Inma Agribusiness Program

LARGE DAIRY FARM MANAGEMENT GUIDELINES

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1. Introduction

These Guidelines outline the key factors to consider when planning to build or re-establish a large dairy farming operation in Iraq. The text is meant to assist the farm owners and management teams in developing business plans to establish or re-establish a profitable business venture in the dairy industry. For the purpose of this document, a large dairy is considered to be a farm with no less than 500 milking cows.

This report will make comments and recommendations on each of the following topics related to a large dairy farm:

- Feeds and nutrition;
- Crops, harvesting, and irrigation;
- Milk parlor, and cooling equipment;
- Cattle housing;
- Veterinarian care;
- Genetic improvement and artificial insemination (AI); and
- Farm management training.

These topics are not listed in order of importance, because all segments of farm management are equally important and intertwined.

There are many different feeding programs that will work on a dairy; however, this report will look at a corn silage and alfalfa haylage forage program and buying all grains and supplements from the local feed mill. These forages and grain supplements will be mixed together in what is called a Total Mixed Ration (TMR) and fed to the cattle in groups.

Agronomics practices will be recommended that will provide enough corn silage and haylage for one cow and her replacement heifer on 2 donums[1] of irrigated land, thus a 500 - cow dairy and it heifer replacements would require a 1,000 donums of irrigated land. As more land becomes irrigated, the herd size can be adjusted accordingly.

Appendices to the report include: pictures of suggested harvest and storage procedures in making and feeding alfalfa haylage and corn silage; and Total Mixed Rations (TMR) for several feeding groups in the farm.

[1] Donum - a traditional measurement unit of land surface in Iraq: 1 *donum* = 2,500 m^2 or 0.62 acres

2. Feeds and Nutrition

Adequate feed in the proper amounts that provide the animal with the exact nutrition it needs at a given stage of life, or production is the key to maximize weight gain or milk production for the herd to be profitable. About 50 % of the farm operating cost is feed cost regardless if it is purchased feed or home grown feed. In most countries in normal years it is just as expensive to buy feeds as it is to grow your own so many large farms buy all their forages and grains. However, in Iraq relying on purchased feed especially forages such as alfalfa and corn silages are very difficult at this time. In the future there might be a different situation. Purchasing small grains is easier especially if there is a working feed mill near the farm.

Both over feeding and under feeding cattle will increase the cost of production. Either way loses money for the farmer given the increase cost of feed or the loss of income from under feeding. The problem in Iraq in all livestock groups (sheep, cattle, lambs, goats, etc.) is under feeding. For better growth rate and milk production a better job of feeding the cattle is needed. When ever a farm is short on feed, the first thing they do is cut back on the amount fed to each animal. However, they either ought to buy more feed or decrease the number of cattle so the remaining cattle are fed properly. If a dairy farmer is not willing or able to follow this feeding principle, he should get out of or never get in the dairy business.

All cattle need energy, protein, minerals, and vitamins. Energy comes from carbohydrates sources being barley, corn, wheat, corn silage, and protein comes from alfalfa, soybean oil meal, sunflower oil meal, and other oil meal products. All these feeds have both energy and protein, but the small grains are high in energy and low in protein. The alfalfa and soybean also have energy, but are high in protein. Also, it is not just feeding the right feeds, it is also feeding them enough of it to achieve the milk production or growth rate desired.

Table 1 is a list of common grains and forages available in Iraq and the protein and energy value of each. These nutrition values are incorporated into a computer software dairy rations program developed by Michigan State University, and simple rations have been developed (see Appendix 2).

The nutrient values of all the listed feeds and forages are from The National Research Council of The Academes of Science (NRC). The two green feed samples listed in Table 1 that are highlighted were taken at a farm in Iraq, and tested at the Dairy One Forage Testing laboratory in Ithaca, New York. All feeds are compared on a dry matter (DM) basis. You will note that straw is on the list only because a lot of farmers in Iraq feed it. It has very little nutrient value as you can see.

