UTILIZATION OF REGROWTH FOR FORAGE IN SEED STANDS OF MEADOW FESCUE (FESTUCA PRATENSIS HUDS.)

Lars T. Havstad
The Norwegian Crop Research Institute, Division Landvik, 4890 Grimstad, Norway

ABSTRACT
Intensive utilization of autumn regrowth for forage production was compared to other autumn treatments in nine seed production fields of meadow fescue (*Festuca pratensis*) during 1993-96. Uncut plots without a N application in autumn always had the lowest number of reproductive tillers and the lowest subsequent year seed yields. Intensive utilization of regrowth, by application of 80 kg N ha-1 immediately after seed harvest and forage harvests in September or October, did not have any negative impact on the following yearsí seed yields. Delaying forage harvest from 10 September to 10 October increased forage yields, but lowered the forage quality.

KEYWORDS
Autumn treatment, defoliation, *Festuca pratensis*, forage quality, meadow fescue, nitrogen, reproductive tillers, seed yield

INTRODUCTION
If moisture conditions and temperatures are favourable during autumn, application of nitrogen immediately after seed harvest may result in high yields of regrowth in meadow fescue (*Festuca pratensis*) seed production fields. Utilization of the regrowth for forage, either for on farm use or for sale, may be of essential economic value for the seed grower.
The objective of this research was to examine the effect of intensive utilization of autumn regrowth on subsequent year seed yield of *Festuca pratensis*, at different locations in south-Norway.

MATERIALS AND METHODS
During 1993-95 nine experiments were established at locations ranging from Landvik (58°N) on the Norwegian south coast, to Gaupen (61°N), in the inland north of Oslo. The experiments were laid out in early August, soon after the first (eight fields with cv. Salten) or second seed harvest (one field with cv. Fure). The experimental treatments were as follows :

1. No cutting. No N-application.
2. No cutting. 40 kg N ha^{-1} as $Ca(NO_3)_2$ on 10 September.
3. Regrowth cut to 5 cm on 10 September. 40 kg N ha^{-1} as $Ca(NO_3)_2$ on 10 September.
4. 80 kg N ha^{-1} as N-P-K 18-3-15 after seed harvest. Regrowth cut to 5 cm on 10 September.
5. Similar to treatment 4, but with an additional application of 40 kg N ha^{-1} as $Ca(NO_3)_2$ after cutting on 10 September.
6. 80 kg N ha^{-1} as N-P-K 18-3-15 after seed harvest. Regrowth cut to 5 cm on 10 October.
7. Similar to treatment 6, but with an additional application of 40 kg N ha^{-1} as $Ca(NO_3)_2$ after cutting on 10 October.

With the exception of autumn cutting and fertilization, seed crops were managed in accordance with typical Norwegian management practices, including application of 80 kg N ha^{-1} in early spring. The experiments were usually harvested in late July/early August by direct combining at 20-30% seed moisture content.

Recordings in autumn included dry matter yield and forage quality (for treatments 3, 4/5 and 6/7). In the following year, the number of reproductive tillers per m^2 were determined in addition to seed yield.

RESULTS
Dry matter yield. On 10 September dry matter yields were approximately 35% higher on plots which had received 80 kg N ha^{-1} after seed harvest than on plots with no N application. (Table 1).

Delaying forage harvest from 10 September to 10 October further increased dry matter yield by an average of 16%. Dry matter production during this month was highest at the southernmost locations, which experienced the highest temperatures in late autumn (data not shown).

Forage quality. Forage quality from the 10 September date was improved by N-application after seed harvest. When forage harvest was delayed from 10 September to 10 October, fodder units per kg of dry matter and the protein concentration were significantly reduced (Table 1).

Seed yield. Subsequent year seed yield was lowest on untreated plots (treatment 1). Plots which had received 40 kg N ha^{-1} in September (treatment 2) and plots which had been both cut and N-fertilized in September (treatment 3) produced ca 40 and 90 kg ha^{-1} higher seed yields than untreated plots, respectively (Table 2).

Application of nitrogen (80 kg ha^{-1}) immediately after seed harvest, in combination with forage harvest in September (treatment 4) or October (treatment 6), did not have any negative impact on seed yield compared with treatment 3. While supplementary N-application after harvesting regrowth in September (treatment 5) tended to reduce seed yield, the opposite tendency was observed after forage harvest in October (treatments 7 vs. 6).

Reproductive tillers. Cutting and N-application in September (treatments 2-3) increased the number of reproductive tillers per m^2 compared to treatment 1 (table 2). A further increase was observed on most plots which had received 80 kg N ha^{-1} after seed harvest (treatments 4-7).

