calves weaned approximately 54 lbs. less per pregnant cow than any other group. This low value for the Jersey-Hereford group was due to the combined effect of low average weaning weights and a high mortality rate among the Jersey-Hereford calves after birth. This may simply be due to chance rather than indicative of the survival ability of this particular breed combination. It is apparent from these data, however, that it is possible for a particular breed combination that has a lighter weaning weight to rank somewhat better in lbs. of calf weaned per pregnant cow if there is less death loss due to calving difficulties (e.g., the Jersey-Angus). Reflecting total production on a per breeding cow basis appears to be a very important and realistic basis for comparing the productivity of different breed groups. It will be of interest to further compare these breed groups on this basis as additional data become available.

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Influence of Harvest Date and N and K Fertility Levels on Soluble Carbohydrate and Nitrogen Fractions in Winter Wheat Pasture

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Story in Brief

Previous studies had demonstrated the existence of high levels of soluble carbohydrates, total-N and nonprotein-N in winter wheat pasture samples. This past year, these fractions were measured in samples harvested at various intervals from early January to early May. Four fer-

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tility treatments were also tested, i.e., control (50 lb. N/acre), high-N (400 lb/acre), high-K (500 lb/acre) and high-N + high -K. Fertility treatments had no effect on soluble carbohydrate content. Total-N in plant tissue was not influenced by the fertility treatments during the winter but levels were slightly higher in mid-Spring in samples taken from plots with high-N fertility.

Soluble carbohydrates increased from 20 percent (D.M. basis) in January to over 30 percent in late February and then declined sharply to around 15 percent in late March. A second peak of 20 percent appeared in April followed by declines to <10 percent in May. Total-N varied between 4 and 5 percent of dry matter from January to early April after which a decline to values between 1.5 and 3 prcent occurred during vegetative spring growth. Nonprotein nitrogen (NPN) varied between 0.5 and 1 percent of dry matter with little seasonal effect. NPN constituted from one-sixth to one-third of the total-N in the plant tissue.

Introduction

Previous studies on winter wheat pasture had shown that the material harvested during the winter months contained large portions of soluble carbohydrates (as high as 25 percent), total-N (as high as 5 percent) and nonprotein nitrogen (>1 percent of D.M.) Such a high proportion of soluble carbohydrates agree with the known high nutritive value of wheat pasture. The nitrogen level, on the other hand, is far in excess of the quantity required for utilization of the carbohydrate present. This not only presents an inherent imbalance of nutrients but may contribute toward potential ammonia toxicity following consumption of large quantities of wheat pasture in a short period of time.

This paper reports the results of studies on the influence of date of harvest and N and K fertilizer applications on the content of soluble carbohydrates, total-N and non protein nitrogen (NPN).

Methods and Materials

Wheat was planted in the autumn of 1972 using four fertilizer treatments, namely, (1) 50 lb. N/acre, (2) 400 lb. N per acre, (3) 500 lb. K per acre and (4) 400 lb N and 500 lb K per acre. The high fertility levels were chosen in association with other studies on the mineral relationships in wheat pasture as well as the need for high N fertility for maximum forage production. Because of an unusually dry fall, growth adequate for sampling did not occur until January, 1973. Following that time, samples were harvested at varying intervals until early May. Samples were hand clipped, frozen immediately on dry ice and stored at —20°C until analyzed.

To prepare the samples for analysis, they were admixed with dry ice and ground through a previously cooled Wiley Mill. Thus, after allowing the dry ice to dissipate a ground sample was obtained without allowing it to thaw. Samples were then analyzed for cold water soluble carbohydrates by the phenol-sulfuric acid method of Dubois. Total-N was determined by the Kjeldahl method. NPN was determined by extracting the wheat forage samples in tungstic acid in a homogenizer. After centrifugation of the homogenate, both the precipitate and the supernate were analyzed for N.