Feeds *	%M	%CP	%ADF	%NDF	%TDN	NEL/kg	NEM/kg	NEG/kg
Grains & Supplements								
Ground Corn	12	10	3	9	85	1.98	2.09	1.43
Oats	11	13.3	16	32	77	1.76	1.87	1.21
Rye	12	13.8	4	9	84	1.94	2.07	1.41
Wheat	11	11.3	4	14	89	2.07	2.2	1.52
Barley	12	13.5	7	19	84	1.94	2.07	1.41
Soybean Raw	10	42.8	10	15	91	2.16	2.27	1.57
Soybean Roost	9	42.8	10	15	94	2.18	2.36	1.65
Soybean meal 44%	11	49	10	15	84	1.94	2.07	1.41
Soybean meal 48%	11	55	6	10	87	2.01	2.16	1.48
Sunflower Meal	7	50	10	15	65	1.48	1.48	0.88
Wheat Bran	11	17.1	15	51	70	1.61	1.63	1.04
Forages								
Alfalfa Hay Early blm	10	18	31	42	60	1.34	1.32	0.75
Alfalfa Green	**70.6**	**19.8**	**34.5**	**41.3**	**59**	**1.35**	**1.24**	**0.67**
Sorghum/Sudan Grass	**78.3**	**8.9**	**45.8**	**62.4**	**57**	**1.12**	**1.13**	**0.57**
Corn Silage	35	8.1	22	42	72	1.61	1.63	1.04
Straw	11	3.6	54	85	44	0.97	0.75	0.22
Mixed Hay	13	13	35	50	57	1.32	1.19	0.51

*** Definition of Terms**
%M = % Moisture
%(DM)=Dry Matter
%CP = Crude Protein
%ADF= Acid Detergent Fiber
%NDF= Neutral Detergent Fiber
%TDN= Total Digestible Nutrients
NEL= Net Energy for Lactating animals
NEM= Net Energy for Maintenance
NEG= Net Energy for Growth

Table 1 - These are average nutrient values for feeds from the National Research Council. Use to compare different feeds. All Nutrients listed are on a Dry Mater (DM) Basis. Green feed results are highlighted.

All feeds are compared on a dry mater basis (DM), meaning that all the water is removed so the feeds can be compared on the same basis. The green forages are high in moisture content; however you can compare it to all other feeds on a DM basis. The green fresh cut alfalfa feed is excellent in nutrient values and is comparable to the NRC book value of alfalfa hay just above it. The forage analysis test of the sorghum - sudan is good, but when compare it to corn silage just below it on the chart, and you will fine it is about the same protein at corn silage but higher in fiber and lower in energy. That makes corn silage a much better feed.

Using the dairy ration software program, below in Table 2 two balanced rations were developed for a cow producing 20 liters of milk per day, one feeding corn silage and alfalfa, and one feeding sorghum-sudan grass and alfalfa.

Grain Mix Cows with corn silage	Kg/cow/day	Ing/MT
Barley	2.25	44.06
Corn		0.00
Wheat Bran		0.00
SBOM	0.7	13.71
Lime		0.00
Mono Ph	0.05	0.98
TM Salt	0.04	0.78
Vit ADE	0.01	0.20
Mineral Mix	0.01	0.20
Molasses	0.01	0.20
Sorgham-Sudan		0.00
Green Alfalfa	22	430.78
Corn Silage	26	509.11
Total Feed/cow in Kg	51.07	1000
Cost/Day/Cow =	$3.59	

Grain Mix Cows with sorghum-sudan	Kg/cow/day	Ing/MT
Barley	6	119.71
Corn		0.00
Wheat Bran		0.00
SBOM		0.00
Lime		0.00
Mono Ph	0.05	1.00
TM Salt	0.04	0.80
Vit ADE	0.01	0.20
Mineral Mix	0.01	0.20
Molasses	0.01	0.20
Sorgham-Sudan	22	438.95
Green Alfalfa	22	438.95
Corn Silage		0.00
Total Feed/cow in Kg	50.12	1000
Cost/Day/Cow =	$5.45	

Table 2 - Grain and forage mix for a cow milking 20 liters of milk per day

Both rations provide the 20 liter cow with all the protein, energy, minerals, and vitamins she needs, however using current local feed cost note that one cost $3.59 a day and one cost $5.45 a day to feed a cow. Which ration would you use if you could choose either? A balanced ration comparison for ten months old heifer was also completed showing similar cost differences. The right hand columns on both ration is a 1,000 kg TMR mix of the same ration. The report will talk more about TMR below.

Recommendations

Infertility can be caused by poor nutrition, brucellosis and other similar diseases, and/or sexually transmitted deceases spread by the bull. In the veterinarian and all sections we will address the later situations. Cattle that are not getting all their nutritional needs will not cycle properly and the reproductive tracks will be small for their age. Poor nutrition is a major cause of infertility. Cattle conceive best when they are gaining weight. After a reasonable amount of time of attempting to get an animal pregnant, if she is still not with calf get rid of her. The feed should be going to milking cows and growing healthy heifers and calves.

