

Arable Extra



Issue 144

Vulpia hairgrass: emergence, flowering and practical management (Canterbury)

Background

Vulpia hairgrass (commonly *Vulpia myuros* and *V. bromoides*) is a problematic annual grass weed in Canterbury arable and herbage seed systems. Vulpia hairgrass behaves as a winter annual under Canterbury conditions.

It is particularly prevalent on lighter soils and in reduced-tillage rotations, where it can establish rapidly and contaminate harvested grain or seed. Growers frequently report high seed head numbers at flowering despite low plant counts during winter, raising questions about whether late-emerging plants can still contribute to seed return.

Some grass weeds show a requirement for exposure to winter cold (vernalisation) before they can produce seed. The amount of winter chilling required varies between species, but, in general, early establishment carries the greatest risk of seed return.

Understanding whether Vulpia plants emerging in spring can complete their life cycle is critical for interpreting crop monitoring data and targeting control strategies. This study investigated how emergence timing influences development, flowering, and seed production in Vulpia hairgrass under Canterbury field conditions.

Trial overview

A field experiment was conducted at Kowhai Farm near Lincoln, Canterbury, New Zealand, on a Templeton silt loam soil following wheat. Treatments comprised six sowing dates spanning late March to late November 2024 (Table 1), selected to expose Vulpia hairgrass to contrasting temperature and photoperiod conditions at emergence. Plots (7.0 m × 1.65 m) were arranged in a randomized complete block design with four replicates per sowing date. Seed was hand-sown at 7 kg/ha and raked to an approximate depth of 1 cm. Irrigation was applied as required to ensure adequate soil moisture for germination and early growth.

Post-emergence broadleaf weeds were controlled using Trimec® (600g/L Mecoprop, 150g/L MCPA and 18.7g/L Dicamba, Group 4), and grass weeds with Gallant™ Ultra (520 g/L haloxyfop-P, Group 1). Rust diseases were suppressed using prothioconazole and pyraclostrobin applied at early stem extension and flag leaf appearance. Nitrogen was applied as ammonium sulphate (40 kg N/ha) in early September, followed by two applications of SustainN totalling 75 kg N/ha in late October and mid November. Argentine stem weevil was controlled with chlorpyrifos as required.

Seedling emergence was assessed every 3–7 days until counts stabilised. When plants reached the 2–5 leaf stage, 10 main stems per plot were tagged and monitored weekly for leaf appearance. Destructive sampling was undertaken on three replicates per treatment at approximately one leaf intervals, with five plants collected per sampling. Leaf development was quantified using modified Haun stage, and reproductive development assessed by dissecting tillers to record primordia and floral structures. Phenological stages, including stem extension, final leaf appearance, and seed head emergence, were recorded using the BBCH scale. Floral initiation was defined as the change in the rate of primordium production on the stem apex.

Key points

- A FAR trial investigated how Vulpia hairgrass emergence timing influences development, flowering, and seed production in Canterbury field conditions.
- Plants emerging from autumn to early winter flowered and returned seed.
- Plants emerging from October onwards remained vegetative and produced no seed.
- Emergence was driven by soil moisture followed by temperature.
- Vulpia hairgrass plants emerging in autumn or winter should be considered a high risk seedbank source.

Climate data (rainfall, air and soil temperature, and soil moisture) were recorded on-site throughout the experiment. To prevent seedbank contamination, plots were destroyed at flowering, and seed head morphology was assessed prior to destruction. Data were analysed using ANOVA, LSD tests, and regression analysis within the Python environment.

Table 1. Target sowing dates for *Vulpia* spp. and associated calculated daylength (Pp) for Kowhai farm, located at latitude -43.7°, Lincoln, Canterbury.

Trt. No.	Target sow date	Actual sow date	Pp at emergence	Direction of Pp
1	28/03/2024	28/03/2024	12.0	shortening
2	20/04/2024	24/04/2024	10.5	shortening
3	15/06/2024	12/06/2024	10.5	lengthening
4	30/08/2024	16/08/2024	12.0	lengthening
5	4/10/2024	2/10/2024	14.0	lengthening
6	15/11/2024	22/11/2024	16.6	lengthening

Results

Seedling emergence

Time to emergence varied widely when measured in calendar days. However, once soil moisture was adequate, all sowing dates required about 213°C days to reach 50% emergence. Dry surface soils delayed the start of emergence but did not increase the total thermal requirement. In practice, this results in strong, often synchronised emergence flushes following autumn rain or irrigation.

Flowering and seed production

Flowering was strongly dependent on sowing and emergence timing. All plants sown between March and June produced seed heads. August sowing resulted in slightly reduced flowering (93%). In contrast, plants sown in October and November failed to flower and produced no seed by the end of the season (Figure 1).

