To determine the effect of supplementation of Barley straw with Lucerne hay, Meadow hay, Rye hay and Timothy hay on gas production during in vitro fermentation.

Introduction:

Work already carried out at NRI by Drs Prasad and Sampath has indicated that fermentation of mixtures of straw and concentrates produces more gas than fermentation of the individual substrates. In many parts of the world, availability or expense may prevent supplementation of basal diets with high protein concentrates. Tree fodders, hays and grasses provide an alternative . Since the idea is basically to increase the animal's protein intake, substitution of a poor quality high fibre diet with higher protein forage or fodder gives farmers in developing countries a chance to improve the general plane of nutrition of their animals. Very little is known about digestion of mixtures of the above feeds in the rumen. This experiment details an attempt to discover how mixtures of high fibre hays and straw behave during incubation with rumen fluid (*in vitro* fermentation).

Method:

The fermentation technique was carried out according to the usual method. A total of 34 sample treatments were run which included running duplicate treatments of the single substrates. There were 3 replicates per treatment. Table 1 shows the assigned treatment numbers and the substrate mixtures.

Results:

Figures 1 to 4 show the fermentation curves for the individual substrates and mixtures. Figure 5 shows the relationship between gas production and apparent digestibility (dry matter loss) for mixtures and single substrates. Figures 6 to 9 show the predicted and actual relationships between Barley straw and supplements (Lucerne, Meadow, Rye and Timothy hays) at four periods during the fermentation run (33,52,94 and 166 Hours). Figure 10 shows the predicted and actual apparent dry matter digestibilities for feed mixtures and single substrates.

Discussion:

Examination of plots suggests that there is, generally speaking, a positive interaction between mixtures of feeds (in respect of gas production) i.e. mixtures of feeds produce more gas than expected on the basis of fermentation of individual feeds. The extent of the interaction and the proportion of supplement associated with maximum interaction varies between supplements. However, over the ranges considered in this experiment, the interaction appears to be most evident for Lucerne and Meadow hays and least evident for Timothy. Interactions would also appear to be more apparent during the early stages of fermentation.

Figures 6 to 10 show the predicted relationship between 100% Barley straw and 100% supplement (a straight line). Any points above the line indicate a positive interaction i.e . production of more gas than predicted and points below the line indicate a negative interaction i.e. less gas than predicted. The standard error associated with each point is also shown. In almost all cases, points representing mixtures fall above the prediction line. Lucerne and Timothy demonstrate quite constant trends while Meadow and Rye show a large amount of scatter between mixtures. Timothy shows a clear point of maximum interaction (90% Barley and 10% Timothy) and then falls sharply until the interaction becomes negative (40% and 50% Timothy). Lucerne shows consistently higher than predicted results with a maximum occurring between 80% and 90% Lucerne supplement.

In all cases, interactions decrease as time progresses. There would appear to be a number of reasons for this. Interactions were expected to be most noticeable during the early stages of fermentation since energy inputs from the supplements (soluble sugars and starch) cause a peak in fermentation rate. This definitely affects the bacterial population either by multiplying numbers or increasing activity and thus allowing an earlier breakdown of the fibre fraction of the feed. This has been demonstrated in a previous experiment using glucose and cellulose as model substrates. The long fermentation time is also allowing the bacteria to become acclimatised and for single substrates, gas pool size at the end of the run is remarkably similar for all substrates regardless of chemical composition.