Suggested rations are attached to this report for growing heifers, dry cows, milking two year olds, milking cows, and open (animals not pregnant) cows and heifers. The farm veterinarian and herdsman should be trained in animal nutrition, and have a computer and a ration balancing software to feed the cows and heifers. Just weaned calves should be fed dry alfalfa hay and grain and not corn silage or haylage. Their stomachs are to small to eat all that extra water. You can start feeding silages at four to five months of age.

A Total Mixed Ration (TMR) feeding program should be considered. TMR is applied when all forages and grains are mixed together for an entire group of cattle that are in perfect balance for their nutritional needs. The forages, grains, supplements, minerals, and vitamins are evenly distributed through out the entire batch. The two rations listed in Table 2 are TMR rations for a 1,000 kg batch in the right hand column. The left hand column is what one cow needs to eat in one day to get her total nutrient requirements. If you were mixing a TMR for a group of 100 cows and you were feeding them twice a day, you would multiply each ingredient in the ration times 100 then divide by 2 for each feeding. It would be best to feed twice a day. A TMR mixer with scales to weigh the amount of feed in it and operated by a tractor should be part of your business plan. A picture of a TMR mixer feeding the balanced ration to dairy cows is shown in Attachment 1.

3. Crops, Harvesting and Irrigation

In this section specific forage crops are recommended, and guide lines for calculating the donums needed for a given herd size. In Iraq, crops grow very well provided irrigation is available. If you must grow your own forages because they can not be bought, do not try to feed more cattle then your irrigated land can feed. You must also grow the forages that provide the most energy and protein per donum. This report is recommending corn for silage, and alfalfa for hay or haylage.

CORN SILAGE

Corn should be grown for corn silage to improve the feed quality and lower the feed cost. When corn become full eared and the corn kernels are in the soft dough stage, the corn grain and stalk is at its prime maturity for high quality corn silage. To harvest the corn as corn silage, you need a field chopper with a corn head that will cut the corn stalks off about 15 to 20 cm above the ground, and chop the whole stalk including the ear the average length of 2 cm. The chopped corn is put into bunker silos for fermentations and storage until feeding. It will provide twice the feed nutrients per donum of any small grain or shelled corn. Recommendations:

- Can two crops of corn be grown at your farm, one planted in February and chopped for the silo in about May or June, and one planted in August or September, and harvested in November or December? It sure would be worth a try to see if double cropping corn for silage can be done.
- A field forage chopper with a corn head should be purchased and part of your farm business plan. This chopper will also be used for harvesting alfalfa.
- Bunker silos need to be build for corn silage and alfalfa haylage storage and fermentation in a large herd dairy farm.
- By multiplying what one cow and her replacement need in one day or one year of corn silage and alfalfa haylage times the days of storage needed for each feed, you can calculate the tonnage of corn silage and haylage the needs to be stored in the bunker silos.

Appendix One has a picture of a bunk silo full of corn silage.

ALFALFA HAYLAGE

The other crop that is essential for a balanced ration is alfalfa. When the alfalfa field is just starting to bloom, it is at the peak of protein value. For every day after that it drops ½ of 1 percent of protein per day. So when you green feed alfalfa every day, the protein level of the feed is lower each succeeding day. It would be better to cut the whole field in one day, let it dry to about 40 to 60 % moisture, chop it with the field chopper, and put into a bunker silo. By feeding the cattle from the bunker silo, the daily feeds would be very uniform.

Alfalfa haylage is wilted alfalfa. You mow it with a mower conditioner into a windrow, and let it dry to between 40 and 60 % moisture. Depending on the weather, it could reach that moisture in the same day that it is mowed if it is very hot, or in cooler parts of the year, it will

reach that moisture lever the next day. A picture of a mower conditioner is in Attachment 1. Then with a pick-up head attached to your field chopper, chop the alfalfa into wagons or trucks and ensile it in separate bunker silos then the corn silage. By letting the alfalfa partially dry you prevent the formation of butyric acid. If direct cut alfalfa is put into a bunker silo, during the fermentation process butyric acid is formed, but at lower levels of moisture it does not form. Also direct cut silage will juice, meaning moisture will run out of the silo taking some nutrients with it. Cows will eat alfalfa silage with butyric acid in it but they will not like the taste as much or milk as much as alfalfa haylage that has been particularly dried before putting into the bunker. Also alfalfa silage with butyric acid smells very bad and can cause an off flavor in the milk.

