Preparation of Silage from Sweet Pea (Grass Pea – *Lathyrus sativus* L.): Methods, Nutrient Composition, and Practical Applications

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Abstract

Sweet pea, commonly referred to in forage contexts as grass pea (*Lathyrus sativus* L.), is a hardy, drought-tolerant legume widely used for silage production, especially in marginal lands and crop rotations. It provides high crude protein, fixes atmospheric nitrogen, and serves as an excellent break crop. This article outlines step-by-step methods for preparing high-quality grass pea silage, either as a sole crop or in mixtures with cereals (e.g., barley, triticale, or oats). Optimal harvest stages, wilting, chopping, ensiling techniques, and fermentation management are described. Representative nutrient data from peer-reviewed studies show grass pea silage typically contains 14–18% crude protein, 40–55% neutral detergent fibre (NDF), and good energy values, with improved fermentation when mixed with cereals. The process supports sustainable livestock feeding by reducing reliance on imported concentrates and enhancing soil health.

Keywords: Grass pea silage, *Lathyrus sativus*, forage pea silage, ensiling, fermentation quality, sustainable fodder.

1. Introduction

Grass pea (*Lathyrus sativus* L.), often called sweet pea in some regional forage literature, is a cool-season legume valued for its resilience to drought, low soil fertility, and waterlogging. It is grown as a dual-purpose crop (grain and forage) in Asia, Africa, and parts of Europe. When harvested as whole-crop forage, it yields protein-rich silage suitable for dairy and beef cattle, sheep, and goats.

Unlike ornamental sweet pea (*Lathyrus odoratus*), the forage type is bred for high biomass and low anti-nutritional factors (e.g., reduced β-ODAP content in modern varieties). Silage preparation preserves its high protein and energy content while improving palatability and reducing anti-nutritional compounds through fermentation. Mixing with cereals (barley, oats, or triticale) balances water-soluble carbohydrates (WSC) and improves ensilability. Grass pea silage is particularly useful in rainfed or semi-arid systems where maize or sorghum silage may fail.

2. Materials and Methods for Silage Preparation

2.1 Crop Selection and Agronomy

- **Varieties**: Use low-toxin, high-biomass genotypes (e.g., Gap Mavisi or locally adapted lines).
- **Sowing**: Spring or autumn sowing at 80–120 kg/ha seed rate. Intercrop with cereals at 1:1 or 2:1 ratios (pea:cereal) for better yield and fermentation.
- **Fertilisation**: Minimal N (20–40 kg/ha starter); benefits from residual soil N and P due to N-fixation.

2.2 Harvesting Stage

Harvest at the **pod-setting to early pod-filling stage** (when lower pods are set but still green and seeds are in the milky stage). This balances protein (highest at flowering/pod set) and energy (starch from developing seeds). Avoid harvesting too late (mature pods), as fibre increases and digestibility drops. In mixtures, cut when peas reach pod set and cereals are at dough stage.

Target dry matter (DM) at harvest: 25–35% (wilting required if wetter).

2.3 Step-by-Step Silage Preparation

1. **Mowing and Wilting**: Mow at 10–15 cm stubble height. Wilt in the field for 24–48 hours (depending on weather) to reach 30–35% DM. Use a roller conditioner for high-pea crops to minimise leaf/pod loss. Turn swaths gently if needed.
2. **Chopping**: Chop to 1–2 cm length using a forage harvester or chopper. Fine chopping improves packing and fermentation.
3. **Additives (Optional but Recommended)**:
    - Bacterial inoculants (*Lactobacillus plantarum* or commercial LAB blends) at 10^5–10^6 CFU/g fresh matter to speed lactic acid production.

    - Molasses or cereal grain (5–10%) if WSC is low.
    - Acid additives (e.g., formic acid) for high-moisture crops.