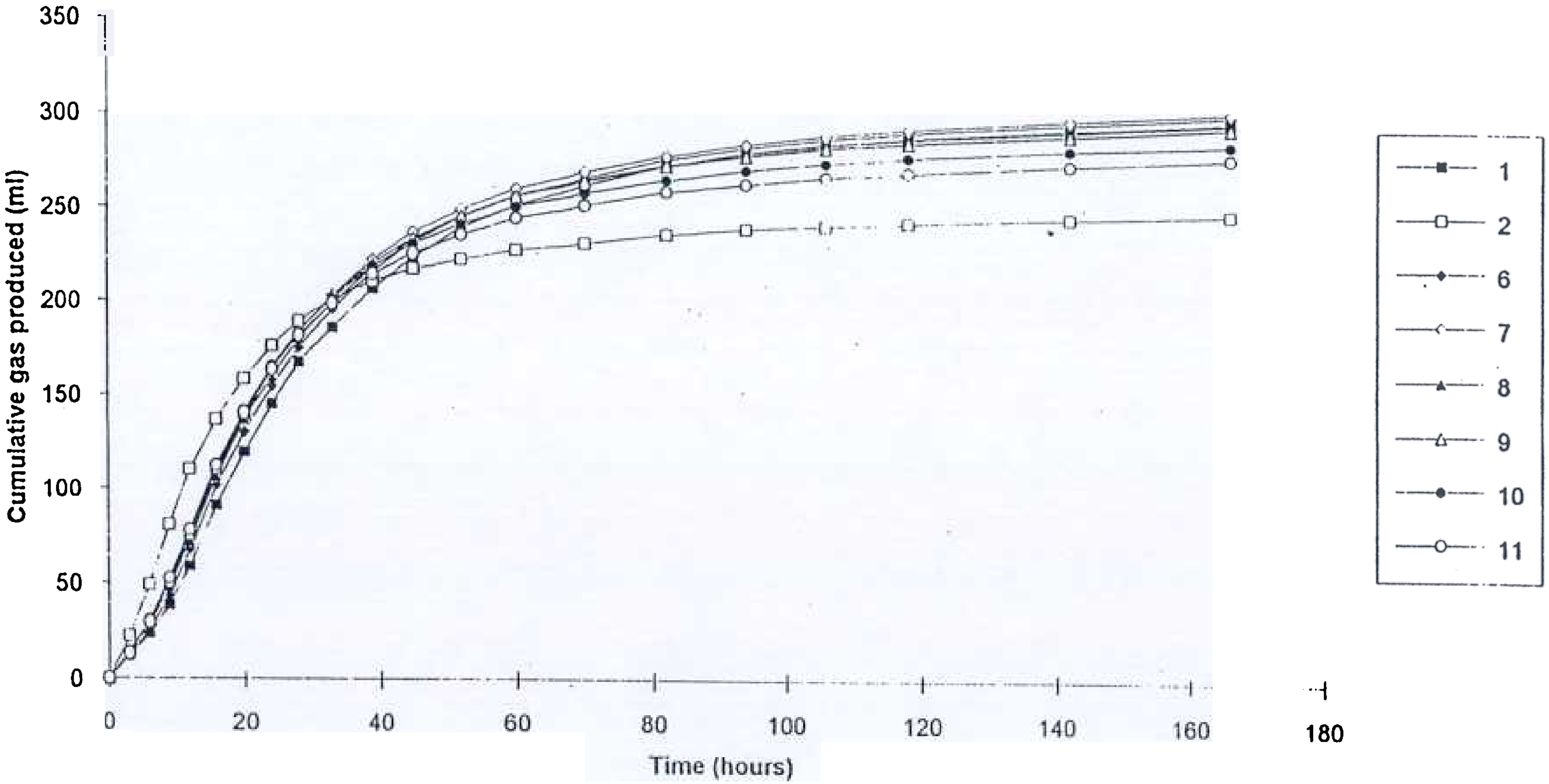
Figure 10 shows that apparent digestibility (recorded at 166 hours) of mixtures is greater than predicted. It has been demonstrated that under assay conditions the digestibility of a feed can be increased by fermenting mixtures instead of single substrates. It is therefore feasible that a similar situation occurs in live animals i.e. that feeding mixtures of feeds is more beneficial to the animal than a single feed.

Table :

Treatment	% Barley	% Lucerne	% Meadow	% Rye	% Timothy
1	100				
2		100			
3			100		
4				100	
5					
6	95	5			
7	90	10			
8	80	20			
9	70	30			
10	60	40			
11	50	50			
12	95		5		
13	90		10		
14	80		20		
15	70		30		
16	60		40		
17	50		50		
18	95			5	
19	90			10	
20	80			20	
21	70			30	
22	60			40	
23	50			50	
24	95				5
25	90				10
26	80				20
27	70				30
28	60				40
29	50				50
30	100				
31		100			
32			100		
33				100	
34					