Equipment needed for corn silage, and alfalfa haylage harvesting

- Field forage chopper – This is a machine with knives that cut the corn stalk and ear, and the alfalfa haylage the average length of 1 to 2 cm and blows it on a wagon or truck. A self-propelled chopper is recommended for a large dairy farm.
- Pick-up head for the chopper – This is a special attachment that is attached to the chopper. The pick-up head removes the alfalfa from the windrow and feeds it into the cutter part of the chopper.
- Mower conditioner – This is the machine that cuts the alfalfa and puts it into a windrow suitable for the field chopper with the pick-up head for chopping
- Corn Head for the chopper – This is a special attachment that is attached to the chopper where and when the pick-up head is removed. This head is specially designed to cut the mature corn stalk about 15 cm above the ground and feed the entire corn stalk including the ears into the cutter part of the chopper.
- Both haylage and corn silage should be cut in lengths of about 2 cm for corn silage or haylage to store in a bunker silo.
- Wagons or trucks to transport the chopped materials to the bunker silos
- A large tractor is needed at the bunk silo to spread out the chopped materials in the bunker and compress it.
- Bunker silos – These are long cement trenched that are big enough to store all the haylage and corn silage. Pictures of bunkers silos are in the attachment, one with corn silage and one with alfalfa haylage in them.
- The silos should be filled as quickly as possible, because when the silages are placed into the silo, fermentation begins.
- Covering of the silos after filling – The silos need to be covered with an air tight material like plastic or dirt to allow the fermentation process to occur for both haylage or corn silage and limit spoilage.
- Total Mixed Ration (TMR) machine – this machine is ideal for weighting each ingredient when added, mixing every thing together, and feeding the batch to the group of cattle to be fed. A ration will be mixed for each feeding group from weaned calves to lactating cows. The scale also allows the herdsman to know if enough feed is being fed to each pen. TMR feeding also assist the cattle in maintain a constant PH level in the rumen, with increased production as a result. A picture of a TMR mixer feeding cows is in the attachments.
- Loader tractor – This machine can load the silages into the TMR mixer in the proper amounts. It can also assist in the filling of the silos.

GRAINS AND CONCENTRATES

A good alfalfa haylage – corn silage forage program will lessen the amount of grains and protein supplement needed to feed all groups. The available land for crops should be used only for alfalfa and corn silage production. Grains and supplements should be bought and mixed by a feed mill according to your nutritionist recommendations and delivered to the farm as needed. Supplement and grain storage at the farm need to be rodent proof, and located so the supplement can be easily added to the TMR mixer. The veterinarian and herdsman should be trained in dairy cattle nutrition and mixing and feeding TMR according to each feeding groups nutritional needs and the number of animals in each feeding group.

AVAILABLE LAND USE

Assuming the available irrigated land will be used for growing alfalfa and corn for silage, we need to determine the donums of each crop that need to be planted to support a certain number of cows, and heifers. You must determine the tons of haylage and corn silage that is needed and the donums needed to grow it. In these projections we will make some assumptions based on the milking cow and growing heifer rations in Table 2 and the Attachment 2:

- In most dairy herds there are as many growing heifers as milking cows in a herd. (ex- a 1000 cow dairy has about 1000 growing heifers, bred heifers, and calves)
- In the two rations being used from Table 2 and Attachment 2, each milking cow is projected to eat 26 kg of corn silage a day and a growing heifer will eat 8 kg for a total of 34 kg / day
- Multiply that times 365 days in a year and you need **16 ton** of corn silage per cow and a heifer per year
- If you can double crop corn for silage, it would be possible to harvest 16 tons of corn silage per donum**. So 1 donum could produce enough corn silage for one cow and one heifer**.
- Using the same methodology, 1 cow and a heifer will use about 4 tons of alfalfa hay equivalents (or about 10 tons of ensiled haylage) per year.
- A well managed alfalfa program could easily produce 4 tons of alfalfa hay equivalents (10 tons of alfalfa haylage) per year per donum. **So 1 donum could produce enough haylage or dry hay for one cow and one heifer.**
- 2 donums are need to grow enough corn silage and haylage or baled hay for 1 cow and 1 heifer for a year and that is assuming that all supplements and grain are purchased form a feed mill.
- **Therefore, 1000 donums could support a 500 cow herd and their growing young stock. Once you determine the size of the herd, you can determine the donums that need irrigation.**

RECOMMENDATIONS

Crops grown on available land should be corn for silage and alfalfa for haylage. Herd size should be based on the availability of irrigated land. Do not use your available land to grow small grains like barley, wheat, or corn for grain. If will be more economical to purchase the grains and protein supplement from a reliable feed mill who will mix the supplements according to your nutritionist specifications, and deliver it in bulk to the grain bins on the farm as needed.

