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Measuring Forage Intake Rates

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A profitable feeding program for a dairy operation requires the liberal feeding of both good quality forage and high energy concentrates. In general, maximum forage intake occurs with excellent quality forage fed in combination with a high energy grain mixture that provides a palatable and balanced ration. Many feeding problems occur from overestimating both the quality and quantity of forages intake and may result in underfeeding. The contribution that forages can make in meeting the nutrient requirements for lactating cows is affected by both the quality and quantity of the forage. Of these, the quantity consumed is the most important. For example, it is not uncommon that a 10% reduction in forage quality measured in terms of TDN content results in a 20% reduction in forage intake. The net result is a decline in energy consumption of approximately 30%.

An ideal situation would be a means for measuring the forage intake for each cow in the herd. In many herds, increasing numbers and advances in feeding and housing systems make this an almost impossible task. The average forage intake rate for the herd is still a useful tool for developing an overall balanced feeding program. It is known that individual forage intakes follow the lactation curve, or cows tend to eat more in the early stage of lactation than in the latter stage. Also, the high producers in the herd tend to eat more and changes in the herd intake rate generally reflect uniform changes in individual forage intakes.

The purpose of this guideline is to show example calculations that will permit easy and rapid methods for estimating forage intakes in different feeding systems.

Forages Fed In Stanchion Barns

Place the usual amounts of forage fed to 10 cows on a split burlap sack and weigh on an accurate set of milk scales. Prior to the next day's feeding, collect the refused forages from the same 10 cows and subtract the weight from the amount fed. The average of the 10 cows selected at random will estimate the forage intake per cow for the herd.

Example #1

Silage fed to 10 cows totaled 530 lbs. The same 10 cows had 40 lbs of refused silage prior to feeding on following day.

$$530 - 40 = 490 \text{ lbs. silage intake}$$

$$490/10 = 49 \text{ lb. silage/cow/day}$$

Silages Fed With Mechanical Unloaders

Mark 4 separate locations of feed bunk into sections of 3' each. After filling bunk, weigh and replace the silage contained in each of the 3' sections. Prior to next feeding, weigh back remaining silage in same 4 locations and subtract from the amount fed. Convert the silage intake to a "per foot" basis by dividing by 12. Multiply the silage intake per foot by the total bunk length to obtain total silage consumed by herd. To obtain silage intake per cow, divide by total number of cows fed.

If silage is fed more than once per day, the above procedure should be repeated each feeding except that refused silage need only be removed after each day's feeding.

Example #2

Silage contained in 4 sections of a 78 ft. feed bunk weighed 81, 86, 73, and 66 lbs. in a total of 12 feet of bunk space. Refused silage in same locations totaled 8.5 lbs.

$$81 + 86 + 73 + 66 = 306 \text{ lbs.}$$

$$306 - 8.5 = 297.5 \text{ lbs.}$$

$$297.5/12 = 24.8 \text{ lbs. silage intake/foot of bunk}$$

$$24.8 \times 78 \text{ ft. in total bunk} = 1934 \text{ lbs. silage intake by herd}$$

$$1934/65 \text{ cows} = 29.75 \text{ lbs. silage/cow/day}$$

The above measurements could be obtained by determining the time the unloader is running at each feeding and collecting silage for 15 second intervals from the unloader.

Example #3

Silage was collected from unloader for 15 seconds. This procedure was repeated 4 times during the 12.5 min. that silo unloader was running. The 4 collections totaled 159 lbs. for each minute that silo unloader ran, 159 lbs. of silage was fed.

$$159 \times 12.5 \text{ min.} = 1988 \text{ lbs. of silage fed}$$

Correcting for the 55 lbs. of refused silage in total bunk would give total silage consumed.

$$1988 - 55 = 1933 \text{ lbs. silage eaten,}$$

$$\text{and } 1933 \text{ lbs./}65 \text{ cows} = 29.75 \text{ lbs. silage/cow/day}$$

Silage Self-fed From Bunker or Stack Silo

First determine the weight of silage contained in 9 cubic feet of silage or 1/3 cubic yard. This is the volume of silage contained in a space measuring 3' wide by 3' high by 1' deep. Dividing this weight by 9 gives the weight of silage per cubic foot. Calculate the total silage removed in one week. Multiplying the total silage removed by the weight of silage per cubic foot will estimate the silage fed per week. An allowance should be made for the amount of wasted silage. The average daily consumption per cow can be made by dividing the silage fed with allowances for waste by the number of cows fed times the days fed.

Example #4

Twenty-five cows are self-fed from bunker silo measuring 16' wide at top and 14' wide by bottom. Average height of silage was 6'. Two areas measuring 3' x 3' on face of silo were removed to a depth of 1'. The 2 volumes totaled 522 lbs. of silage.

$522 \text{ lbs.} / 18 \text{ cu. ft.} = 29 \text{ lbs. silage per cubic foot}$

After one week, 3.4 linear feet of silage was removed from bunker.

