

Using Irrigation to Feed a Large Dairy

How many dairy cows can one pivot feed? At the peak production a dairy cow can produce 40 kg of milk a day. The ration of a first trimester dairy cow is probably the most complicated cattle ration to balance for a couple reasons. First you hope to keep the cow for 4-5 years of production, so you don't want to burn out her rumen with acidosis. A feedlot steer has a shorter life expectancy so acidosis is a less of a concern. Also, with milk production that high, she has incredibly high energy demands. Dairy Nutritionists currently don't know how to get enough feed into her to keep her from losing weight during this first trimester period.

To keep it simple, we will just look at Total Digestible Nutrients (TDN) and Crude Protein (CP). A Nutritionist would balance a ration for many other factors as well. A 600 kg dairy cow's requirements are about 4 kg of Crude Protein, and 17 kg of TDN a day in the first trimester. That works out to a typical first trimester ration of about 18% Crude Protein (CP), and 73% TDN, with an intake of about 25 kg DM/day. So the question becomes what crops can I grow to produce the ingredients to fulfill that ration? You have



to also remember that a dairy ration is about 50% forage and 50% concentrate and some of the protein and TDN would come from each. The forage is basically what you have in the silo and the concentrate is then balanced to fit the forage. The concentrate will end up providing most of the TDN, and anything else that might be lacking in the forage. So the more TDN or other ingredients in your crop, the less you will need to add in the concentrate.

So let's make some assumptions and do some math to figure out how many pivots it takes to feed a 300 cow dairy herd for a full year. The new large dairies have a milking herd of about 300 cows which is why I chose 300 cows for a herd size.

In order to do that we need to know how much a cow eats. If half of the cows 25 kg DM/day ration comes from the forage she would eat about 13 kg DM of forage per day. So in 90 days that 300 cow herd would eat about 337 tons of forage DM. For the second trimester intake is cut back a bit to about 22 kg DM/day, or about 11 kg DM from the forage. So in the next 90 days a 300 cow herd would eat about 304 tonnes forage DM.

Table 1. Forage DM Required for a 300 cow dairy herd over a year.

	First Trimester	Second Trimester	Third Trimester	Dry Period
Total Intake (kg DM/day)	25	22	19	12
Forage Intake (kg DM/day)	13	11	10	12
Total Forage Required for 300 cows over the period (tons DM)	337	304	257	324

For the last trimester intake decreases even more, to about 19 kg DM/day or about 10 kg DM/day from the forage. So in these 90 days the 300 cow herd would eat 257 tonnes forage DM. During the dry period intake is restricted to only 12 kg DM/day. This is to prevent the cows from getting fat just before calving. Although there is no energy requirement for lactation, there is a smaller but increasing energy demand for pregnancy. Most of this ration would be forage, with only a small amount of concentrate. So a 300 cow herd would eat about 324 tonnes during these 60 days. So all together, a 300 cow dairy herd eats about (337 + 304 + 257 + 324) 1222 tonnes of forage DM per year.

So which crops do you grow to provide that? There are a number of different crop choices and Table 2 shows averages of some of our plots from over the years. As the table shows, the best crop to grow for TDN is corn, and the best protein crop is 3 cuts of alfalfa. So if you grow alfalfa, you will need less protein in the concentrate, or if you grow corn you'll need less energy in it.

Table 2. Average Yields and Qualities of Feed Crops under Irrigation.

	Corn	Barley	Oats	Triticale	Alfalfa (2 cut)	Alfalfa (3 cut)
Yield (65%M, t/a)	16	12	12	10	11	11
TDN (%DM)	70%	63%	52%	52%	40%	63%
CP (%DM)	8%	13%	12%	12%	15%	22%

Using the table, corn produces about 16 tonnes/acre of silage or for a 135 acre quarter section pivot, which works out to about 685 tonnes of DM. With 15% harvest and storage waste, just over 2 quarter section pivots of corn should provide the forage DM required to feed a 300 cow dairy herd for a year. By using just corn silage in the diet it would decrease the amount of grain required in the concentrate, although it would significantly increase the protein supplement. There are other nutritional reasons why you might want corn silage in the diet as well.

Barley silage has more protein than corn does, although a bit lower yield. With barley yielding about 12 tonnes per acre, a pivot would produce 437 tonnes of DM. So it would take about 2.8 quarter section pivots of barley silage to provide all the forage requirements. You would also be saving some protein supplement, but requiring slightly more grain to make up the TDN. Barley is also quite easy to grow and will grow on some poorer land than corn will.



Oats yields approximately the same as barley, although it has less TDN. Barley or corn silage can have a bit too much TDN for a dry cow ration, which would be the only reason you would grow oats instead. Triticale yields less, with similar quality to oats.

Alfalfa produces 11 tonne per acre of silage under irrigation and can be cut in either two cuts or three cuts. We have found you get approximately the same yield with either two or three cuts, although a three cut system the alfalfa

will be less persistent. If you cut it three times you can get a TDN approximately that of barley but with quite a bit more protein. You also have to include a year of lower production for establishment of the alfalfa. So a pivot of alfalfa would produce about 471 tonnes DM and it would take about 3 pivots to provide the forage for a 300 cow dairy herd for a year.

The amount of grain required depends a lot on the forage you grew. Since protein supplements are currently quite expensive, let's assume you grew alfalfa and cut it three times. A typical first trimester ration would include about 8 kg DM of barley grain, and 3 kg DM of wheat. Using these numbers this would require 732 tonnes DM of barley, and 275 tonnes DM of wheat over the 305 day lactating period. This would be an overestimation since the amount of grain would decrease in the second and third trimester rations. A quarter section pivot of barley produces about 90 bu/ac or about 264 tonnes DM, and a quarter section pivot of wheat produces about 70 bu/a or about 240 tonnes DM. So for this ration you would need another 2.75 pivots of barley for grain, and 1.1 pivots of wheat for grain.

So you could feed a 300 cow dairy herd for a year on 3 pivots of alfalfa, 2.75 pivots of barley grain, and just over 1 pivot of wheat. Two sections of irrigation should provide the land base to support a 300 cow dairy herd.

Of course there are many other factors that have to be looked at when formulating a ration. When you have the feed in the silo, send samples for analysis, it would be important to consult a nutritionist for the details.

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In the end, choosing which crop to grow really comes down to economics and management. It will really depend on your cost of production, the cost of buying the feed, and the cost of supplements. Do you want to be an expert at growing crops or milking cows or both? It may be cheaper on your dairy to buy the TDN in the form of barley grain (and paying a profit to the grower) than rent a pivot to grow corn and grow it yourself. It may be cheaper to buy the canola meal as a protein supplement rather than reserve the land for growing alfalfa. You really need to know your own cost of production for each of these crops before deciding.