IV. Milking Parlor, Milking Procedures, Cooling Equipment and Cattle Housing

The milking parlor is where you harvest you main cash crop, milk. This equipment is used every day of the year, and requires regular maintenance and tuning by trained engineers. Careful thought needs to be given when determining how you will milk the cows. An automated computerized labor efficient parlor is very expensive. In Iraq, labor is not expensive so you might want to consider a more labor intense parlor. Let's compare these two options:

MILKING PARLORS

Automated Computerized Milking Parlor

An excellent parlor system that when maintained and operated properly will do a good job of milking the cows properly, recording production and herd health information, and providing valuable information for management decisions and herd health information. Return on you investment, and hard work occur in the milking parlor. However, this equipment requires regular service and maintenance, or production will be hinder, and mastitis will become a major problem. To follow are guidelines and suggestions for proper milking parlor operations:

- The farm should send a top employee engineer to the manufacture for training to learn how to maintain and service the parlor.
- The farm computer operator needs training in how to fully operate and utilize the data information center connected to the parlor.
- All vacuum pumps need daily observation. Each time they are turned on, the vacuum level must be checked to make sure the manufactures recommended level is occurring. If not, adjust the vacuum controllers to the proper level. At least twice a year each vacuum pump needs to be taken apart and worn parts replaced by a company trained service man.
- All milkier and parlor parts need replaced when necessary.
- The milkier inflations that attach to the cow's teats should be replaced once a month.
- A parts inventor needs to be kept, and arrangements with the manufacture to ship parts needed when not in inventory to the farm as fast as possible.
- All milkier and milk pipelines need to be washed in place by the parlor washing system after each milking, and sanitized prior to starting the next milking. Use only recommended soap, acid rinses, and chlorine sanitizers recommended by the manufacture.

Lower Cost Labor Intense Parlor

We will call this parlor the Flat Parlor. This is a flat barn with 100 lever action stations. A pipeline milkier system runs the entire length of the barn so cows can be milked at any

location. The people milking the cows start milking at one end. When they get 50 cows milked, workers will remove those cows and bring in the next group of 50 cows while the milkier continue with the remaining 50 cows. When then second group of 50 are finished, the people move to the other group and keep milking. The workers then change that group. Continual milking occurs as cattle are being moved in and out of the two ends of the flat parlor. This system requires more labor, but can be as fast as the automated parlor, and the cost is much less. Recommendations:

- All vacuum pumps need daily observation. Each time they are turned on, the vacuum level must be checked to make sure the manufactures recommended level is occurring. If not, adjust the vacuum controllers to the proper level. At least twice a year each vacuum pump needs to be taken apart and worn parts replaced.
- All milkier parts need replaced when necessary.
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MILKING PROCEDURE

The conditions of the milkier inflations and the vacuum pump must be monitored and kept in perfect working order or you will have mastitis problems in the herd. Besides keeping the equipment working properly, the following are milking practices that will greatly lower mastitis cases in the herd.

- Replace teat cup inflations once a month
- Turn the parlor systems on, and check vacuum levels before each milking.
- Preparing the cows for milking. If the cows are fairly clean, do not wet wash the cows prior to milking.
- Dry wipe each cow's teats with an individual paper towel to remove lose dirt. Recommend that you buy the lowest cost brown toilet paper you can buy and tear off about 15 to 20 centimeters, and wipe each teat with it. No warm soapy water unless the cow is really dirty.
- Teat dip each teat with a commercial teat dip. This procedure is called predipping
- Wait 30 seconds and blot dry all four teats with another paper towel.
- Apply milkiers.
- When cow had completed giving her milk, post dip each teat with the same teat dip and do not touch the teat again until the next milking.
- If a commercial teat dip it not available or affordable, you can make your own Teat-Dip solution as follows: 1 liter of clean water, 3 table spoons of Ace clothing bleach, a big drop of Dosia or any good dish water soap. Shake well.
- Make sure the bleach is chlorine bleach.
- The chlorine in this teat dip is unstable, so the mixture should be made just prior to milking time. The dip cup full of the teat dip can be used on many cows before it needs to be thrown away. If it becomes dirty, throw it away and pour in a fresh solution. Do not keep a used solution until the next milking, but you can use the dip for several different shifts through the parlor. There should be a teat-dip cup available of every person in the

parlor who milks cows. Several liters of teat dip can be mixed before milk, and taken to the parlor. The milkiers can refill their teat dip cups from these bigger bottles as needed. A teat dip cup is about the size of a large coffee cup and should be plastic so that if it is dropped, it will not break.