Results and Discussion

Figure 1 illustrates the soluble carbohydrate (CHO) analyses. The general pattern of variation due to date of harvest was similar for all fertility treatments. Soluble CHO averaged between 20 and 25 percent of the dry matter in early January and increased sharply to over 30 percent in mid-February. Following that peak, it declined to 15 percent. There was a slight increase to near 20 percent in April but after rapid vegetative growth began the levels fell to <10 percent. One exception was the apparent sharp increase in the sample from the high-N plot in early May, for which no explanation is available.

The contents of total-N, protein-N and NPN are presented by fertility treatment in figures 2 and 3. Again, the general pattern was similar for all fertility treatments. Total-N and protein-N remained high from January to late March. Thereafter, they declined rapidly. The levels appeared to remain slightly higher in samples harvested from the high fertility treatments but there is not sufficient data to analyze statistically. Levels of total-N were between 4 and 5 percent of the dry matter in January. They varied only slightly until early April after which they fell rather precipitously.

Final levels in early May were variable from 1.5 to 3.0 percent. NPN levels did not show quite as much seasonal variation ranging between 0.4 and 1.2 percent of the dry matter. As a result, the NPN fraction constituted any where from ⅙ to ⅓ of the total-N on different days. On the last sample date in the High-N + K treatment, the NPN level was extremely high (near 2 percent). No explanation is available for this at this time.

The soluble carbohydrates shown to exist in these samples are quite likely very highly fermentable in the rumen. This is characteristic of a

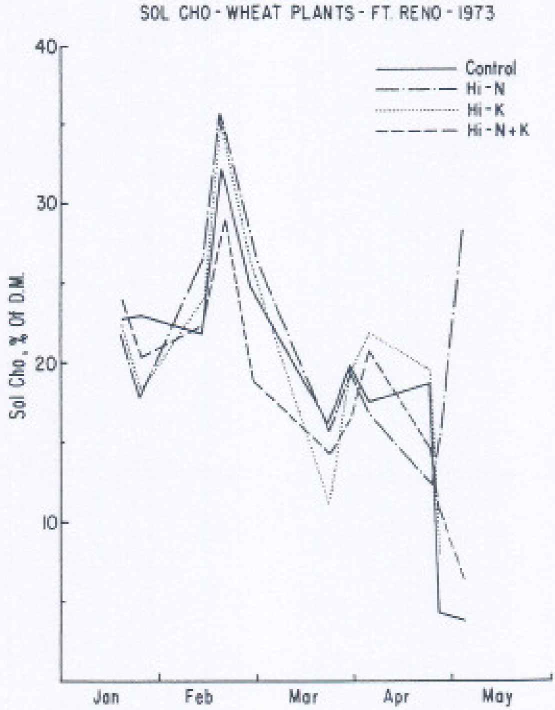

Figure 1. Soluble carbohydrate content of wheat pasture samples harvested from four fertility treatments in 1973.

material which is not only highly nutritious, energy wise, but also which passes through the digestive tract rapidly, allowing greater consumption. These are characteristics of wheat pasture already established by animal trials and field experience. Since the fermentation of soluble carbohydrates resembles the fermentation of sugar or molasses, one might expect rapid gas evolution during this time. This is of considerable interest considering the recent association of the wheat pasture stocker death syndrome with frothy bloat.

Possibly of greater interest are the high levels of nitrogen in the plant tissue. Firstly, these levels are far in excess of those that would be required to balance the carbohydrate available. Thus, wheat pasture is a "high protein" feedstuff and could, in fact, be used as a supplementary source of nitrogen with other N-deficient feedstuffs. From a simple percentage standpoint, one part of wheat pasture could be diluted or fed

