Climatic Factors, Acid Detergent Fiber, Neutral Detergent Fiber and Crude Protein Contents in Digitgrass

C. S. Chen
Taiwan Livestock Research Institute, Taiwan

S. M. Wang
Taiwan Livestock Research Institute, Taiwan

Y. K. Chang
Taiwan Livestock Research Institute, Taiwan

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CLIMATIC FACTORS, ACID DETERGENT FIBER, NEUTRAL DETERGENT FIBER AND CRUDE PROTEIN CONTENTS IN DIGITGRASS

C. S. Chen, S. M. Wang and Y. K. Chang

Taiwan Livestock Research Institute, Heng-Chun Station, 1, Ranch Road, Ken-Ting, Heng-Chun, Ping-Tung, Taiwan, 94606

Abstract

Digitgrass (*Digitaria Xumifolia*) was treated according to a set of programmed harvest cycles to study the impact of climatic factors on the quality of the grass. It is found that seasonal changes have greater effect on the quality of the grass than does the length of the harvest cycle. The highest correlation coefficient (0.81) between the ADF content and accumulated temperature is attained when the base temperature is set to 15.5 , while the highest correlation coefficient (0.88) between CP and is attained at a base temperature of 15.0 . The determination coefficient of regression (R^2) for ADF is reached at 0.81 when accumulated temperature and day length are introduced as factors. For NDF however, R^2 is lower (0.71) when the same factors are introduced. For CP, R^2 can reach up to 0.78 when the accumulated temperature alone is introduced as a factor.

Keywords : Forage quality, environment, accumulated temperature

Introduction

Due to differences in climate and conditions of local markets, the number of harvests per year and harvest time vary at each location in Taiwan. In a previous study, we assessed the quality of six lines of Digitgrass in different environments and showed that the seasons have much greater effect than genotype and location on the ADF and NDF contents in Digitgrass. We also found that seasonal factors and location have nearly the same effect on the CP content in Digitgrass, while the effect of the length of harvest cycle is less obvious (Chen *et al.* 1997). We are now further exploring the seasonal effect of weather by examining the relationships between the ADF, NDF, and CP components in Digitgrass and changes in climatic factors. The quantification indices comprising several factors to indicate changes in grass quality are also discussed.

Material and Methods

The material used in this study, Survenola (*Digitaria Xumifolia*), is a variety of Digitgrass released from University of Florida. The sward consists of four block, each divided into four plots for a total of sixteen blocks that were arranged by radomized complete block design. The blocks were harvested at four different cycles (Treaments A, B, C and D) beginning in March to April of the next year. From March to October 1995, the harvest cycles are 25 days for treatment A, 35 days for treatment B, 45 days for treatment C, and 55 days for treatment D. From November to February, the harvest cycles are 35 days for treatment A, 45 days for treatment B, 55 days for treatment C, and 65 days for treatment D. At the beginning of the experiment and after each harvest cycle, 250, 350, 450, and 550 kg/ha of composed fertilizer $N:P_2O_5:K_2O$ =11:9:18 were applied to the plots A, B, C and D. After each cut, agronomic characters and yield were surveyed, and one kilogram of fresh plants was sampled from each plot and air-dried in an oven at 80 for 48 hours then ground for chemical analysis.

Results and Discussion

In the span of one year, the ADF, NDF and CP contents of the four treatments were substantially different (Figure 1). In summer and early autumn, the ADF content of treatments B, C and D were about 45% and decreased to about 30% in winter and early spring. However, the ADF content of the longest harvest cycle (treatment D) in winter and early spring were lower than those of the shortest harvest cycle (treatment A) in summer and early autumn. The NDF content is also higher in longer harvest cycles but with a smaller difference between longer and shorter cycles than that of the ADF content. As with the ADF content, the NDF content in the longest harvest cycle (treatment D) in winter and early spring were also lower than those in the shortest harvest cycle (treatment A) in summer and early autumn. The CP content is lower in longer harvest cycles. A higher content of CP is found in winter and a lower content of CP is found in summer in all of the samples. It was shown that temperature accelerates the transformation of photosynthetic products into structural compounds (Fales, 1986; Akin *et al.*, 1987). Our results also showed that the ADF, NDF, and CP contents are highly correlated with temperature and have no correlation with sunlight duration and precipitation in the growth period. In addition, we calculated the accumulated temperature from a proposed base temperature. The highest coefficients of correlation between the accumulated temperature and the ADF, NDF and the CP were 0.81, 0.63 and 0.88 when the base temperatures were 15.5, 17.0 and 15.0, respectively. The ADF, NDF and CP components are substantially influenced by various factors of climate which act in combination rather than independently. Through the stepwise regression, we found that the determination coefficient of regression R^2 for ADF is reached at 0.81 when accumulated temperature and day length are introduced as factors. For NDF however, R^2 is lower 0.71 when thee same factors are introduced. For CP, we found that R^2 can reach up to 0.78 when the accumulated temperature alone is introduced as a factor. Observing the combined influence of different climatic factors on forage helps to elucidate causes for variations in forage quality. We conclude that the air temperature and the day length are critical factors affecting the fiber and CP contents of Digitgrass. They can account for up to 80% of the variations in the ADF and CP contents of Digitgrass. They can account for up 80% of the variations in the ADF and the CP contents in Digitgrass and 70% for it in the NDF content.