Fig

Fermentation curves for mixtures of Barley straw and Lucerne hay



RYECURVS.XLC

Fig 2 **Fermentation curves for mixtures of Barley straw and Rye hay**

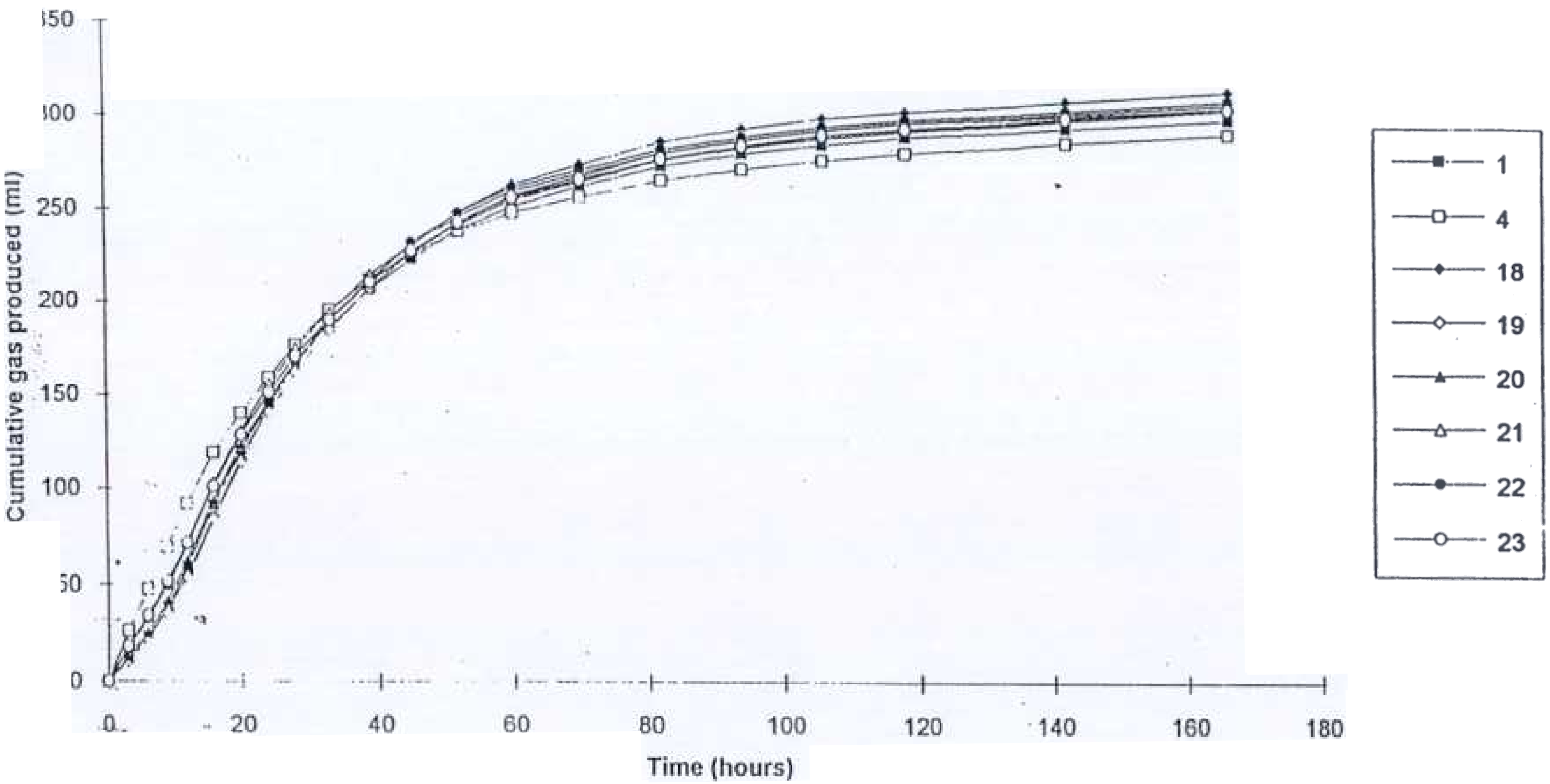