4. **Packing and Ensiling**:
   - **Pit/Bunker**: Layer chopped material evenly; compact thoroughly with tractor (target density 600–800 kg/m³).
   - **Bales**: Use round or square balers with stretch film (6–8 layers). Ideal for small-scale or protein-boosting supplements.
   - **Drum/Tube Silos**: Suitable for smallholders. Seal immediately with plastic sheeting, weights, or tyres to exclude air.
5. **Fermentation Period**: Minimum 45–60 days (ideally 90 days) before feeding. Monitor temperature (should not exceed 40°C initially).
6. **Harvesting Silage**: Open from one end; feed out daily to minimise aerobic exposure.

Vermiwash or Effluent Management: Drain excess liquid to prevent clostridial spoilage.

Safety Note: Grass pea contains β-ODAP; use low-toxin varieties and limit to 30–40% of total ration to avoid lathyrism in monogastrics (safe for ruminants at moderate levels).

3. Nutrient Composition and Fermentation Quality

Nutrient values vary with variety, growth stage, mixture ratio, and ensiling conditions. Below is a synthesis of representative data from multiple studies (dry-matter basis unless stated).

Table 1: Typical Macronutrient Profile of Grass Pea / Pea Silage

Parameter	Pure Grass Pea Silage	Pea + Cereal Mixture (e.g., Barley/Oats)	Typical Range (Literature)
Dry Matter (DM, %)	28–36	32–40	25–45
Crude Protein (CP, % DM)	14–18	13–16	12–20
Neutral Detergent Fibre (NDF, % DM)	45–55	48–58	40–60
Acid Detergent Fibre (ADF, % DM)	32–40	30–38	28–45
Crude Fibre (% DM)	25–32	24–30	22–35

Parameter	Pure Grass Pea Silage	Pea + Cereal Mixture (e.g., Barley/Oats)	Typical Range (Literature)
Ash (% DM)	8–12	7–10	6–13
Metabolisable Energy (MJ/kg DM)	9.5–11.0	10.0–11.5	9–12

Table 2: Fermentation Characteristics (After 60–90 Days Ensiling)

Parameter	Pure Grass Pea	Pea + Cereal Mix	Ideal for Good Silage
pH	4.2–4.8	4.0–4.5	<4.5
Lactic Acid (% DM)	4–7	5–8	>4
Ammonia-N (% of total N)	8–12	5–9	<10
Butyric Acid (% DM)	<0.5	Trace	<0.5

Key Observations:

- Pure grass pea silage has excellent protein but may show higher proteolysis (ammonia-N) due to low WSC.
- Cereal mixtures improve fermentation, lower pH faster, and enhance aerobic stability.
- Inoculation reduces ammonia-N and improves DM recovery.

4. Results and Discussion

Studies consistently show that harvesting at the early pod-filling stage maximises nutritive value while wilting to 30% DM minimises effluent and clostridial risk. Mixtures with barley or triticale (1:1 ratio) yield higher total biomass (up to 50 t fresh matter/ha) and better silage quality than sole crops. Fermentation is dominated by lactic acid bacteria, producing stable, palatable silage with minimal spoilage when properly sealed.

Compared to maize silage, grass pea silage offers higher protein and better amino-acid balance but requires careful management of moisture and packing. Aerobic stability is good (especially with inoculants), making it suitable for tropical/subtropical conditions. Limitations include potential anti-nutritional factors (use modern low-ODAP varieties) and the need for rapid wilting in humid climates.

5. Conclusion

Preparation of silage from sweet pea (grass pea) is a simple, low-cost technology ideal for smallholders and commercial farms. By harvesting at the optimal pod-set stage, wilting properly, chopping finely, and using inoculants or cereal mixtures, farmers can produce high-quality, protein-rich silage that supports sustainable livestock production. Integration into rotations improves soil fertility and reduces feed costs. Adoption of this practice in drought-prone areas can significantly enhance fodder security.

Future Scope: Breeding for lower ODAP and higher biomass, combined with precision inoculants and large-scale bale silage systems.

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