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Table 1 - The stepwise regression of climatic factors on the ADF, NDF, and CP contents.

	ADF		NDF			CP	
Step	Variable entered	Model R^2	Variable entered	Variable removed	Model R^2	Variable entered	Model R^2
1	Accu. temp.	0.65	Min. temp.		0.59	Accu. temp.	0.78
2	Day length	0.81	Day length		0.65	Max. temp.	0.80
3	Length of the harvest cycle	0.82	Accu. temp.		0.71	Length of the harvest cycle	0.82
4				Min. temp.	0.71	Day length	0.83

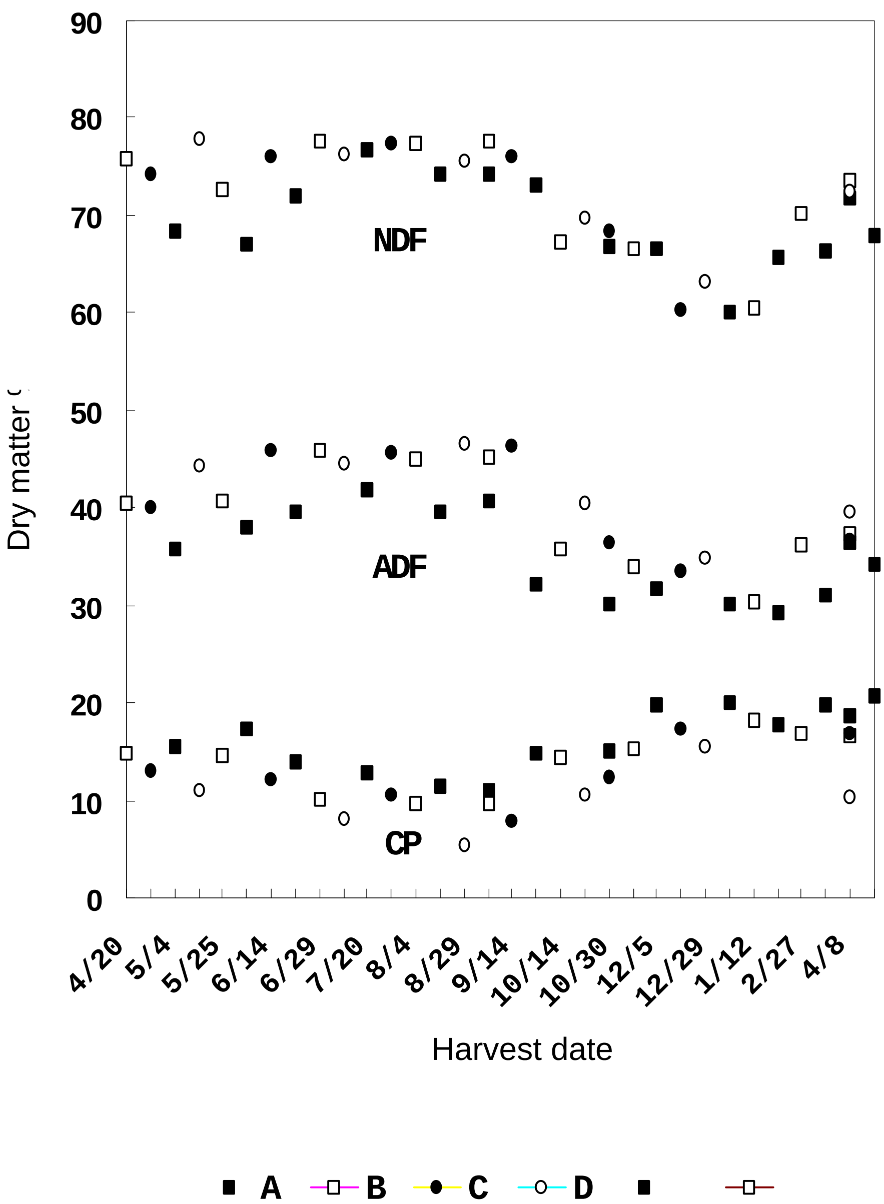

Figure 1 - The contents of NDF, ADF, and CP harvested in continuous cycles. The four treatment cycles were: from March to October -- 25 days (treatment A), 35 days (treatment B), 45 days (treatment C), and 55 days (treatment D); from November to February of the following year -- 35 days (treatment A), 45 days (treatment B), 55 days (treatment C), and 65 days (treatment D).