- This milking procedure and a well tuned milking machine will greatly reduce mastitis in the cows and increase milk product 5 to 15 %.

COOLING MILK TANKS

All equipment requires regular servicing and maintenance. Large enough stainless steal milk cooling tanks are needed to store all milk for two days and make sure all milk is cooled to 3 or 4 degrees centigrade. After the tank is an empty, wash tank with same soap, acid rinses, and sanitizers as used in the parlor. The goal is to produce the cleanest, healthiest milk for the dairy plant.

V. Cattle Housing and Care

The cattle can be housed in a loose housing or free stall type of buildings that are designed for the hot climate of Iraq. These buildings should be open on all sides with a large offset opening in the middle of the roof so that on the very hot days with the barns full of cattle, the buildings will be cool and well ventilated (Hot moist air will rise and go out the openings in the roof). Calves can be kept in the open barn year around. It is recommended that three sided of the calf pens be wrapped with a canvas on the prevailing wind side during the two coldest months of the winter, but kept in the open barn year around.

Tips on cattle care:

- Feed should be available in the mangers 20 hours out of a 24 hour day.
- If a TMR mix is not fed, feed corn silage on one feeding, and alfalfa haylage on the next feeding. The grain amount for a particular pen should be fed twice a day and put on top of the silage after feeding the silage. This will work in the absence of a TMR mixer; however the most feed efficiency is obtained with TMR feeding. It will pay for itself in increased milk production and feed efficiency.
- Keep that manure clean up as necessary, and use the manure on crop fields.
- Water availability is an absolute essential 24 hours a day particularly with lactating cows.
- One or more persons must walk through the barns just looking at the cattle twice a day with a note pad to write down cow's number of animals that are in heat, have sore feet, not eating, or any other sickness. This person should have no other responsibility except observe ever animal in the barn during the walk through. This walk through should occur between feedings and not at feeding time.
- The observer should either be the farm veterinarian, or report to the veterinarian with all information after each walk through. Sick animals must be reported to the veterinarian for immediate attention.
- Another good time to observe the cattle is just after feeding the TMR. Especially look at the animals that do not run up as soon as the feed is out. This is a good time to see cattle with feed disorders.
- When most cows are not eating, look for 40 to 60 % of the cattle chewing their cud. This is a good sign of healthy ruminating cows.
- Calves on milk need to have fresh water, fresh grain, and alfalfa hay available 24 hours a day.
- Calf pens should be bedded with straw or sand especially during the winter months.

VI. Veterinarian Care

The herd veterinarian is a key person and an essential link in the dairy farm operational team. Preventative veterinarian medicine is the term used in Western dairies. Preventative medicine involves bi-monthly herd health checks that include:

- Vaccinations for diseases prevalent in the region
- Monitoring the nutrition of all feeding groups in the herd to see if expected results are occurring such as milk production on milking groups, and weight gain on replacement heifers and calves.
- Individual cow health records should be kept on the results of veterinarian pregnancy checks and due dates, reproductive track rectal examinations of all open cows, and cows bred long enough to be pregnant.
- Individual animal health records containing all the information from the veterinarian's work should be recorded in the individual cow record book by the person in charge of record keeping.
- The herd should be checked at least annually for Tuberculosis, and Brucellosis.

Veterinarian medicine is an ever changing profession, and their needs to be a continuing education program for the herd veterinarian.

VII. Genetic Improvement and Artificial Insemination (AI)

Artificial Insemination of cattle with the latest world dairy genetic is not widely used in Iraq. Because of this situation genetic progress has stopped and will actually regress. Artificial Insemination (AI) with top dairy genetics must be reintroduced. Combined with a good nutrition program, genetic progress is essential. Advantages of AI are as:

- Genetic progress will improve 100 to 200 litters of milk per cow per generation
- Sexually transmitted deceases spread by the bull will be halted.
- The value of the cattle will increase
- Conception rate will improve
- Even though AI cost money, having a large number of cows and older heifers not pregnant cost a whole lot more.