Fig 2 : **Fermentation curves for mixtures of Barley straw and Meadow hay**

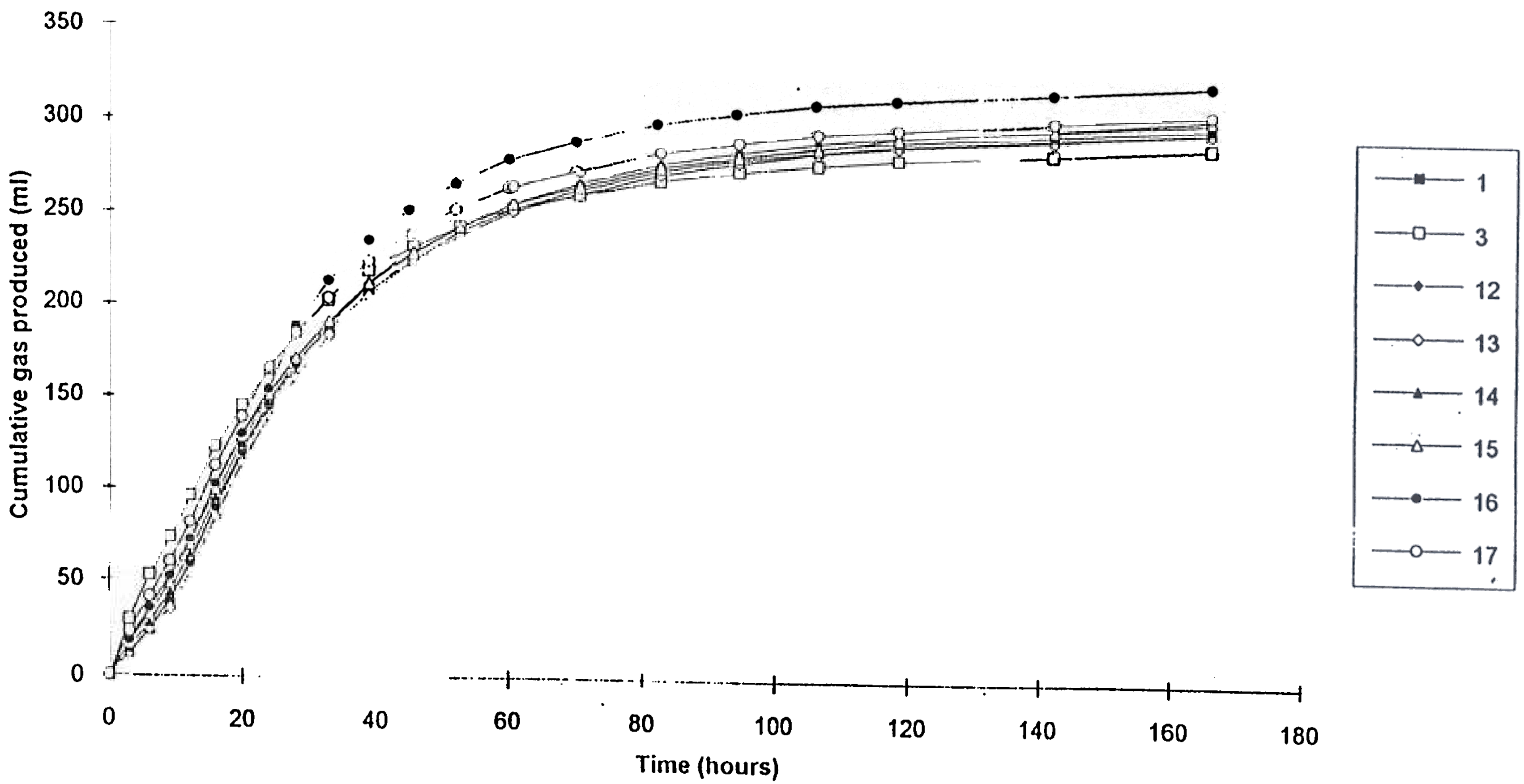


Fig 4: **Fermentation curves for mixtures of Barley straw and Timothy hay**

