Hay Study, USU

Addendum

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As an addition to the original report sent to Harvest Tec on a hay study conducted in 2013, it was requested that the hay bales be sorted in various combinations and the averages determined. Those averages were then put into a ration balancing program to determine what effect this would have on projected milk output based on ME (metabolizable energy) and MP (metabolizable protein). The base ration was adapted from the ration used at the USU Caine Dairy and was formulated for 90 lb milk, 3.7% fat, 3.2% protein and 60 lb DM/c/d (model calculation). The ration was a high forage ration (~59% forage AF; 36.3 lb DM from forage of which alfalfa hay constituted 61.7% of forage DM). Hay bales from 2 different fields and each from a different cutting were used to simulate hay as it would come out of the field. All bales were averaged for moisture % (then converted to DM%), CP%, ADF%, NDF% and RFV. The only items changed in the ration were those pertaining to the alfalfa hay of which the DM%, CP%, ADF% and NDF% were the only elements changed. After changing those items, the lb of alfalfa AF were adjusted to a consistent value (24 lb). Bales from within a field were averaged by the following scenarios: a) Base (average of all bales in the field); b) sorted by CP% and divided into 3 groups of < 1 SD from mean, =/- 1SD Mean, > 1 SD mean; c) sorted by RFV and divided into 3 groups of < 1 SD from mean, =/- 1SD Mean, > 1 SD mean; and d) using the original data of how the bales came out of the field, picked 1 out of 10-11 bales. This last scenario was repeated 4 times using a new starting point to see how stable the selection way. This is probably more systematic than a normal farmer would do, but represents sampling of a certain population from a field. Results are shown below. Tables 1 and 3 are the averaged data and ration results from Field 1, respectively. Tables 2 and 4 are the averaged data and ration results from Field 2, respectively.

It is important to remember that these diets are formulated to feed a high forage diet. It is also important to note that alfalfa hay grown in the Intermountain area is more consistent than other regions because of our growing conditions. With those two things in mind, the data can be interpreted in two different ways. The first is that if a person randomly selects ~10% of the bales as they come out of a field, composites them and used that average to formula a ration, it will give results essentially the same as the field average for all bales. However, it is obvious from the scenarios where hay was sorted by CP% and RFV that there is variation within a field that can show changes in milk production of about 3-4 lb ME milk or 4 to 6 lb MP milk (depending on the field; in our rations MP was more limiting than ME). Even though you have a ration balanced for the average of a field, you feed bales alone or in smaller batches, depending on herd size. Without making changes in bale composition, it is likely that a herd will see some daily variation that can’t be explained. However, if bales could be sorted after they come out of the field, a more consistent ration could be formulated that would minimize the unexplained variation and provide a more consistent ration for a herd. The only way this could be accomplished in a reasonable manner would be if they bale could be analyzed as it comes from the field. Waiting for a lab analysis may make it difficult to sort because of feed-out rate or excessive movement of bales after they are stacked.

**Table 1.** Field 1 averages for the different scenarios.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Scenario | No. samples | DM% | CP% | ADF% | NDF% | RFV |
| All bales | 78 | 93.5 | 19.7 | 32.3 | 38.1 | 156.5 |
|  |  |  |  |  |  |  |
| Sort Prot, <1 SD | 14 | 93.4 | 17.7 | 35.4 | 41.3 | 138.8 |
| Sort Prot, Mean | 47 | 93.5 | 19.6 | 32.4 | 38.1 | 155.7 |
| Sort Prot, >1 SD | 17 | 93.5 | 21.6 | 29.7 | 35.3 | 173.3 |
|  |  |  |  |  |  |  |
| Sort RFV, < 1 SD | 9 | 93.4 | 17.7 | 36.0 | 42.0 | 135.6 |
| Sort RFV, Mean | 57 | 93.5 | 19.6 | 32.4 | 38.1 | 155.8 |
| Sort RFV, >1 SD | 12 | 93.5 | 21.6 | 29.4 | 34.9 | 175.8 |
|  |  |  |  |  |  |  |
| Select every X, 1 | 8 | 93.2 | 19.3 | 32.8 | 38.4 | 153.9 |
| Select every X, 2 | 8 | 93.6 | 19.8 | 32.2 | 37.9 | 157.5 |
| Select every X, 3 | 8 | 93.4 | 20.1 | 31.6 | 37.3 | 161.9 |
| Select every X, 4 | 8 | 93.5 | 19.4 | 32.8 | 38.9 | 153.8 |

