

## Effect of Cutting Interval and Cutting Height on Yield and Chemical Composition of Hedge Lucerne (*Desmanthus virgatus*)

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**ABSTRACT :** The experiment was conducted to determine the effects of cutting interval and cutting height on the yield and nutrient composition of hedge lucerne (*Desmanthus virgatus*) when grown on a sandy soil in the Northeast of Thailand. The cutting intervals compared were 30, 40 and 50 days between harvests and the cutting heights 30, 40 and 50 cm above ground level. The experiment was a 3×3 factorial layout in a randomized complete block design with 4 replications-giving a total of 36 plots each 3×3 m<sup>2</sup>. Harvested plant material was weighed, dried and the ground subsamples taken for analyses of crude protein (CP), crude fiber (CF), ash, ether extract (EE) and nitrogen-free extract (NFE). At the last harvest the hedge lucerne samples were separated to determine leaf to stem ratios and then analyzed for nutrient composition in the leaf and stem. Results showed that increasing the cutting interval (i.e. advancing age of maturity) increased dry matter and nutrient yields significantly. In terms of nutrient content, it also increased the crude fiber, ash, ether extract and nitrogen free extract percent in the plant. However, crude protein percent was markedly decreased as the cutting interval increased. Increasing cutting height had no effect on dry matter yield and yields of nutrients, but in terms of nutrient content, it increased crude protein and ash content, but decreased crude fiber content. The percent EE and NFE in the plant was unaffected by cutting height. From the results presented it is clear that cutting a stand of hedge lucerne every 40 to 50 days will achieve greater dry matter and nutrient yields than cutting more frequently, at 30 days. The cutting height at harvest, whether 30, 40 or 50 cm above ground level had no effect on dry matter or nutrient yields of hedge Lucerne. Hedge lucerne therefore offers the Thai poultry farmer a useful alternative protein supplement for poultry diets rather than relying on the more expensive soybean meal. As it can be readily and successfully grown on a range of soil types and climates throughout Thailand, hedge lucerne also offers the Thai farmer a valuable additional source of income. (*Asian-Aust. J. Anim. Sci. 2006. Vol 19, No. 1 : 31-34*)

**Key Words :** Hedge Lucerne, *Desmanthus virgatus*, Cutting Interval, Cutting Height, Yield, Chemical Composition

### INTRODUCTION

The leguminous shrub, *Desmanthus virgatus*, has been proposed as an alternative plant protein feed ingredient to the expensive soybean meal commonly used in poultry diets (Battad, 1993). It is commonly known as hedge lucerne, donkey bean or desmanthus (Partridge, 1998) and its morphological characteristics, production and chemical composition have been reviewed by Gutteridge (1994) and Partridge (2003). Skerman et al. (1988) reported a yield of 23 tons/ha/year when hedge lucerne was cut at 91 day intervals, while Vuthiprachumpai et al. (1998) reported average production of 1,544 kg DM/ha and 310 kg protein/ha from each cut when frequently harvested.

Stage of maturity at harvest significantly affects the yield, crude protein and crude fiber content of hedge lucerne. Fiber content in turn has a significant effect on feed intake and thus production of the animal. Punyavirocha et al. (1992a) reported yields of 1,469, 2,275 and 2,638 kg DM/ha and 281, 413 and 444 kg crude protein/ha at each

cut when harvested at 30, 45 and 60 days respectively. These crude protein yields reflected a percentage of 19.08% crude protein from cutting at 30 day intervals 18.80% crude protein from cutting at 45 day intervals and 16.74% crude protein from cutting at 60 day intervals. They also recorded yields of 2,075, 2,238, 2,463 and 2,206 kg DM/ha at each cut when hedge lucerne was harvested at heights of 5, 20, 35 and 50 cm respectively (Punyavirocha et al., 1992b). Skerman et al. (1988) also reported a significant drop in digestibility with advancing maturity.

The aim of the present study was to further investigate and confirm the effects of cutting intervals and cutting height on the yield, leaf: stem ratio and chemical characteristics of hedge lucerne, for its possible use as a feed ingredient in poultry diets.