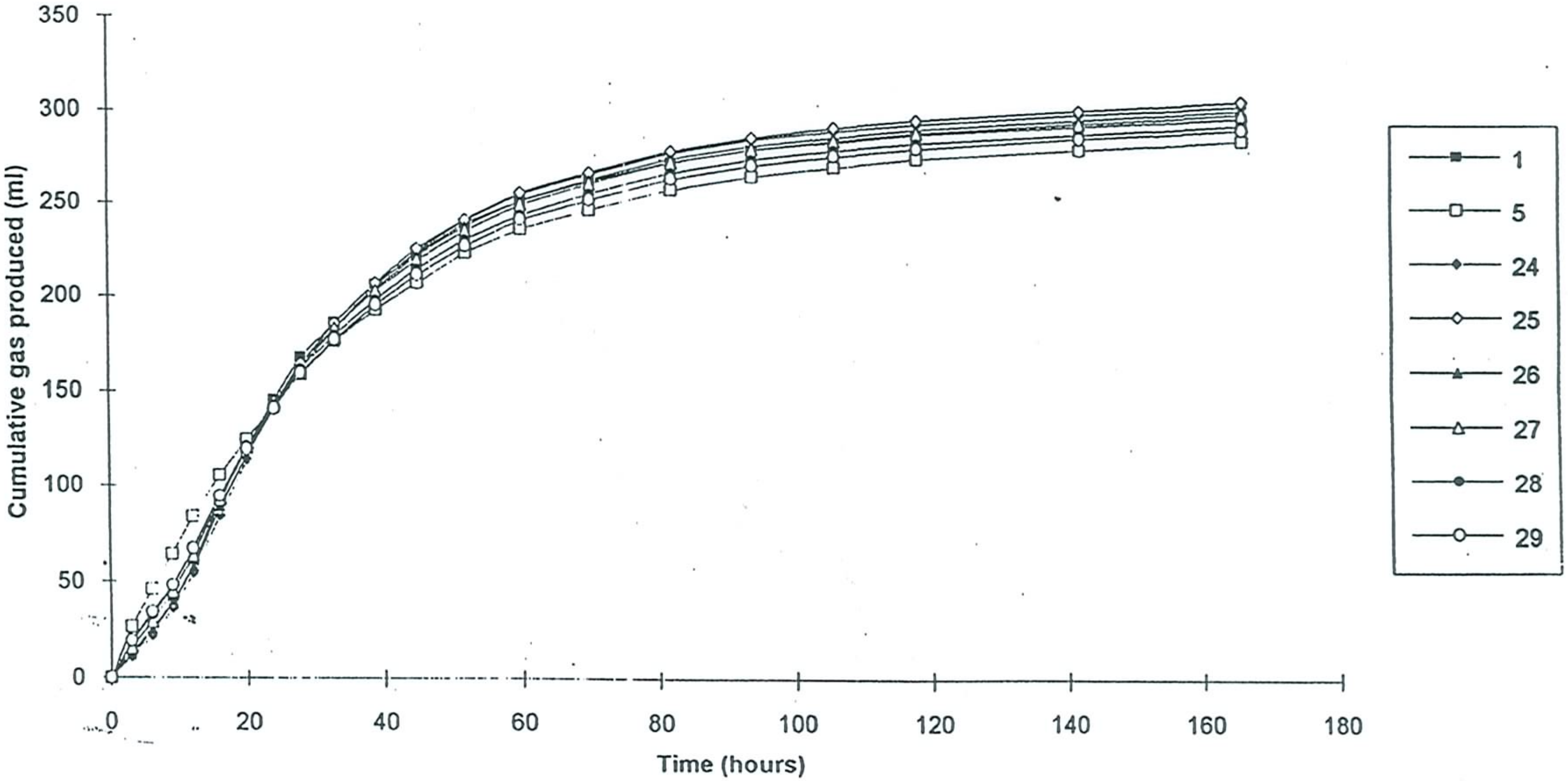
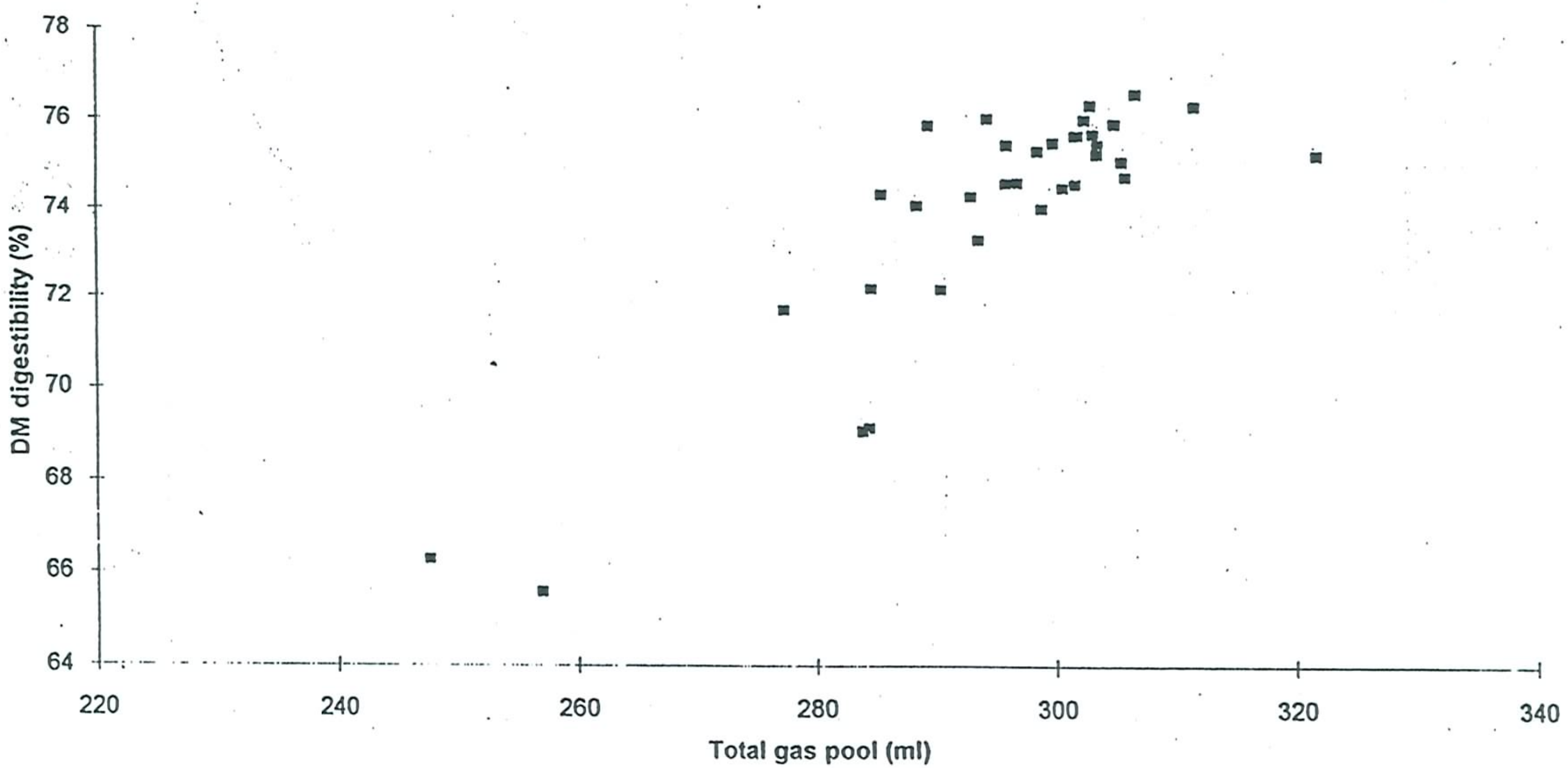
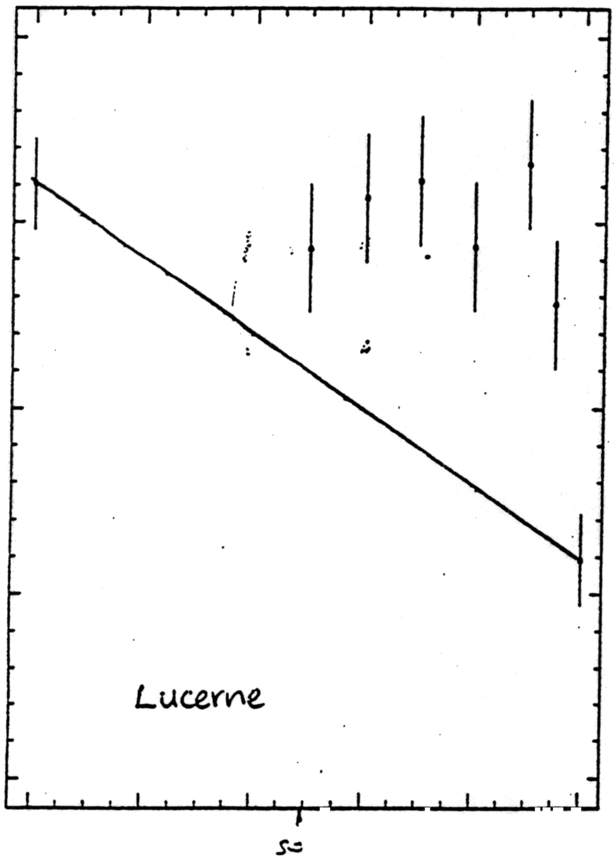
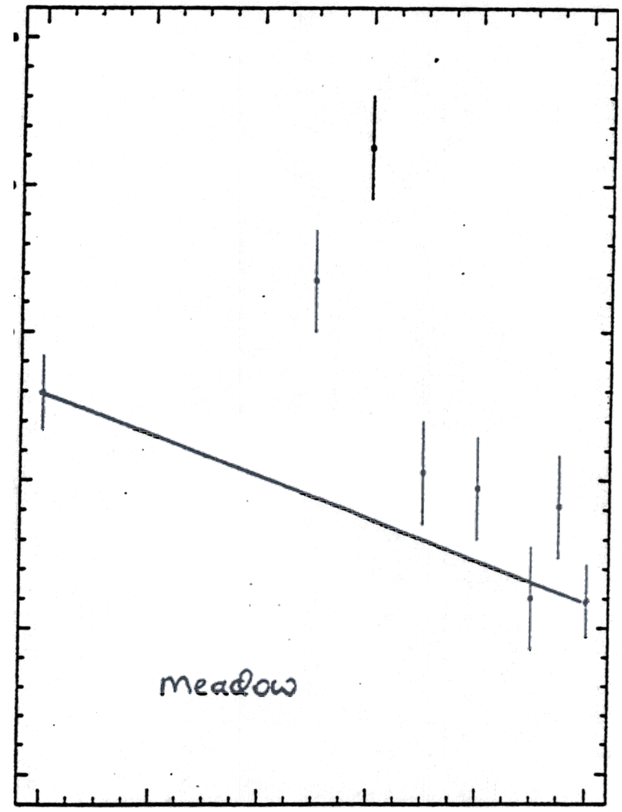


