DAIRY RESEARCH

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Here's some research to help

Expensive Corn and Short Forage Supply?

Record-high corn prices and short forage supplies will make ration formulation challenging this winter and spring. We have conducted research over the past few years which may help you put together diets that still make milk.

Lower the Starch

Last year we conducted a feeding trial that compared a conventional 26% starch diet to a lower 21% starch diets using two basic feeding strategies:

1.Increase the forage-to-concentrate ratio with highly digestible forage fiber from brown midrib (bmr) corn silage.

2.Replace starch from corn grain with non-forage fiber sources (NFFS) that are high in digestible fiber.

We evaluated three diets: 1) a standard diet comprised of 50% forage with 26% dietary starch, 2) a high-forage diet containing 63% forage with only 21% starch, and 3) a 50% forage diet similar to the standard diet but with NFFS replacing the corn meal to lower dietary starch to 21% just like the high-forage diet. The dietary ingredients and formulation are shown in **Table 1**. The standard diet was typical for the northeastern US and contained a 50:50 blend of conventional and bmr corn silage plus some haycrop silage. The high-forage diet contained over 50% bmr corn silage to boost digestible fiber with no added corn meal. The NFFS diet contained beet pulp, wheat midds, and distillers dried grains plus solubles in place of the corn meal.

From **Table 1**, we can see that the high-forage diet and the NFFS diets both had substantially less starch and greater NDF than the standard diet.

Table 1. Diet formulations and nutrient profiles for low-starch study.

	Standard	High forage	NFFS
Ingredients (% of DM)			
Conventional corn silage	20.0	---	20.0
Brown midrib corn silage	20.0	53.3	20.0
Haycrop silage	10.0	10.0	10.0
Corn meal	15.0	---	3.7
Beet pulp	5.0	5.0	10.8
Wheat midds	5.0	5.0	10.8
DDGS	---	3.3	4.2
Grain and mineral mix	25.0	23.4	20.5
Nutrient composition (% of DM)			
Crude protein	16.6	16.8	16.3
NDF	32.0	36.9	35.8
Starch	26.0	21.4	21.3

Table 2. Feed intake and milk production responses for the low-starch study.

Item	Standard	High forage	NFFS	P-value
DMI, lb/day	62.^{0x}	59.8^{y}	60.9^{xy}	0.08
NDF intake, lb/d	20.0^{b}	22.0^{a}	21.8^{a}	<0.01
NDF intake % of BW/day	1.23 ^{b}	1.35 ^{a}	1.34 ^{a}	<0.01
Milk, lb/day	113.5^{ax}	106.5^{by}	111.1^{abx}	<0.01
3.5% FCM, lb/day	115.7	113.7	115.3	0.78
Milk fat, %	3.66^{y}	3.98x	3.76^{xy}	0.07
Milk true protein, %	3.10	3.07	3.08	0.47

^{ab} Least squares means within a row without a common superscript differ (P 0.05).
^{xy} Least squares means within a row without a common superscript differ (P 0.10).

Dry matter intake was similar for cows fed the standard and the NFFS diets **(Table 2)**, but it was lower for cows fed the high-forage diet. Gut fill may have been approaching a maximum, possibly limiting feed intake even for this high-bmr diet, which underscores the importance of having highly digestible forage-NDF. As with intake, milk yield was similar

FYI

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for the standard and NFFS diets, but it was lower for the high-forage diet. Milk fat was boosted when cows consumed more forage and so 3.5% fat-corrected milk was the same for all diets. These results indicate that diets with NFFS can maintain similar milk production when substituted for starch in the form of corn meal. Increasing the level of dietary forage may limit intake if pushed too far, but overall solids-corrected milk yield and efficiency of solids-corrected milk production are the same for all three feeding approaches. The relative cost of highly digestible forage, various NFFS, and corn grain will determine which feeding strategy is most economical.

Forage Supplies Limited Too?

In addition to expensive corn, some producers face limited supplies of forage. Is it possible to feed low-starch and low-forage diets and still sustain productivity? We fed diets containing ~21% starch with 37% NDF and either 52, 47, 43, or 39% of a blend of corn and haycrop silages (see **Table 3**). As the forage content of the diets was reduced, wheat straw was incrementally added in an effort to maintain normal chewing activity and rumen function.

As the forage content of the diets decreased from 52 to 39%, dry matter intake increased with no change in milk production or milk components. As expected, chewing activity was similar for all diets despite the lower forage content due to the effectiveness of relatively small amounts of straw at stimulating chewing. Efficiency of milk production was similar for diets containing 52, 47, or 43% forage, but it was reduced when forage content dropped to only 39%.

Table 3. Ingredient and nutrient composition for the low-starch, low-forage study.

	Diet			
Ingredients (% of DM)	**52% forage**	**47% forage**	**43% forage**	**39% forage**
Corn silage	37.3	34.0	30.9	27.8
Haycrop silage	14.5	11.1	5.8	0.5
Wheat straw	-	2.0	6.1	10.3
Beet pulp	6.2	6.2	6.2	6.2
Grain mix[1]	42.0	46.7	51.0	55.2
Composition (% of DM)				
Crude protein	17.3	17.7	17.3	18.1
NDF	37.4	37.5	37.0	36.0
Starch, %	20.2	20.8	21.2	21.6
IV NDFD24h, %NDF	49.7	49.8	46.7	46.2

[1] *Grain mixes were unique to each diet, but all were comprised of the same feeds in varying proportions as % of ration DM: DDG 9-11%, SBM 10-12%, wheat middlings 7-20%, corn meal 5-7%, commercial soy 1%; minerals, vitamins and fat mix 5%.*

Table 4. Intake and milk production for cows fed low-starch, low-forage diets.

Item	52% forage	47% forage	43% forage	39% forage	P-value
DMI, lb/d	50.2	51.6	51.6	53.1	0.07
DMI, % of BW/day	3.47[b]	3.55[ab]	3.54[ab]	3.67[a]	0.03
Milk, lb/day	93.7	93.9	93.5	93.9	0.99
SCM, lb/day	88.0	87.5	89.7	88.2	0.53
Fat, %	3.62	3.52	3.68	3.59	0.24
True protein, %	2.99	3.01	3.04	3.02	0.32
SCM/DMI	1.76[a]	1.70[ab]	1.76[a]	1.67[b]	0.01

[ab] *Least squares means within a row without a common superscript differ (P 0.05).*

Lower forage diets with low starch content are a good strategy for feeding high-producing dairy cows under conditions of expensive or limited supplies of grains and forages, but the limit appears to be between 39 and 43% forage with these types of diets, particularly when high productivity is the goal.

A full report of these studies may be obtained by contacting us through our website: www.whminer.org.