### MATERIALS AND METHODS

#### Experimental design

The experiment incorporated 3 cutting intervals of 30, 40 and 50 days, and 3 cutting heights of 30, 40 and 50 cms. from ground level imposed on a stand of hedge lucerne (*Desmanthus virgatus*). The design was a 3×3 factorial arrangement in a randomized complete block with 4 replications-giving a total of 36 plots each 3×3 m<sup>2</sup>.

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**Table 1.** Chemical composition (%) of hedge lucerne cut at different intervals and heights

Age	Height	%DM	%CP	%CF	%EE	%ASH	%NFE
30 D	30 cm	31.77	18.62 <sup>a</sup>	19.91	2.97	7.26	51.24
	40 cm	31.64	18.55 <sup>a</sup>	18.91	2.92	7.48	52.14
	50 cm	31.16	19.00 <sup>a</sup>	17.12	2.84	7.14	53.90
40 D	30 cm	32.58	15.81 <sup>c</sup>	26.27	2.75	6.21	49.05
	40 cm	30.47	17.19 <sup>b</sup>	22.37	2.66	6.68	50.50
	50 cm	29.85	17.18 <sup>b</sup>	22.98	2.86	6.45	50.54
50 D	30 cm	35.36	14.37 <sup>d</sup>	28.55	2.62	6.00	48.46
	40 cm	33.31	14.37 <sup>d</sup>	27.51	2.81	6.45	48.59
	50 cm	33.59	15.53 <sup>c</sup>	27.30	2.89	6.60	47.88
SEM		0.58	0.34	0.96	0.07	0.14	0.84
		----- p-value -----					
Block		0.0055	0.8238	0.3736	0.0004	0.0038	0.4628
Age		0.0001	0.0001	0.0001	0.0309	0.0001	0.0001
Height		0.0029	0.0084	0.0109	0.3515	0.0097	0.2226
Age×height		0.2926	0.0495	0.4394	0.0551	0.1631	0.3655

SEM = Standard error of mean.

### Management, measurement and chemical analysis

Prior to sowing, the experimental area was cultivated to produce a firm, fine seedbed and the hedge lucerne seed sown in rows, at the rate of 12.5 kg/ha, to form hedge-rows with row spacing of 50 cm. All plots then received a basal dressing of a compound NPK fertilizer (15:15:15) at the rate of 150 kg/ha. Prior to sowing the hedge lucerne seed was soaked in hot water at 80°C for 1 min to break dormancy. All plots were watered once per week by sprinklers to ensure adequate soil moisture for plant growth.

At 80 days after sowing, the hedge lucerne plants were all cut to 30 cm above ground level and the upper parts of the plants removed. The residual plants were then allowed to regrow and cut again after a further 30, 40 and 50 days, but to the 3 cutting heights of 30, 40 and 50 cm, above ground, to measure production. The second and third cuts were repeated after 30, 40 and 50 days of regrowth to the respective cutting heights (30, 40 and 50 cm) for further production measurement.

After each cut the fresh forage was weighed and subsamples taken for determination of dry matter (oven dried at 60°C for 36 h), crude protein (Kejltac autoanalyzer; Foss Tecator, Denmark), crude fiber (Fibertec autoanalyzer; Foss Tecator, Denmark), ether extract (Soxtec autoanalyzer; Foss Tecator, Denmark) and ash (500°C overnight) (AOAC, 1990) and nitrogen-free extract.

At the third harvest of each cutting interval treatment the hedge lucerne plants were separated to determine leaf: stem ratio and then analyzed for the nutrient parameters stated above. The data of yields from the 3 cuts were averaged for statistical analysis.

### Statistical analysis

All data were subjected to analysis of variance by the procedure of SAS (1985). Data from three cuts and from

each treatment were combined. The differences among mean values were compared by Duncan's New Multiple Range Test (DMRT) at 5% significance level (Steel and Torrie, 1986).