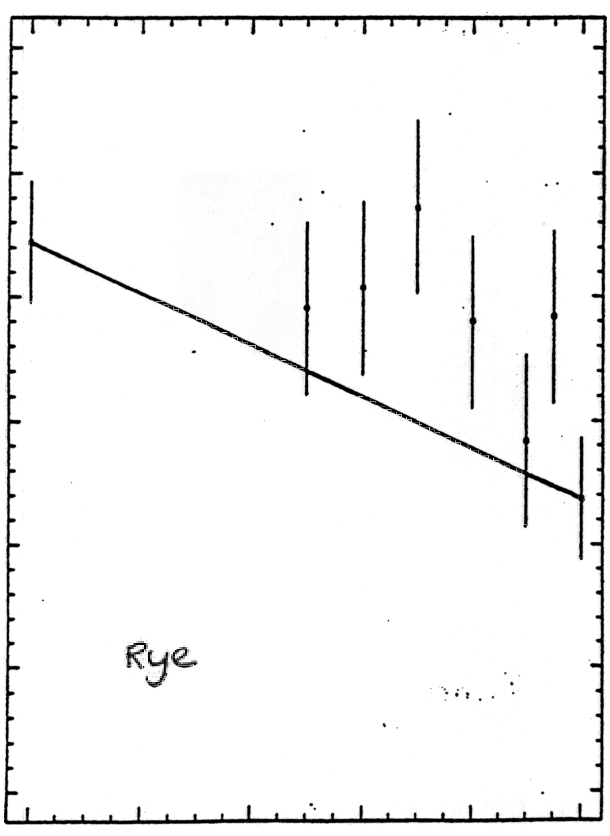
Fig 5: **Relationship between apparent dry matter digestibility and total gas volume produced during in vitro fermentation of mixtures of hay and straw**



