Effect of Delays in Inoculum Collection on Artificial Rumen Digestibilities

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Highlight

Range forage samples were digested (in vitro) with rumen inoculum collected after delays of 2, 6, 10, and 14 weeks after the forage collection. Inoculum collected after the 6-week delay gave equivalent forage digestibility values as the 2-week delay; 10-week inoculum delay resulted in digestion values statistically related to but lower than the 2-week delay values. Inoculum collected after a 14-week delay could not be used to estimate range forage digestibility.

The artificial rumen (in vitro) digestion technique, which simulates natural digestion, is used to measure the nutritive value of forages for domestic livestock and wildlife. Since many forage samples can be analyzed easily at the same time, the technique has been increasingly used in recent investigations of range forage.

Several aspects of the technique are still in developmental stages. Problems in inoculum preparation and source, length of fermentation, fineness of grind and substrate influence, and drying temperature have been discussed by several investigators (Johnson, 1963; Shelton and Reid, 1960; Tilley and Terry, 1963; Van Dyne, 1962). The question has been raised as to the validity of using inoculum from an animal fed on a different kind of feed than the one being evaluated (Bezeau, 1965; Shelton and Reid, 1960; Van Dyne, 1962). For example, Van Dyne (1962) found that inoculum from animals fed high-quality alfalfa hay produced higher digestion values than when inoculum came from animals fed low-quality oat hay. Neither of the inoculum-source animals were fed on the kinds of feed being evaluated.

Before in vitro digestions can be made, freshly-collected range forage must be dried, ground, and weighed into digestion tubes or containers. After the forage has been prepared, rumen inoculum is collected from animals and added to the forage. This process usually requires a week, and sometimes longer. Therefore, the activity of the inoculum collected just prior to digestion trials may be different than it was when the forage was collected.

This paper presents results from artificial rumen digestion studies of range forage with different delays in inoculum collection.

Methods

The study was conducted on the ponderosa pine (*Pinus ponderosa* Lawson) range type of northern Arizona (*Pearson*, 1964). Forage samples consisted of Arizona fescue (*Festuca arizonica* Vasey), mountain muhly (*Muhlenbergia montana* (Nutt.) Hitchc.), sedge (*Carex* spp.), bottlebrush squirreltail (*Sitanion hystrix* (Nutt.) J. G. Smith), and mixtures of these species. The forages to be examined were prepared for digestion trials within 2 weeks after collection. At the end of the second week, inoculum was collected from rumen-fistulated cattle that were grazing on the range where the forage was collected (source 2). Inoculum was also collected from the cattle at 6, 10, and 14 weeks (sources 6, 10, and 14), and samples from original forages were again digested with these inoculum sources. Inoculum for the digestibility comparisons came from animals grazing on the same range, but on vegetation in different stages of maturity. The digestion technique used was that of Tilley and Terry (1963), with the filtration procedure of Alexander and McGowan (1961). Each forage digestibility sample was analyzed in triplicate.

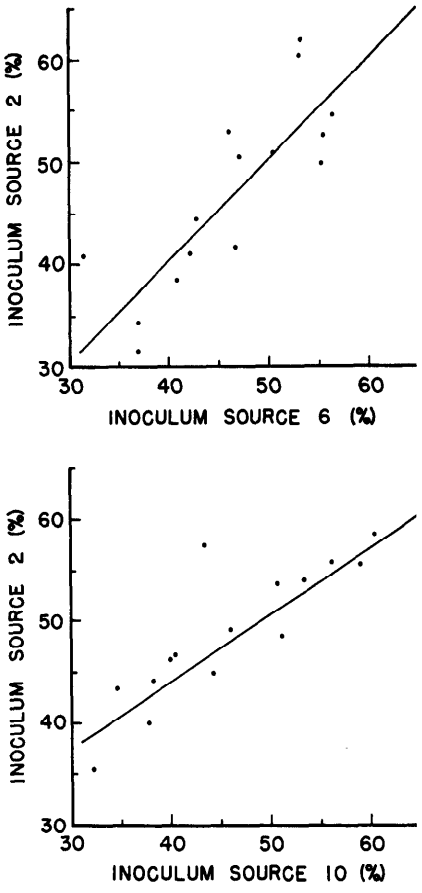

FIG. 1. Relationships of range forage digestibility (in vitro) with inoculum sources collected 2 and 6 weeks (upper graph) and 2 and 10 weeks (lower graph) after forage collection.

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Results and Discussion

Forage digestibilities obtained with inoculum sources 6 and 10 were highly correlated ($P < 0.01$) with forage digestibilities obtained with inoculum source 2 (Fig. 1). The relationships between inoculum sources are expressed by the equations $X_2 = 2.7 + 0.959X_6$ and $X_2 = 19.0 + 0.652X_{10}$, where the subscripts of X indicate the inoculum source (weeks elapsed between forage collection and inoculum collection). Digestibilities determined for inoculum source 14 were not significantly related to digestibilities with inoculum source 2. Since the first regression is not different from a line through the origin with unit slope, digestibility values from sources 2 and 6 may be regarded as equivalent. This is obviously not true for the second regression and a calibration equation must be used for estimating digestibility.

From these forage evaluations, with inoculum source 2 as a standard, it appears that digestibility could be determined with inoculum collected up to about 6 weeks after forage collection. If inoculum collection is delayed 10 weeks, a calibration equation is required for estimating digestibility. Inoculum collected 14 weeks after forage collection can not be used to estimate digestibility. These findings not only support the need for inoculum-source animals grazing the kinds of forages to be evaluated, as recommended by other workers, but also show a need for expediency in processing artificial rumen digestibility determinations.

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