## RESULTS AND DISCUSSION

As shown in Table 1, cutting interval had a significant effect on the percentage content of all the components measured, with dry matter percent and crude fiber percent increasing as the cutting interval increased from 30 to 50 days. By comparison, crude protein, ash ether extract and nitrogen free extract percentage all showed a decrease as the cutting interval increased.

The effect of cutting height, presented in Table 1, was also significant but in the opposite direction to the cutting interval effect i.e. both %DM and %CF decreased with increasing cutting height, while %CP and %ash increased with increasing height of cutting. Percentage of EE and NFE, however, showed no significant response to cutting height.

The decrease in DM and CF content with increasing cutting height can possibly be attributed to the fact that the upper parts of the hedge lucerne that were harvested at 50 cm height were inclined to contain fewer branches and stems and more leaves than in the lower parts included in the 30 cm cutting height. Hence the 50 cm cut was of higher quality as reflected in the higher CP content.

In terms of cutting interval and hence age of the plant at harvest, the most frequently cut treatment (every 30 days) resulted in younger, leafier plants being harvested, which was reflected in the higher CP content and lower CF content recorded, compared with the least frequent cutting treatment (every 50 days) and hence older plants with lower CP content and higher CF content.

**Table 2.** Yields (kg/ha) of hedge lucerne cut different intervals and heights

Age	Height	DM	CP	CF	EE	ASH	NFE
30 D	30 cm	1,545	288	309	46	112	791
	40 cm	1,494	271	302	43	112	767
	50 cm	1,376	259	256	40	97	724
40 D	30 cm	2,552	396	693	68	153	1,246
	40 cm	2,460	430	568	64	160	1,238
	50 cm	2,405	398	577	68	148	1,215
50 D	30 cm	3,024	428	867	79	179	1,470
	40 cm	3,497	499	989	98	218	1,693
	50 cm	2,844	423	800	82	180	1,358
SEM		223	32	77	7	15	103
----- p-value -----							
Block		0.0092	0.0065	0.0250	0.0169	0.0112	0.0065
Age		0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Height		0.3307	0.3108	0.3831	0.6728	0.1988	0.2991
Age×height		0.6033	0.7232	0.5654	0.4625	0.7101	0.5293

SEM = Standard error of mean.

**Table 3.** Leaf:stem ratio and chemical composition of leaf and stem of hedge lucerne cut at different intervals and height

Age	Cut	Ratio (DM)		%Protein		%Fiber		%Ash		%EE		%NFE	
		Leaf	Stem	Leaf	Stem	Leaf	Stem	Leaf	Stem	Leaf	Stem	Leaf	Stem
30 D	30 cm	61.61	38.39	23.72	9.31	9.87	40.98	6.49	4.94	3.32	1.73	56.61	43.04
	40 cm	59.82	40.18	23.42	9.30	9.45	41.01	6.67	5.24	3.56	1.18	56.90	43.27
	50 cm	61.60	38.40	23.27	9.94	9.12	39.56	6.69	5.36	3.24	1.31	57.78	43.83
40 D	30 cm	50.51	49.49	20.75	6.81	10.26	46.21	6.92	4.49	2.78	1.29	59.29	41.20
	40 cm	53.10	46.90	22.14	7.95	8.99	43.72	6.69	5.20	2.87	1.35	59.31	41.79
	50 cm	52.58	47.42	22.15	7.46	9.52	44.07	6.54	4.87	2.70	1.37	59.09	42.23
50 D	30 cm	45.33	54.67	19.43	7.13	10.97	46.38	7.99	3.79	3.40	1.27	58.21	41.43
	40 cm	49.23	50.77	20.10	6.99	12.00	46.77	7.95	4.11	3.15	1.18	56.81	40.96
	50 cm	51.53	48.47	19.51	7.47	11.83	45.74	7.78	4.60	3.16	1.39	57.73	40.80
SEM		3.42	3.41	0.61	0.44	0.60	1.08	0.23	0.15	0.23	0.13	0.82	1.10
----- p-value -----													
Block		0.8619	0.8621	0.1473	0.8635	0.2229	0.3657	0.1781	0.0001	0.0015	0.1231	0.0073	0.4349
Age		0.0006	0.0005	0.0001	0.0001	0.0002	0.0001	0.0001	0.0001	0.0109	0.4873	0.0100	0.0467
Height		0.6180	0.6182	0.5097	0.3221	0.8802	0.3040	0.6584	0.0005	0.6523	0.1831	0.7245	0.8990
Age×height		0.8736	0.8736	0.5548	0.5642	0.3674	0.6959	0.8460	0.1253	0.8589	0.1094	0.7345	0.9482

SEM = Standard error of mean.