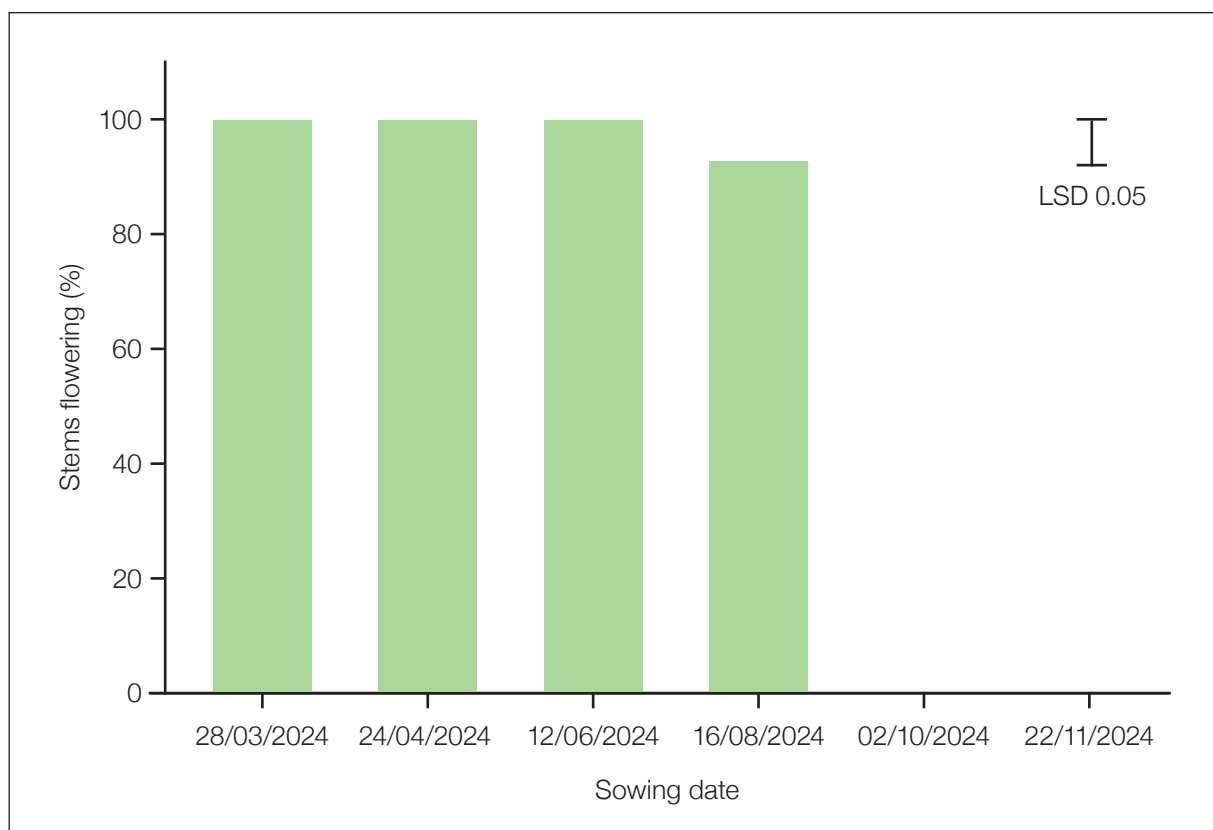


Figure 1. The percentage of tagged *Vulpia* stems that developed seed heads at the final assessment date when sown on six dates near Lincoln, New Zealand in the 2024-25 growing season.

Leaf development

Once emerged, leaf appearance was consistent across all sowing dates. On average, plants produced one new leaf every 96°C days. This rapid and predictable development means *Vulpia* hairgrass can establish quickly, narrowing the window for effective post-emergence control.

Time of reproductive development

Floral initiation was delayed ($P < 0.05$) from 24/6/2024 until 31/10/2024 as sowing date was delayed. All seedlings that emerged from SD5 (2/10/2024) or later remained vegetative. Delays in FI lead to different Pp lengths at FI ranging from 10 – 13.3 hours (Table 2).

Table 2. Date and photoperiod of floral initiation (FI) and terminal spikelet (TS) formation of *Vulpia* hairgrass sown on four dates near Lincoln, New Zealand in the 2024-25 growing season.

Trt. No.	Sowing date	DOY (Date FI)	Pp at FI (hours)	DOY TS (Date)	Pp at FI (hours)
1	28/03/2024	176 (24/6/2024)	10.0	256 (12/9/2024)	12.8
2	24/04/2024	211 (28/7/2024)	10.8	279 (4/10/2024)	14.0
3	12/06/2024	253 (9/9/2024)	12.6	296 (21/10/2024)	14.9
4	16/08/2024	305 (31/10/2024)	13.3	335 (30/11/2024)	16.4
	Mean	236	12.2	292	14.5
	P value	<0.001	<0.001	<0.001	<0.001
	LSD0.05	9.40	0.31	2.29	0.10
	CV%	1.99	1.29	0.43	0.34
	SEM (treatment)	2.7	0.09	0.72	0.029

Summary

This study quantified the effects of sowing date on emergence, and reproductive phenology of *Vulpia* hairgrass under field conditions in Canterbury, New Zealand. Six sowing dates spanning autumn to late spring were established in a replicated field experiment to generate contrasting thermal and photoperiod environments. Seedling emergence varied by calendar days among sowings but converged to a consistent requirement of c. 213°C days once soil moisture constraints were accounted for. Leaf appearance progressed at a constant phyllochron of approximately 96°C days across sowing dates, allowing Haun stage to be used as a robust measure of physiological age.

Flowering was strongly dependent on sowing date, with all plants sown from March to June producing seed heads, partial flowering in August, and complete failure of flowering from October onwards. Floral initiation was progressively delayed with later sowing and occurred across a wide range of photoperiods, indicating a dominant vernalisation requirement rather than strict photoperiod control. Although vegetative primordia production was conserved among sowing dates, later sowings experienced a shortened reproductive development phase, reducing total organ number, stem length, and reproductive structure size. These results demonstrate that both autumn and winter emergence are critical for successful reproduction and seed return in *Vulpia* hairgrass.

What this means for growers

Vulpia hairgrass plants emerging in autumn or winter should be considered a high risk seedbank source. In contrast, plants emerging from October onwards are unlikely to contribute to future infestations. Management decisions should prioritise control of autumn and winter flushes, particularly following rainfall.

References

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