FACT SHEET

Multispecies Forage Mixes

Based on a presentation by Marie-Noëlle Thivierge, agr., Ph.D., Agriculture and Agri-Food Canada (AAC), prepared in collaboration with Brigitte Lapierre, agr., DLF Canada.

PRESENTED ON FEBRUARY 26, 2025



A multi-species forage mix consists of **three or more species.**



> **A mix containing a large number of species—seven or more—provides more stable yields, with a lower risk of yield losses during disturbances such as droughts, floods, and insect infestations.**
>
> — Marie-Noëlle Thivierge, agr., Ph. D. (AAC)

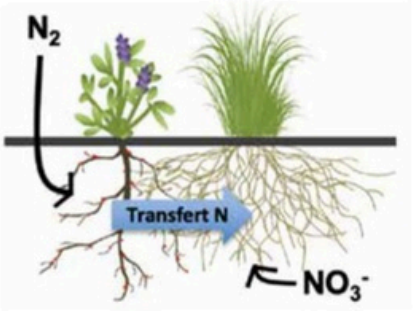
How forage species work together

Forage species can complement one another in how they use resources through **three main mechanisms.**

1. Nitrogen transfer from legumes to grasses and forbs

Nitrogen moves from legumes to neighbouring plants through:

- The decomposition of legume roots and their nodules;
- Nitrogen-rich root exudates produced by legume roots;
- Mycorrhizal fungi that act as a bridge between the roots of legumes and grasses.



(Thivierge and Bélanger, 2022)

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Did you know?
Depending on the species grown together, legumes can transfer up to 50–60 kg of nitrogen to grasses. This is equivalent to applying 120 kg of mineral nitrogen fertilizer if approximately 50% is lost through volatilization or leaching.



(Thivierge and Bélanger, 2022)

2. Different rooting depths and root structures

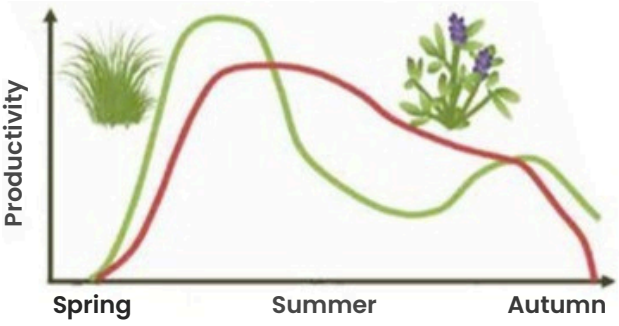
Species with different root systems access resources in different parts of the soil, allowing **complementary resource use** to outweigh competition.

This can also happen between two grasses or two legumes with contrasting characteristics. Species do not have to belong to different plant families to complement one another.

3. Different growth cycles

Species grow and use resources at different times throughout the season.

Timothy and alfalfa, for example, do not have the same resource needs at the same time.



(Adapted from Thivierge and Bélanger, 2022)



Forbs: adding diversity beyond grasses and legumes

Examples: Chicory, plantain, small burnet, yarrow.

- Recommended for use on pasture only, as their impact on the preservation of harvested forage is not well understood.
- Their nitrogen requirements are similar to those of grasses.
- They contain tannins, which can aid the digestion of nitrogen in ruminants.
- Their root systems comprise both taproots and fibrous roots.
- They help reduce nitrogen losses through leaching and nitrous oxide (N_2O) emissions in the field.
- Chicory and plantain are the most productive forbs in Quebec.
- Chicory should only be used in intensively managed pastures with frequent grazing.

Nutritional value of multispecies mixes

Productive pastures containing more than six species tend to have very few weeds.

→ **Fewer weeds = better nutritional value.**

The balance of legumes and grasses has the greatest influence on nutritional value. The number of grass species—one, two or three—has little effect, provided they are harvested at the optimal growth stage.

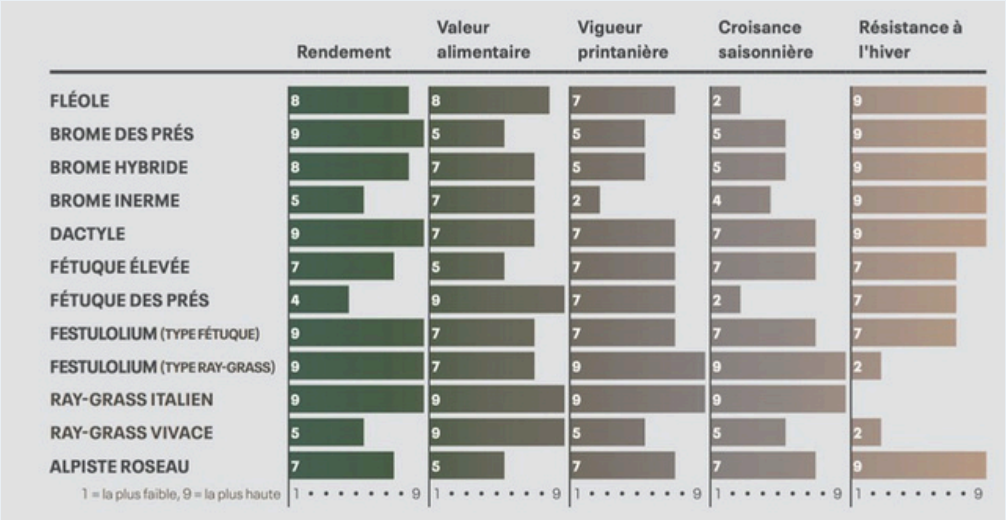
Adding a second legume alongside alfalfa generally improves nutritional value.