F 6 33 Hours







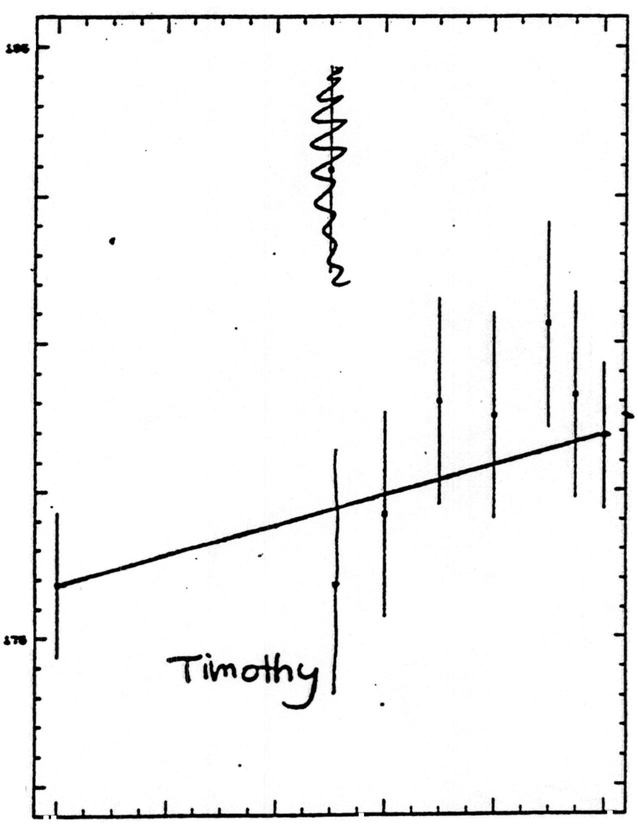


Fig 7: 52 Hours

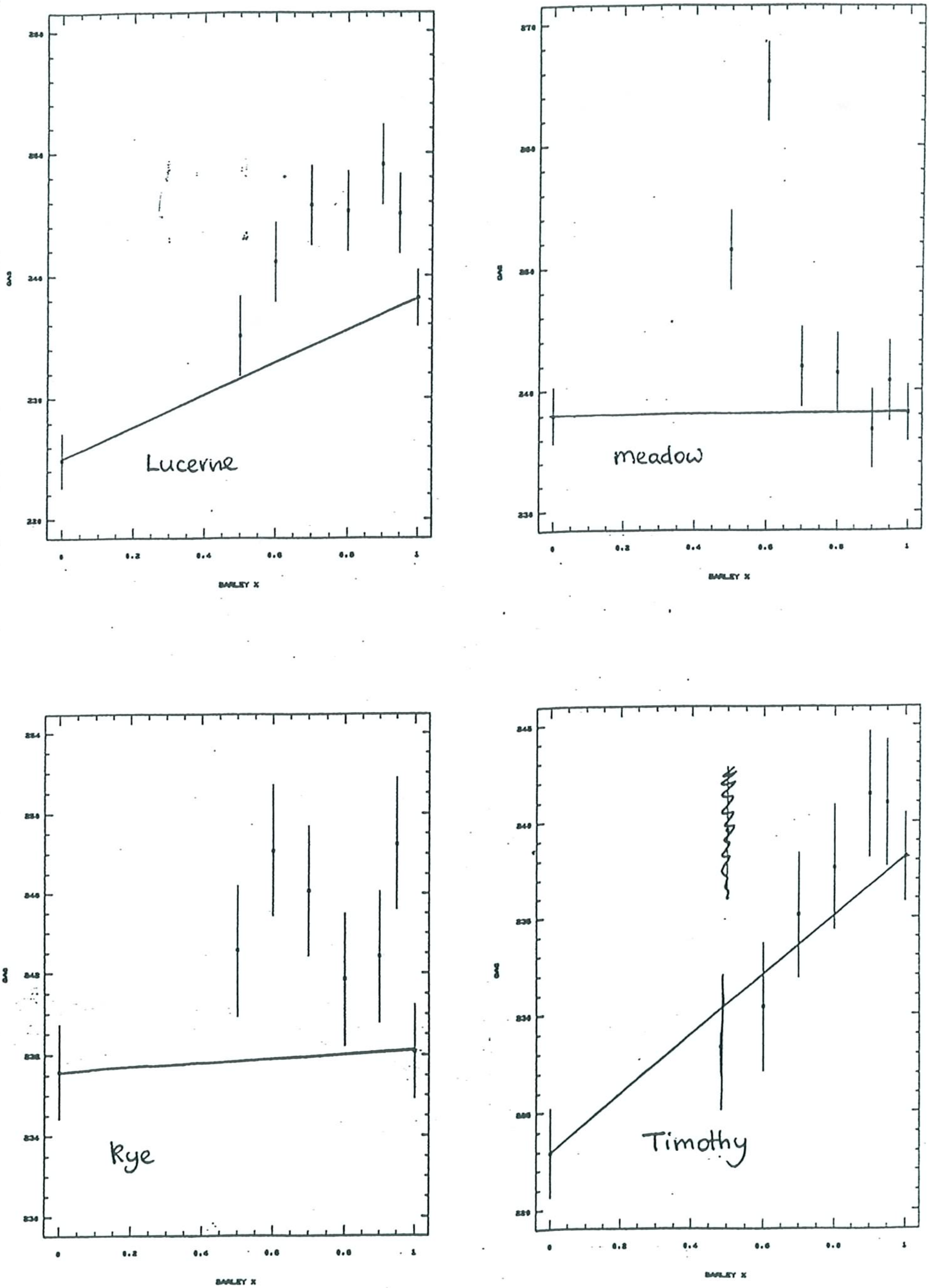


Fig 8: 94 Hours.

