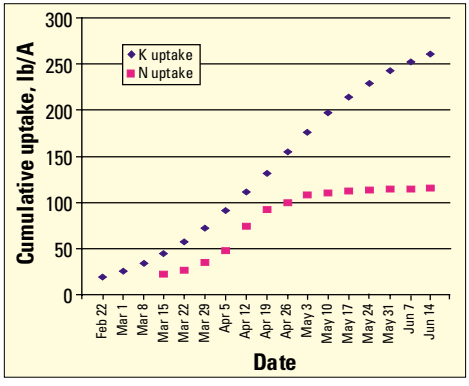

Figure 3. Accumulation of K and N by tall fescue during the growing season.

These results suggest that the removal of K from grass seed fields has greatly increased since the straw is now routinely removed from the field. Potassium removal is as much as five times greater when straw is removed in addition to the seed. Soil test K concentrations should be maintained above 100 ppm in the surface 6 in. and replacement of removed nutrients should be part of an ongoing soil fertility program. BC

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