For example:

- White clover **increases the digestibility of dry matter**.
- Red clover and bird's-foot trefoil increase the energy-to-protein ratio, helping animals **use protein more efficiently**.

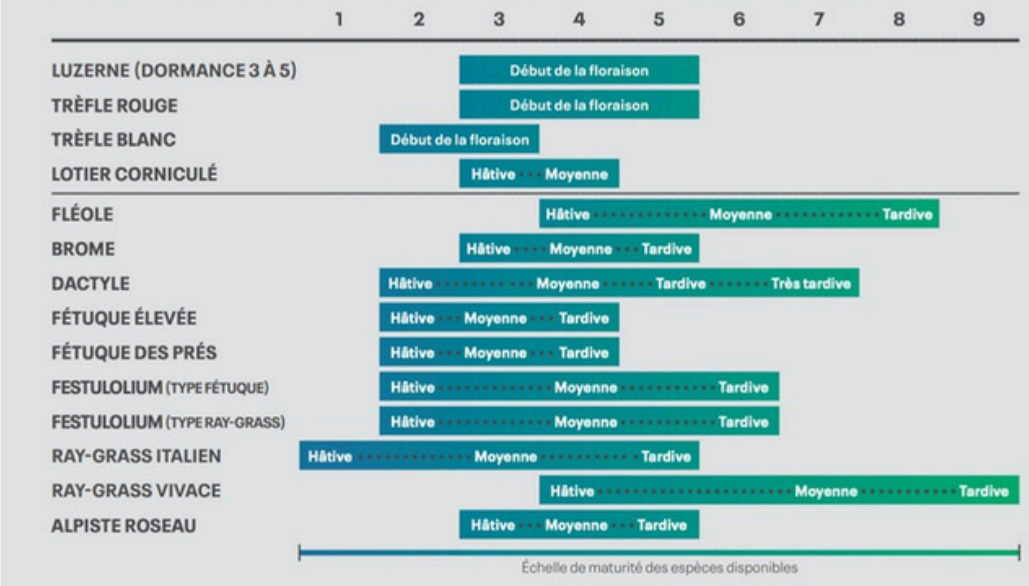
Choosing cultivars

Characteristics of different grasses



(Guide des produits Est du Canada, 2e édition, DLF 2025)

Forage species maturity chart



(Guide des produits Est du Canada, 2e édition, DLF 2025)

- Orchardgrass cultivars can now differ in maturity by as much as 20 days.
- Planting two groups of mixes—one early-maturing and one late-maturing—can create two separate hay harvest windows, offering greater flexibility when harvest conditions are unfavourable.

What is the recommended seeding rate?

For mixes containing more than three species, the **replacement method** is recommended.

For each species in the mix, calculate:

Desired proportion in the mix (%) × Recommended pure sowing rate (kg/ha or seeds/m²)

	Alfalfa	Timothy grass	Meadow bromegrass	Tall fescue
Pure Seeding Rate (kg/ha)	14	10	13	16
Pure Seeding Rate (seeds/m²)	700	2500	230	800

Example

For a mix of 50% alfalfa + 25% timothy + 25% tall fescue:

- Alfalfa: 50% × 14 kg/ha = 7 kg/ha
- Timothy: 25% × 10 kg/ha = 2.5 kg/ha
- Tall fescue: 25% × 16 kg/ha = 4 kg/ha

Total seeding rate: 13.5 kg/ha

Allow the stand to establish during its first year before expecting its composition to approach the desired proportions.

Questions to ask before choosing species in a forage mix

1. Will the forage be mechanically harvested for hay or silage, or grazed?
2. If it will be grazed, what grazing system do you use?
   - Strip grazing
   - Continuous grazing
3. What is your main goal?
   - High yields
   - Nutritional quality
   - Resilience to climate-related stresses
4. What are your animals' nutritional needs? Are you feeding heifers, dry cows or lactating cows?
5. What type of soil do you have?
6. Are there any specific constraints, such as acidic soil?
7. Would you like to favour certain species to improve ration digestibility?

Source

Thivierge, M.-N., and G. Bélanger. 2022. "Mélanges d'espèces fourragères pérennes." Chapter 2, p. 56, in Guide de production – Plantes fourragères. 2nd ed., Vol. 1. G. Bélanger, A. Claessens, M.-N. Thivierge and G. Tremblay (scientific editors). Centre de référence en agriculture et agroalimentaire du Québec (CRAAQ). ISBN 978-2-7649-0636-1.