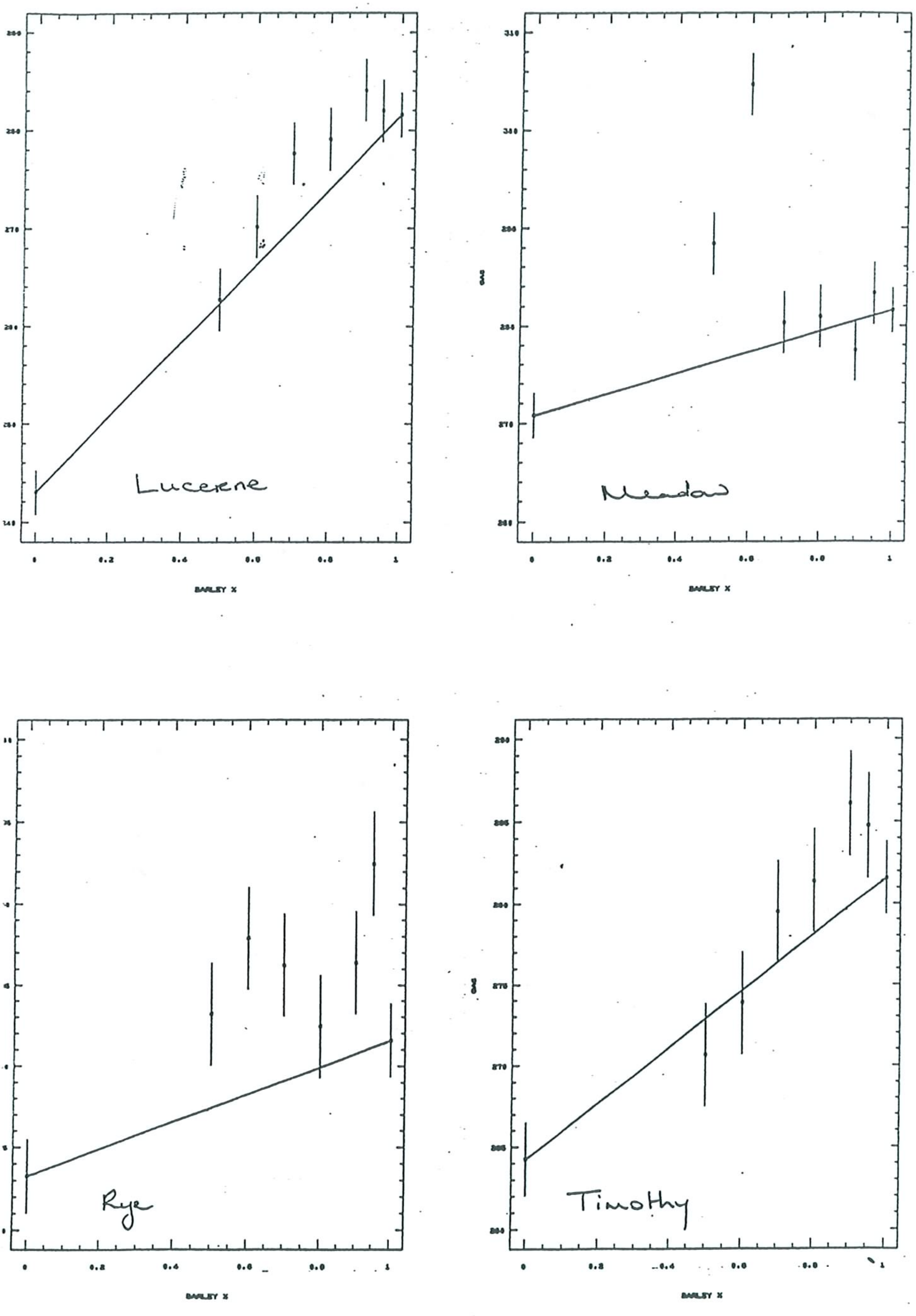
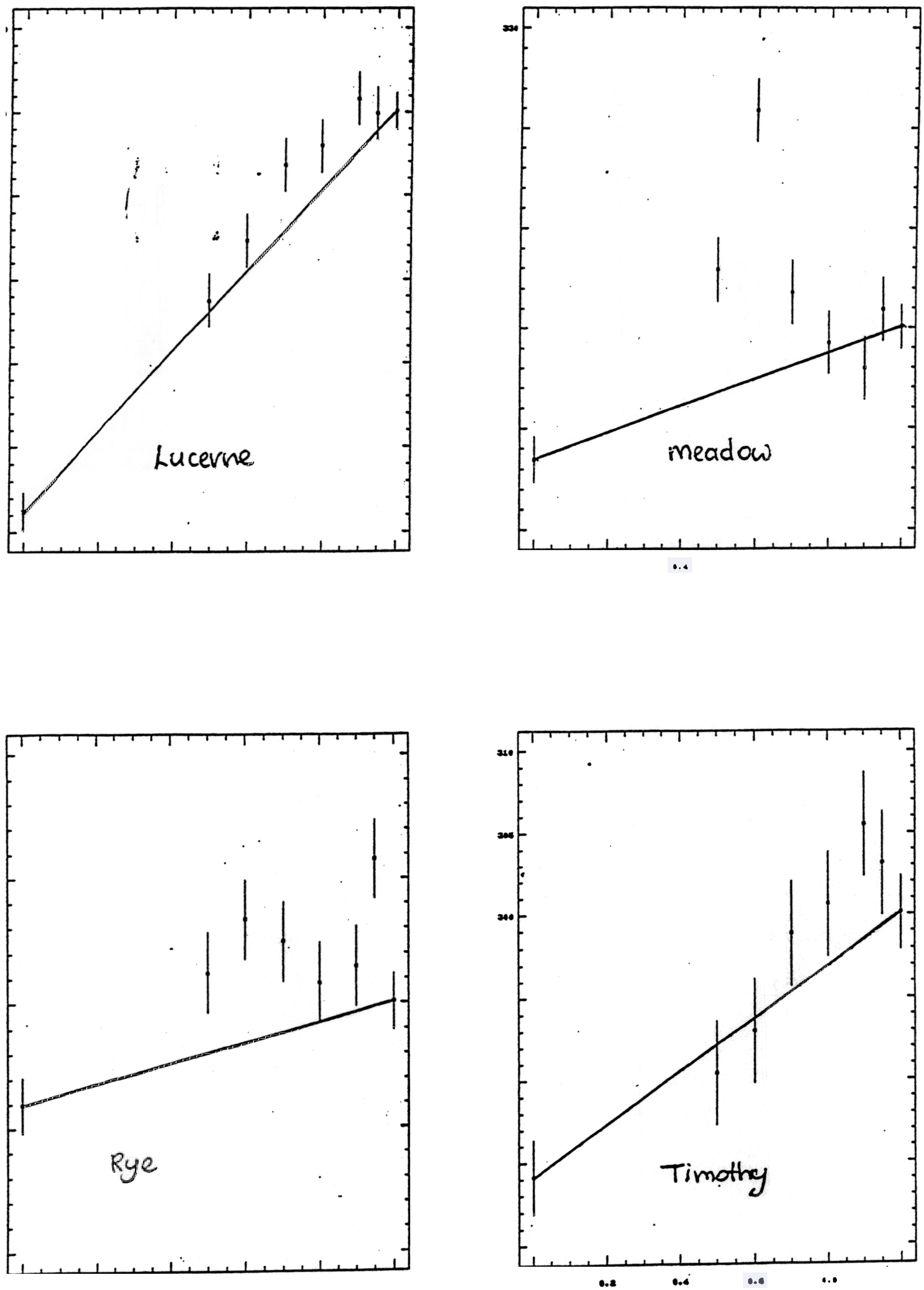


Fig 9 66 Hour



Apparent Digestibilities