SEPARATE HARVEST OF LEAVES FROM THE STEMS OF LUCERNE STANDS

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ABSTRACT
Lucerne leaves have significantly higher crude protein and lower crude fibre contents than the stems. The present methods for separating the leaves from the stems have serious deficiencies. Early harvesting, for example, weakens the lucerne stand, and sifting after artificial drying impairs quality. Above that, preparation of leaf protein concentrates is rather expensive.

Field trials with a pronged cylinder which strips the leaves from the stems produced leaf yields of ž 80 % with a stem portion of £ 15 % (containing ž 26 % crude protein and £ 18 % crude fibre in the dry matter). Lucerne leaves can be preserved by artificial drying, silage mixed with CCM or chemical aids (e. g. AIV acid).

The digestibility of crude protein and lysine amounted to ~70 % in pigs and hens, and the metabolisable energy was 10.7 MJ in pigs and 7.0 MJ/kg DM in hens.

KEYWORDS
Lucerne, leaves, harvesting method, preservation, nutritive value

INTRODUCTION
Lucerne (Medicago sativa) is one of the most important forage legumes. Its nutritive value is limited by the high crude fibre content and low protein content in the stems. For this reason, monogastrids must not be fed too much lucerne forage. Different methods have been developed for separating the leaves from the stems. They involve, however, serious disadvantages.

The early harvest date below 30 cm plant height weakens the plants and shortens plant life. Cutting in two storeys (the upper storey at 30 cm height is rich in nutrients) is not effective. Sifting after artificial drying leads to inferior quality and requires high energy input. Moreover, the production of leaf protein concentrate is very expensive.

METHODS
In different lucerne stands (2-3 years old, 1st to 4th regrowth, different cultivars, plant height from 30 to 90 cm, varying weed infestation) a machine with a pronged cylinder (figure) for stripping the leaves from the stems was tested at varying rotation speed (150... 300 rotations per minute) and driving speed (1...10 km/h^{-1}). The portion of harvested leaves and the percentage of stems in the harvested material was measured to estimate the efficiency of this method.

The mechanically harvested leaves were used for the following investigations:
- Storage trials without and with aeration up to 60 hours at 1m filling height.
- Preservation trials under the conditions of artificial drying, silage mixed with corn-cob-mix and chemical aids.
- Trials for estimating the nutritive value in pigs and hens.

RESULTS AND DISCUSSION
By means of the pronged cylinder more than 80 - 90% of leaves were stripped from the stems in lucerne stands. The leaf fraction contained 5 - 15% stems, mainly from the top of the plants, which is usually low in crude fibre content.

The mechanically harvested leaves contained ž 26 - 35 % crude protein, -18 % crude fibre and ž 2 % lysine in the dry matter (Table 1).

However, it is necessary to consider the following preconditions:
- harvest between 40 and 75 cm plant height,
- upright growth habit, no lodging,
- no weed contamination (- 10 %).

Mechanically harvested leaves can be stored up to 12 hours without and up to 60 hours with aeration at a storage height of 1 m.

Leaf preservation is most successful when the following factors are observed:
- artificial drying is more uniform than drying whole plant,
- silage mixed with CCM and up to 20 % of lucerne leaves (Wecke, 1992)
- chemical silage supplemented by 16 - 18 val AIV acid or HCl (Rügheimer, 1985).

The nutritive value of lucerne leaves is characterised by:
- Digestibility of crude protein and lysine: 69 - 74 % in pigs and 61% and 71 % resp. in hens (Gruhn and Wiesemüller, 1990).
- Metabolisable energy: 10.7 MJ/kg DM in pigs and to 7.0 MJ/kg DM in hens (Schmidt and Wiesemüller, 1992).

Stem portions with a small percentage of leaves can be used as forage for sheep or as raw material in different industries (paper mills, building sector).

Summarizing these results, it can be concluded that separate harvesting of the leaves from the stems in lucerne stands is an effective method for the production of feedstuff with high protein and lysine content and low share of fibre for pigs and hens.

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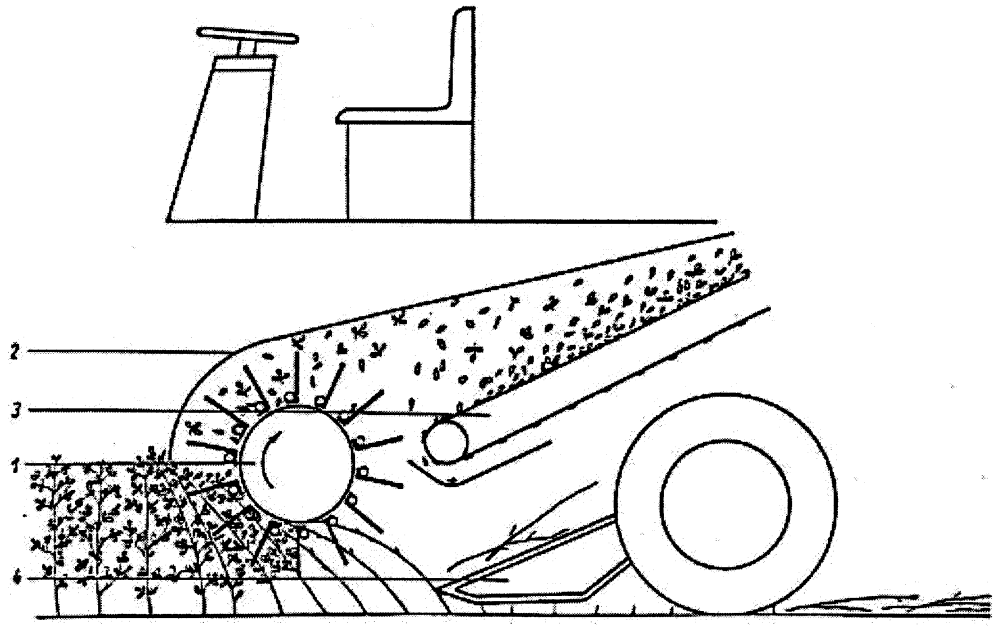
Table 1
Nutritive value of mechanically harvested lucerne leaves

Components	g per kg DM		Digestibility in % by	
	span	average	pigs	hens
organic matter	872 ... 899	880	75	•
crude protein	263 ... 348	317	72	61
crude fibre	98 ... 180	160	67	•
crude lipid	31 ... 39	35	44	•
NFE	370 ... 490	430	83	•
lysine	19 ... 22	20	73	71
methionine	6 ... 10	8	•	65
metabolisable energy in MJ per kg DM			10,7	7,0

Figure 1
Working scheme of a lucerne leaf harvester (Schmidt, 1980)



1... cylinder with prongs 2 ... box 3 ...transfer equipment 4 ... cutting tool