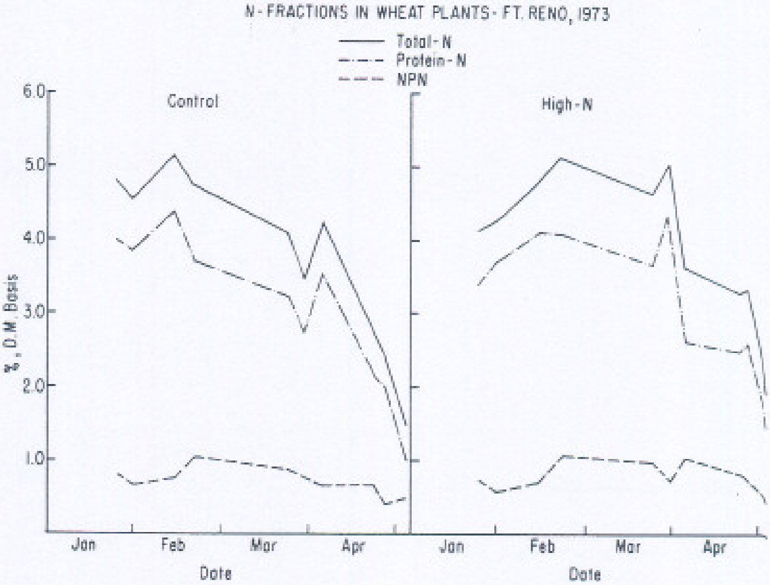

Figure 2. Total-N, Protein-N and NPN in wheat pasture samples harvested from the control (50 lb. N/acre) and high-N (400 lb./acre) treatments in 1973.

with 2 to 3 parts of a N-deficient feedstuff and still provide adequate N-intake. The nature of the protein and other forms of N have not been sufficiently studied. However, the fact that up to ⅓ can be present as NPN permits some speculation. This level of NPN alone is equivalent to feeding over 2 percent of the ration as urea. The solubility of the protein-N fraction is not known. Nevertheless, this complex would yield large quantities of ammonia in the rumen soon after consumption, possibly in toxic quantities.

Preliminary work by one of the authors (F. P. Horn, unpublished data) shows that rumen ammonia levels were extremely high after consumption of wheat pasture and this was coupled with extremely high rumen pH values (>7.0). These circumstances are ideal for ammonia toxicity. Although the classic symptoms of ammonia toxicity have not been observed, there is strong cause to suspect these circumstances as being directly connected to the initiation of the sudden death-bloat condition since rumen tetany is involved in ammonia toxicity. These possibilities are being investigated during the present year.

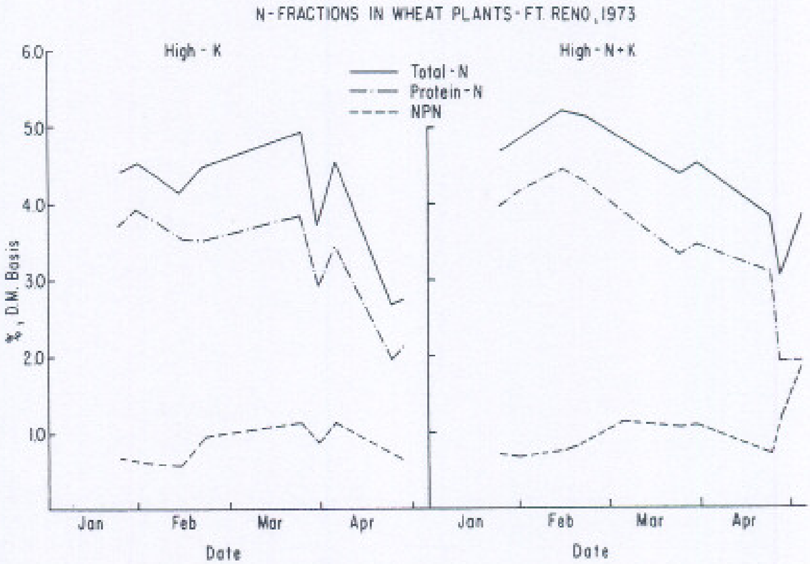

Figure 3. Total-N, Protein-N and NPN in wheat pasture samples harvested from the high-K (500 lb/acre) and high N + K treatments in 1973.

These results emphasize the high potential feed value of wheat pasture, but they also indicate that maximum utilization of this feed value would necessitate using this product as a supplement or at least as a companion to other feeds. This is practiced to a limited extent in the field. A longer look might be taken, however, at the means by which this maximum utilization of wheat pasture might be accomplished. This is especially important in the present situation of high costs for sources of supplemental-N.