$15' \text{ average width} \times 6' \text{ average height} \times 3.5 \text{ ft. depth} = 315 \text{ cu. ft.}$

$315 \text{ cu. ft.} \times 29 \text{ lb. silage/cu. ft.} = 9135 \text{ lb. silage fed}$

Allowing 50 lbs. per day waste or $7 \times 50 = 350 \text{ lb. silage wasted.}$

$9135 - 350 = 8785 \text{ silage consumed}$

$8785 / 25 \text{ cows} \times 7 \text{ days or } 8785 / 175 = 50.2 \text{ lbs. silage/cow/day}$

Baled Hay

Weigh at least 5 bales, preferably 10 bales, to obtain an average weight per bale. Multiply average bale weight by number of bales fed per day. Divide to obtain total hay fed. Make corrections for refusals and divide by total animals fed.

Example #5

The 65 cows are fed 14 bales of hay daily in combination with silage. The combined weights of 10 bales totaled 412 lbs. and total refusal for one day equaled 24 lbs.

$412 / 10 = 41.2 \text{ lbs. per bale}$

$41.2 \text{ lbs./bale} \times 14 \text{ bales} = 576.8 \text{ lbs. of hay fed daily}$

$576.8 - 24 = 552.8 \text{ lbs. of hay intake}$

$552.8 \text{ lbs.} / 65 \text{ cows} = 8.5 \text{ lbs. of hay/cow/day}$

Conversion of Silage Intakes to Hay Equivalents:

Most group feeding methods are based on hay equivalent or dry matter consumption per 100 lbs. of body weight. By using the information contained in a forage test, these figures are readily available. To convert green forage or silage intakes to a dry matter basis, multiply the average intake per cow by the percent dry matter. This product is dry matter intake per cow. To obtain hay equivalents, divide the dry matter intake by 0.9 (average dry matter content of cured hay). To obtain the hay equivalents per 100 lbs. of body weight, divide average intake by average body weight per cow expressed in hundred weights.

Example #6

In examples 1 and 5, 49 lbs. of silage and 8.5 lbs. of hay were eaten per cow per day. Forage testing indicates that the silage contained 42% DM and the hay was 88% DM. Assuming that these intakes were obtained from the same herd, averaging 1300 lb./cow body weight, the hay equivalent intake would be calculated as follows.

$49 \text{ lbs. of silage at } 42\% \text{ DM} = 20.58 \text{ lbs. DM}$

$8.5 \text{ lbs. of hay at } 88\% \text{ DM} = 7.48 \text{ " "}$

Total + 28.06 lbs. DM intake

28.06 intake/0.9 avg. DM of hay = 31.2 lbs. of hay equivalent intake

Expressing the 2 above measures on a per hundred weight basis:

28.06/13 = 2.16 lbs. DM/100 lbs. body weight

31.2/13 = 2.40 lbs. hay equivalent/100 lbs. body weight

Estimating Silage Intakes by Difference

Another approach to estimating silage intake is by difference in dry matter intake. The capacity of a cow is limited to about 3.5 lbs. of dry matter per 100 lbs. body weight. This means a 1300 lb. cow will consume a maximum of 45.5 lbs. of total D.M. (13 x 3.5) but an average intake is about 3 lbs. per 100 lbs. or 39 lbs. for the 1300 lb. cow (13 x 3). Since the grain mixture intake is easy to measure and hay intake is not difficult (see Example 5), it is simple to calculate silage intake.

Example #7

1300 lb. cow producing 40 lbs. milk daily:

Consumes 10 lbs. grain (Ratio 1:4)

10 x 90% (D.M. of grain) = 9 lbs. D.M.

Consumed 8 lbs. hay

8 x 85% (D.M. of hay) = 6.8 lbs. D.M.

9 (grain) + 6.8 (hay) = 15.8 lbs. D.M.

39 (capacity of cow) - 15.8 = 23.2

23.2 ÷ 42% (D.M. of silage) = 55.2 lbs. silage

Importance of "Forage Quality" and Forage Intakes

Forage intakes by lactating cows are influenced by the quality of the forage. From a study of 19 silages fed to lactating cows, the following points concerning the influence of dry matter (DM) and crude fiber (CF) contents were apparent. With silages ranging from 16.8 to 41.4% DM and 18.9 to 39.2% CF, the average silage DM intakes increased 0.46 lbs. for each percent increase in silage DM when the level of grain feeding, milk production, and silage quality were considered. As the CF levels increased, (percent CF on dry basis declines with maturity and grain development in corn plant) intakes decreased 0.49 lbs. for each percent CF increase with fiber levels expressed on dry basis.

Another factor that influenced silage intake was the supplementary energy fed as grain. For each pound of supplementary TDN fed, silage DM intakes decreased by approximately 0.5 lb. In practical feeding program, there would be little effect on silage intakes unless heavy grain feeding was the practice. The area where silage intakes would be lowered significantly would be when grain was fed in excess of 10 lbs. grain/head/day. To take advantage of the effect of grain feeding and silage quality, it would be advisable to increase the protein content of concentrate mixes in order to feed less total grain while meeting protein needs.