**Table 2.** Field 2 averages for the different scenarios.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Scenario | No. samples | DM% | CP% | ADF% | NDF% | RFV |
| All bales | 107 | 92.2 | 21.2 | 28.8 | 33.8 | 183.6 |
|  |  |  |  |  |  |  |
| Sort Prot, <1 SD | 16 | 92.3 | 19.1 | 31.4 | 37.0 | 162.3 |
| Sort Prot, Mean | 75 | 92.2 | 21.3 | 28.8 | 33.7 | 183.6 |
| Sort Prot, >1 SD | 16 | 92.3 | 23.1 | 26.6 | 31.0 | 205.0 |
|  |  |  |  |  |  |  |
| Sort RFV, < 1 SD | 15 | 92.3 | 19.2 | 31.6 | 37.3 | 160.8 |
| Sort RFV, Mean | 77 | 92.2 | 21.3 | 28.8 | 33.7 | 183.5 |
| Sort RFV, >1 SD | 15 | 92.3 | 22.9 | 26.3 | 30.8 | 206.8 |
|  |  |  |  |  |  |  |
| Select every X, 1 | 10 | 92.2 | 21.2 | 29.1 | 34.1 | 180.9 |
| Select every X, 2 | 10 | 91.9 | 21.5 | 28.5 | 33.5 | 186.2 |
| Select every X, 3 | 10 | 92.6 | 21.2 | 28.7 | 33.6 | 184.4 |
| Select every X, 4 | 10 | 92.1 | 21.7 | 28.2 | 33.0 | 189.3 |

**Table 3.** Results from Field 1 are listed as the difference between the base scenario, which was all bales from the field, and the scenario.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Scenario | ME, lb milk | MP, lb milk | ME, lb milk  (absolute difference in range) | MP, lb milk (absolute difference in range) |
| Sort Prot, <1 SD | -1.8 | -3.5 | 3.3 | 6.0 |
| Sort Prot, Mean | 0.0 | -0.1 |  |  |
| Sort Prot, >1 SD | 1.5 | 2.5 |  |  |
|  |  |  |  |  |
| Sort RFV, < 1 SD | -2.2 | -3.9 | 3.9 | 6.6 |
| Sort RFV, Mean | 0.0 | -0.1 |  |  |
| Sort RFV, >1 SD | 1.7 | 2.7 |  |  |
|  |  |  |  |  |
| Select every X, 1 | -0.3 | -0.6 | 0.1 | 0.1 |
| Select every X, 2 | 0.1 | 0.2 |  |  |
| Select every X, 3 | 0.4 | 0.6 |  |  |
| Select every X, 4 | -0.4 | -0.7 |  |  |

**Table 4.** Results from Field 2 are listed as the difference between the base scenario, which was all bales from the field, and the scenario.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Scenario | ME, lb milk | MP, lb milk | ME, lb milk  (absolute difference in scenario) | MP, lb milk (absolute difference in scenario) |
| Sort Prot, <1 SD | -1.8 | -2.6 | 3.3 | 4.3 |
| Sort Prot, Mean | 0.0 | -0.1 |  |  |
| Sort Prot, >1 SD | 1.5 | 1.7 |  |  |
|  |  |  |  |  |
| Sort RFV, < 1 SD | -2.0 | -2.6 | 3.7 | 4.2 |
| Sort RFV, Mean | 0.0 | -0.1 |  |  |
| Sort RFV, >1 SD | 1.7 | 1.6 |  |  |
|  |  |  |  |  |
| Select every X, 1 | -0.3 | -0.2 | 0.6 | 0.5 |
| Select every X, 2 | -0.1 | 0.0 |  |  |
| Select every X, 3 | 0.2 | 0.1 |  |  |
| Select every X, 4 | 0.3 | 0.3 |  |  |