A successful AI program depends on the following:

- All cattle being fed a balanced ration starting from weaning as a calf
- Bi-monthly herd health program by the herd veterinarian
- Herd records that include calving dates, herd health and reproductive records, dates to check for pregnancy, due dates, etc.
- Continual training for the veterinarian and who ever else is assigned to breeding the cattle.
- A person walking through the barns twice a day and during the night who is trained in heat detection and finding sick cows and heifers.
- Equipment and liquid nitrogen to store frozen semen at the farm, and equipment to thaw and use the French Straw frozen semen used by all AI companies in the West
- A liquid nitrogen source for the semen tanks
- A semen supplier who can import frozen semen into Iraq, and deliver it to the farm.
- A supplier that has access to the best bulls in the World at the best price

VIII. Farm Management Training

One of the most over looked yet most important aspect of operating a successful dairy herd is training for the farm management team. This is especially important on a large dairy farm. Dairy herd management is a constant changing field. New ideas and knowledge is a constant in this profession and it is important that the management team has access to knowledge and opportunities to learn. Each member of the team must handle their responsibility well, and coordinate their efforts with all others. Communication between all team members is important. To follow are suggested management team positions:

- Farm Manager – in charge of the overall operation and all the employees. He reviews all the information coming out of the parlor on production, the herd health records, and the financial records. He is responsible for making sure that all of the management team and employees are fully prepared to do their work, and that they work together as a team.
- Veterinarian – responsible for the overall health of the cattle, the AI program, the nutrition program.
- TMR Nutritional assistant – responsible to the veterinarian and trained in dairy cattle nutrition and TMR mixing.
- Parlor maintenance and operations engineer – supervises all routine maintenance and repair of the milking parlor, milk pipelines, cooling tanks and other milk handling equipment
- Milking and Parlor supervisor – responsible for all milking and parlor operations. He must make sure the people milking the cows know the importance of their jobs. These people should be the best of the labors on the farm.
- Field crop Agronomist – manages all field crop operations - planting and harvesting.
- Data processing expert – responsible for all the data entry of information from the milking parlor, the herd health data, the nutritionist, and accountant and making it available for all to use when making management decisions.
- Labors – These people must also be part of the farm team. They need to be encouraged to report problems and share any of their ideas about farm operations. Top down management does not work, there needs to be a two way movement in communications.

All employees are members of the total farm team, and they need to be part of the management process. The people that milk the cows, drive the tractors, sweep the managers, clean the manure, etc. are all part of making the farm profitable. They are expected to do their work correctly yet desire to be treated with respect. They must be able to talk to their supervisors and freely inform the management team of problems that they notice, and ideas that they have to solve problems. The most important assets of a dairy farm business are the employees, all employees.

IX. General Recommendations

This report is full of recommendations that are important in starting and running a large dairy herd. As detailed as this report has been and if all the recommendations are followed, we have only begun the process. Managing a large herd requires the best of management. The profit margins are narrow and mistakes are very costly. The feeding program and the management procedures in this report should get more cows pregnant, and average production per cow per year to between 5,000 and 5,500 liters. However, if the farm is to become profitable and sustainable, you need to set the following goals:

- Average production per cow per year of 8,000 liters or better
- Mastitis infections to less then 5 % but shoot for 3 %
- Use AI and aim for a 60 % conception rate on first service and use less natural service
- Heifers reaching breeding weight of 300 kg at 14 to 16 months of age
- Average age of first calving heifers 24 to 26 months of age.
- Calf mortality rate of less then 5 %

If you keep the calf mortality rate low and you get some of the open cows and heifers bred, the herd will grow in numbers from with in. However, as the herd grows, more land will have to be brought back into production. Our calculations showed that 1,000 donums will support a 500 cow herd and its herd replacement, so working up from there:

- 500 cows need 1,000 donums
- 1,000 cows need 2,000 donums
- 2,000 cows need 4,000 donums

Where do you want to go from here? What size herd do you plan? These are decisions that the owners need to make. If you plan to move forward you need to:

- Develop a business plan describing in detail the planned approach you want to take
- Prepare a capital budget that includes parlor and milk cooling tank repair, equipment to be purchased, irrigation pumping station repair, and may be cattle.
- Prepare an operating cash flow budget show the cash flow over the next 3 years.
- And present this proposal to Inma for consideration as a possible partner in the reestablishment of the dairy farm and a provider of technical assistance.