As one would expect, dry matter yield per cut of hedge lucerne (Table 2) increased with increasing intervals between harvests, from 1,472 kg DM/ha/cut at 30 day interval to 3,122 kg DM/ha/cut at 50 day interval. However when the respective growth rates of these treatments were compared on a per day basis it showed that both longer cutting intervals of 40 and 50 days grew at a similar and much faster rate than the plants under the shorter cutting interval of 30 days. This may well be a reflection of the regrowth of the different cutting intervals representing different parts of a normal growth curve and the associated differences in growth rates. Crude protein, crude fiber, ash, ether extract and nitrogen free extract also showed significant increases in yield as the cutting interval increased. This differs from the finding of Punyavirocha et al. (1992a) who reported no significant difference in DM and CP yields between different cutting intervals.

In contrast, however, the different cutting heights

imposed on the rows of hedge lucerne had no significant effect on DM production or nutrient yields measured (Table 2).

These results tend to support the work of Battad (1993) who reported that optimum yields can be obtained at 45-60 days cutting interval during the dry season and 35-45 days cutting interval during the rainy season. However he also recommended 50 cm as the optimum cutting height whereas the current experiment showed no difference in cutting height effects between 30 and 50 cm.

The effect of cutting interval on leaf: stem ratio and on the nutrient composition in the leaf and stem is presented in Table 3. As expected the leaf: stem ratio of the DM decreased as the cutting interval increased. This reaction also occurred with the CP content, while CF content increased with advancing plant maturity, especially in the stem fraction. In terms of ash content, however, it tended to increase in the leaf as the cutting interval increased but

tended to decrease in the stem with increasing age. Levels of EE and NFE were noticeably higher in the leaf than the stem but were relatively little affected by cutting interval.

In terms of the effect of cutting height on leaf: stem ratio and nutrient composition of the leaf and stem (Table 3), there was virtually no significant effect on any of the parameters measured. The only exception was the small rise in ash content of the stem as cutting height increased. The proportion of plant leaf was consistently higher than stem and all nutrients measured showed markedly higher contents in the leaf than in the stem.

### IMPLICATION

The present study clearly shows that cutting interval can have a marked effect on the dry matter yield and nutrient composition of hedge lucerne. Cutting every 40 to 50 days will achieve a much higher dry matter yield than cutting every 30 days and also result in higher yields of CP, ash, EE and NFE, in spite of a significant decrease in the percentage of these components in the plant as cutting interval is increased. Crude fiber, on the other hand, increases both in content and yield as the cutting interval is increased and must be given consideration when compiling poultry diets.

By comparison, cutting hedge lucerne to different heights at harvest has no significant effect on DM yield and on nutrient composition.

As expected, leaf: stem ratio decreases significantly as the cutting interval is increased, whereas cutting height has little effect on leaf: stem ratio. In all cases the leaf fractions contain much higher content of nutrients than the stem i.e. highlighted the importance and value of the leaf component for the production of quality feeds.

It is therefore recommended that hedge lucerne should be harvested every 40-50 days at any convenient cutting height between 30 and 50 cm above ground level. However, it must be recognized that the yield of crude fiber is also markedly increased by less frequent cutting which may have a bearing on the cutting interval adopted.

Hedge lucerne represents a positive alternative to other more expensive feeds for the Thai poultry farmer, as the plant can be easily grown on a range of soil types or climates in Thailand and readily harvested, dried and processed for use as a protein-rich meal supplement in poultry diets.

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