Nitrogen: Application Timing in Relation to Plant Development and Yield in Kentucky Bluegrass Seed Production

Nitrogen is the only fertilizer element that gives consistent, economic increases in seed yield in grass seed crops. Nitrogen is vital because it stimulates growth and development of tillers and leaves. Seed yield is low when N is low because the crop's ability to capture solar energy and carbon is reduced.

Nitrogen is needed for development of the Kentucky bluegrass seed crop at two distinct times – fall and spring. Application of fall N supports formation of tillers in fall that contribute to seed yield in the following spring (Chastain et al., 1997). Good crop management in fall is critical in that the seed yield potential for the next seed crop is established during this period. With no fall N, fertile tiller numbers (tillers with panicles) are low in spring (Griffith and Murray, 2006).

The second important time that N is needed is in spring. In spring, the crop builds a canopy of leaves and stems needed to capture solar energy and CO_2 and to convert this energy and carbon into harvested seed. Thus, the seed yield potential of the Kentucky bluegrass seed crop is set in fall, and it is realized in spring.

Traditionally, N has been mostly applied in fall in semi-arid parts of the Pacific Northwest where Kentucky bluegrass has been grown. However, current OSU recommendations for Kentucky bluegrass seed crops suggest that N applications may be split between fall and spring (Affeldt et al., 2011). The recommendations also state that application of spring N without fall N will reduce seed yield.

These recommendations are based on the study of Vance Pumphrey, former OSU agronomist working over a five-year period with Kentucky bluegrass in the Grande Ronde Valley (Pumphrey, 1965). Figure 1 compares applications of N made in fall (Sept 20th to Oct 10th), spring (April 1st to April 10th), and split between spring and fall, over four total N rates. With no N application in fall, seed yield was reduced by 30% averaged across the four N rates. Since fall is when seed yield potential is set, it should not be surprising that no N during this critical period would lead to reduced panicle production in spring and seed yield at harvest.

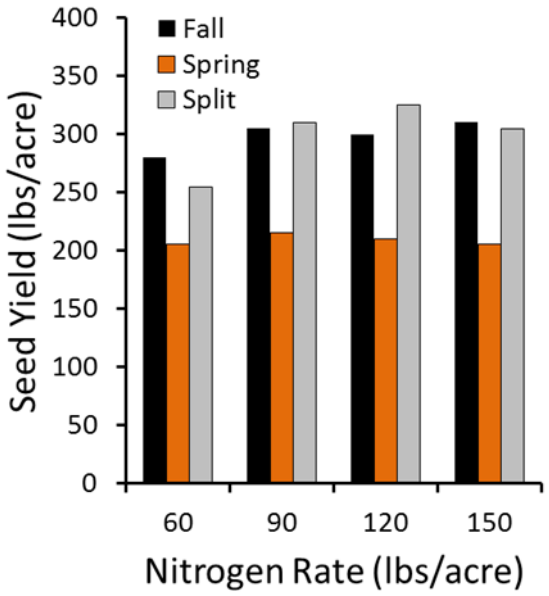

Figure 1. Effect of N application timing and rate on seed yield of Kentucky bluegrass in the Grande Ronde Valley. Adapted from Pumphrey (1965).

On the other hand, split applications – applying half of the N in fall and the other half in spring produced seed yields that were equal to application of the entire amount of N in

fall (Fig. 1). One consideration in interpreting these results is that the source of N in these trials was ammonium nitrate and is less subject to volatilization losses than urea.

Whether N is applied solely in the fall or split between fall and spring, N must be available to the crop for uptake in the two critical periods - to support tillering in fall and dry matter accumulation in spring. Pumphrey (1965) found that for best seed yield in Kentucky bluegrass, fall N applications were made between mid-September and mid-October (Fig. 2).

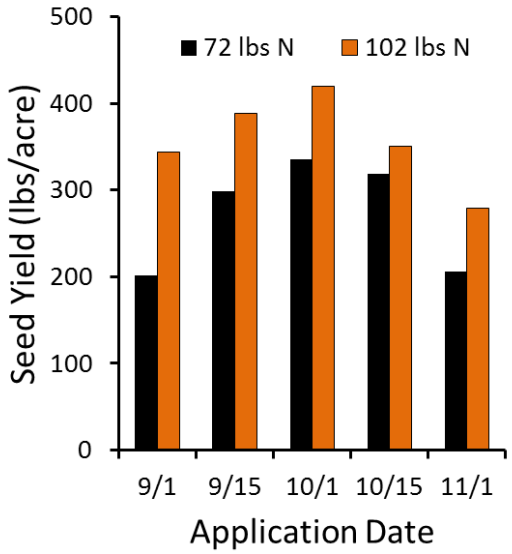

Figure 2. Effect of fall N timing and rate on seed yield of Kentucky bluegrass in the Grande Ronde Valley. Adapted from Pumphrey (1965).

Spring N applications must be made prior to biomass (dry matter) accumulation (Fig. 3). Nitrogen should be resident in the soil and available to the crop no later than the start of crop growth (stem elongation). This is essential because N fuels crop growth in spring and expansion of the crop canopy needed for seed yield. N uptake precedes dry matter accumulation in the plant and is completed prior to the end of biomass accumulation and panicle emergence. If N is only applied in fall, then an adequate amount (no less than half) must remain over winter in the soil to support development of the crop in spring.

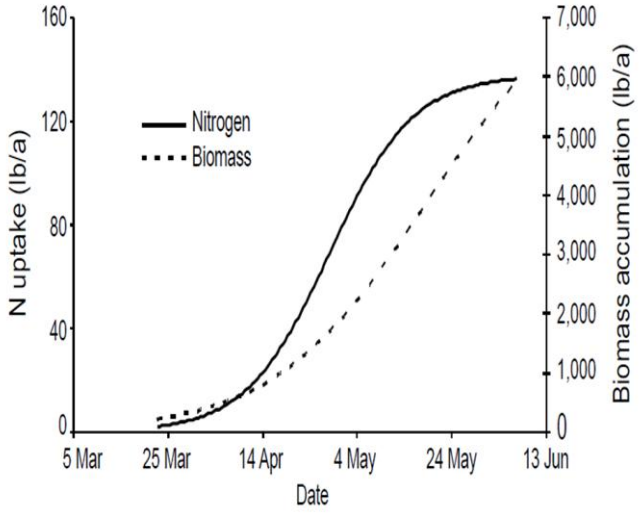

Figure 3. N uptake and biomass accumulation in Kentucky bluegrass at Hermiston. From Affeldt et al. (2011).

References

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