Appendix One: Illustrations

HAYLAGE AND CORN SILAGE IN BUNKER SILOS

Mower Conditioner windrowing alfalfa and grass for haylage

Filling bunker silo with alfalfa haylage

Bunker silo with corn silage

TMR being fed containing corn silage, haylage, and grain supplement

Appendix II - Sample TMR Mixes for Various Feeding Groups

Ration for High Milking Group	Ing/cow/day	Ing/MT
Barley	2.25	45.70
Corn		0.00
Wheat Bran		0.00
SBOM	0.85	17.27
Lime		0.00
Mono Ph	0.06	1.22
TM Salt	0.04	0.81
Vit ADE	0.01	0.20
Mineral Mix	0.01	0.20
Molasses	0.01	0.20
Sorgham-Sudan		0.00
Green Alfalfa	20	406.26
Corn Silage	26	528.13
Total Feed/cow in Kg	49.23	1000
Cost/Day/Cow =	$3.91	

Ration for Low Milking Group	Ing/cow/day	Ing/MT
Barley	0.3	6.59
Corn		0.00
Wheat Bran		0.00
SBOM	0.1	2.20
Lime		0.00
Mono Ph	0.02	0.44
TM Salt	0.05	1.10
Vit ADE	0.01	0.22
Mineral Mix	0.01	0.22
Molasses	0.01	0.22
Sorgham-Sudan		0.00
Green Alfalfa	15	329.67
Corn Silage	30	659.34
Total Feed/cow in Kg	45.5	1000
Cost/Day/Cow =	**$2.58**	

Ration for Milking 2yr Olds	Ing/cow/day	Ing/MT
Barley	-	0.00
Corn	-	0.00
Wheat Bran	-	0.00
SBOM	1	21.69
Lime	-	0.00
Mono Ph	0.04	0.87
TM Salt	0.04	0.87
Vit ADE	0.01	0.22
Mineral Mix	0.01	0.22
Molasses	0.01	0.22
Sorgham-Sudan	-	0.00
Green Alfalfa	15	325.31
Corn Silage	30	650.62
TMR/head/day	46.11	1000
Cost/Day/cow =	$3.02	

Ration for Dry Cows	Ing/cow/day	Ing/MT
Barley		0.00
Corn		0.00
Wheat Bran		0.00
SBOM	0.75	28.94
Lime		0.00
Mono Ph	0.02	0.77
TM Salt	0.01	0.39
Vit ADE	0.01	0.39
Mineral Mix	0.01	0.39
Molasses	0.01	0.39
Sorgham-Sudan		0.00
Green Alfalfa	7.11	274.31
Corn Silage	18	694.44
Total Feed/heifer in kg	25.92	1000
Cost/Day/cow =	$2.27	

Ration for Growing Heifers	Ing/cow/day	Ing/MT
Barley	1	51.07
Corn		0.00
Wheat Bran		0.00
SBOM	0.5	25.54
Lime		0.00
Mono Ph	0.04	2.04
TM Salt	0.01	0.51
Vit ADE	0.01	0.51
Mineral Mix	0.01	0.51
Molasses	0.01	0.51
Sorgham-Sudan		0.00
Green Alfalfa	8	408.58
Corn Silage	10	510.73
Total Feed/heifer in kg	19.58	1000
Cost/Day/Heifer =	$1.68	

Just weaned calves should be fed dry alfalfa hay and the grain mix. You can start them on corn silage, haylage plus grain at 5 months of age.

Ration for Open Cattle	Ing/cow/day	Ing/MT
Barley	0.3	10.46
Corn		0.00
Wheat Bran		0.00
SBOM	0.3	10.46
Lime		0.00
Mono Ph	0.04	1.39
TM Salt	0.01	0.35
Vit ADE	0.01	0.35
Mineral Mix	0.01	0.35
Molasses	0.01	0.35
Sorgham-Sudan		0.00
Green Alfalfa	13	453.28
Corn Silage	15	523.01
Total Feed/heifer in kg	28.68	1000
Cost/Day/open cow	$1.95	

Ing/cow/day = Ingredients per animal per day

Ing/MT = Ingredients per Metric Ton

SBOM = Soybean Oil Meal

TMR = Total Mixed Ration

Right Column is a 1,000 kg TMR batch