DISCUSSION
The desired effect of N-application to grass seed crops in autumn is to stimulate growth of the primary induced tillers in the late autumn and spring (Nordestgaard and Andersen, 1991), (Heide, 1994). This stimulation was clearly achieved in the present experiment with *Festuca pratensis*, in which N-application had positive effects on both the panicle production and seed yield (Table 1). Similar results were reported by Nordestgaard (1974), who also found that the effect of N-application in autumn depended on the amount of N applied in the spring.

These experiments also revealed that autumn cutting, in addition to N-application, is required for optimal panicle and seed production in *Festuca pratensis* (Table 2). Similar effects of cutting were observed by Meijer & Vreeke (1988) in *Poa pratensis* and *Festuca rubra*. The authors stated that the positive effect of autumn cutting was mediated by better light penetration to tiller bases and increased survival of reproductive tillers in spring.

Intensive regrowth utilization in autumn (treatments 4 and 6) did not reduce seed yield the following year (Table 2), compared to cutting and N-application in September (treatment 3). These results are in agreement with an earlier Danish investigation concerning regrowth utilization (Nordestgaard, 1981). Additional N after forage

harvest (treatments 5 and 7) had little influence on seed yield compared to plots which where unfertilized after cutting (treatments 4 and 6). The reason for this might be that the quantity of nitrogen which was removed from the field when regrowth was cut in the autumn normally did not exceed the amount of nitrogen (80 kg ha^{-1}) which had been applied after seed harvest (data not shown). Nordestgaard (1981) reported that N-application after regrowth cutting normally had less effect on seed yield when the amount of nitrogen applied immediately after seed harvest was high.

In the present experiment delaying forage harvest from September to October increased dry matter yields but lowered the forage quality, especially the percentage of protein in dry matter (Table 1). Since the date of cutting apparently influenced forage production more than seed yield, we recommend that the forage harvest be taken not too late in autumn, and preferably before the quality of the forage declines.

REFERENCES

Heide, O. M. 1994. Control of flowering and reproduction in temperate grasses. New Phytologist **128**: 347-362.

Meijer, W.J.M. and S. Vreeke. 1988. The influence of autumn cutting treatments on canopy structure and seed production of first-year crops of *Poa pratensis* L. and *Festuca rubra* L. Netherlands Journal of Agricultural Science **36**: 315-325.

Nordestgaard, A. 1974. Experiments with autumn and spring application of increasing amounts of nitrogeneous fertilizer to meadow fescue (*Festuca pratensis*) for seed growing. Tidsskrift for planteavl **78**: 395-407. (In Danish, with English abstract).

Nordestgaard, A. 1981. Burning of straw and utilization of vegetative regrowth after first and second year seed crops of red fescue (*Festuca rubra*), cooksfoot (*Dactylis glomerata*) and meadow fescue (*Festuca pratensis*). Tidsskrift for Planteavl **85**: 97-113. (In Danish, with English abstract).

Nordestgaard, A. and S. Andersen. 1991. Stability of high production efficiency in perennial herbage seed crops. Supplement to Journal of Applied Seed Production **9**: 27-32.

Table 1

Effects of N-application after seed harvest (0 or 80 kg ha^{-1}) and cutting date (10 September or 10 October) on dry matter yield (kg ha^{-1}), % protein of dry matter and fodder units per kg dry matter.

	No N. Cut on 10 Sept. (treatment 3)	80 Kg N ha-1 after seed harvest Cut on 10 Sept. (treatment 4/5)	80 Kg N ha-1 after seed harvest. Cut on 10 Oct. (treatment 6/7)	$LSD_{0.05}$
Dry matter yield (kg ha^{-1-1})	1681	2253	2614	353
% protein of dry matter	12.2	17.2	14.5	1.4
Fodder units per kg dry matter	0.73	0.79	0.77	0.03

Table 2

Effects of different autumn treatments (N-application and cutting) on seed yield (kg ha^{-1}) and the number of reproductive tillers per m^2 in the following year of meadow fescue in Norway.

Treatment	N-application	Forage harvest	Seed yield (kg ha^{-1})	Number of reprod. tillers per m^2
1	No	No	562	712
2	40 kg N ha^{-1} on 10 Sept.	No	604	824
3	40 kg N ha^{-1} on 10 Sept.	10 Sept.	652	899
4	80 kg N ha^{-1} after seed harvest	10 Sept.	646	1037
5	Similar to treatm. 4, + 40 kg N ha^{-1} on 10 Sept.	10 Sept.	611	1049
6	80 kg N ha^{-1} after seed harvest	10 Oct.	641	1048
7	Similar to treatm. 6, + 40 kg N ha^{-1} on 10 Oct.	10 Oct.	671	954
$LSD_{0.05}$			50	151