

Milk Production Cost on a Well-managed Medium Size Dairy Farm in Gongzhuling, Jilin Province, China in 2004

By

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【論文要旨】

中国吉林省公主嶺地域の中規模酪農家の牛乳生産コストに関する分析

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本稿の目的は、中国の酪農家の牛乳生産コストおよび収益を明らかにすることにある。この目的を達成するために、2004年9月に、中国吉林省公主嶺地域にある、経営状況が良好で中規模の酪農家について聞き取り調査を行った。

調査分析の結果によると、乳牛1頭当たり1日当たりの生産量は17.4kgで、乳牛1頭当たりの年生産量は5,266kgある。生産コストとして直接投入費用のみを計算する場合、牛乳1kg当たりの生産コストは0.16ドルであるが、税金、保険などの経営コストおよび家族労働も生産コストに加算すれば、牛乳1kg当たりの生産コストは0.18ドルに上昇する。さらに、それに土地・建物などの固定費用を加算すれば、その生産コストは0.35ドルに上昇する。収益について、直接投入費用のみを生産コストとして計算すれば、乳牛1頭当たりの年平均所得は253ドルである。

Abstract

Milk production costs and returns of a medium-size, modern, well-managed dairy farm near the city of Gongzhuling in north-central Jilin province, China obtained in September, 2004 are provided. Milk production averaged 17.4 kg per day per cow in inventory. The annual average milk production per cow in inventory is 5,266 kg. Cost per kg of milk produced per cow in inventory is \$0.16 when direct costs only are taken into consideration. It grows slightly to \$0.18 when ownership cost and family labor are included, and is \$0.35 when all costs are taken into account. Annual net income per cow in inventory is \$253 when only direct production costs are taken into account.

Key words

Dairy, cows, dairy farms, milk, production, cost, China, Japan, USA
酪農、雌牛、酪農場、牛乳、生産、費用、中国、日本、米国

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Introduction

The authors of this article interviewed the owner of a medium-size modern, well-managed dairy farm near the city of Gongzhuling in north-central Jilin province, China on September 10, 2004. One purpose of this article is to provide results on management practices, and costs and returns. A second one is to compare with data for Japan and the United States.

Cattle Milk Production Systems in China

There are four main types of cattle milk production systems in China. The first, and most rudimentary one, is part of grassland animal production systems in which milk is for suckling calves and the herder family. The second is a low-input, low-cost operation based on crossbred cows that are found in urbanized areas. The system is both grazing and cut-and-carry feedstuffs oriented, with most of the milk sold for urban dweller's consumption as fresh product. The third system is traditional medium to large-scale farms that were originally state farms and are now oriented to selling the milk. They are in a period of flux regarding ownership, management and modernization. The fourth, and the subject of this article, is a private operation that may be owned by an individual, a partnership or a corporation. Most of these type farms are characterized by a desire to improve management, size and economic efficiency. Experience in other countries indicates that this type system will become the dominant one in China.

Production Data on the Jilin Dairy Farm

The farm interviewed is a sole proprietorship with 166 cows in lactation (310 day lactation period), 191 total milking cows, and 245 total inventory (other than calves) (Table 1-A). Most of the cows are at least $\frac{3}{4}$ purebred Holstein (American) and none are less than $\frac{1}{2}$ purebred Holstein. The cows are artificially inseminated although one clean-up bull is used. All milk is sold daily to a dairy, and as raw milk.

A silage based confinement system (no grazing) is used. All feedstuffs are purchased. The owner was in the process of doubling the size of operation at the time of the interview. There is an 82 percent calf crop with a 14.2 month average calving interval. First calving is at 24 months of age. Average replacement is 8 years of age. The cost of silage, fed at the rate of 25 kg daily to both lactating and dry cows, is \$0.02 per kg (United States dollars, denoted as \$ from this point, are used in this article).

Concentrate, costing \$0.20 per kg, is fed at 9.5 kg per day to lactating cows and 4.5 kg to dry cows (Table 1-B). Cows are grouped and fed according to size. Milking is done by machine while cows are in their stalls. Milk production averages 17.4 kg per day per cow in inventory. Annual milk yield is 5,266 kg per cow in inventory. Concentrate is fed lactating cows at the rate of 1 kg per 2.1 kg of milk. Minerals are added to the concentrate, and grass hay is provided to young stock.

Labor cost in China is still quite inexpensive, to the extent that 28 persons are employed full-time and, in addition, 750 days of part-time labor is also contracted (Table 1-C). There are also 3 foremen and 3 family members' involved. The large number includes ancillary personnel such as guards. In addition, feedstuffs are prepared and fed by hand, and hand labor is used for cleaning stalls and exercise areas.

The sale price of the 600 kg cull cows is \$0.54 per kg (\$325 per head). The average sale price of calves (\$723 per head) is quite high as the females, which are quite high grade, are sold or used for replacements.

Land in China is owned by the government and leased out on a long-term basis. The rental charge of \$843 annually is shown in Table 1-D along with the other investments and expenses.

Economic Analysis

Annual costs

Total investment by the dairy farm was \$803,916 of which 23 percent is constructions and buildings, and 63 percent in breeding animals (Table 2-A).

Direct costs, meaning cash (out-of-pocket) costs for production are \$247,974 annually. Forty four percent is for concentrate, 17 percent for forage and another 14 percent for other feedstuffs resulting in 75 percent being for feedstuffs. Hired labor constitutes 11 percent of direct costs. Land rental is 0.3 percent of direct expenses.

Ownership costs, which include depreciation, taxes and insurance, total \$20,687. Family labor is \$4,337, amounting to 2 percent of total other (non-direct) costs. Capital costs, in other words the annual opportunity cost of funds tied up in investments and operating expenses, is quite high, \$175,662, because the owner estimates that he has ample opportunity to make a high return on his money in alternative investments. The opportunity cost rate he estimates is 20 percent, compared to less than 5 percent on bank savings accounts.

Total annual costs, direct and other, are \$448,659.

Annual and Net Income

Annual income amounts to \$296,340 of which 71 percent is from sales of milk (Table 2-B). Cull cows are 3 percent of income, and sales of calves not required as replacements for old milking cows constitutes the other 26 percent of income.

There is no “one” net income (income above costs) figure, or cost of agricultural product produced. Rather, “the” net income, or cost of production, depends on which costs are included, and these vary widely depending on the farmer’s interests and management strategy. It also depends on whether it is a farmer or an economist doing the calculations. A producer tends to only take cash cost and possibly ownership costs into account, while many economists argue that family labor costs and capital costs should also be taken into consideration.

Direct costs, meaning cash or out-of-pocket costs (except those for ownership costs) are ones which must be covered in order to stay in business over the shorter or medium term. The annual net income of the producer interviewed, only taking into account direct costs, is \$48,367, which is about a 6 percent return on his investment.

Net income taking ownership costs as well as direct costs into account results in \$27,680 per year. The charge for family labor is relatively small, so also taking that category into consideration reduces the net income only slightly, to \$23,343.

Capital costs are a major factor as the owner has a large investment, \$803,916. The charge for capital costs is quite high as the owner believes his opportunity cost is quite high, estimated at 20 percent annually on capital invested the dairy farm. Addition of capital costs results in a net loss of \$152,319. But, that loss could be cut to \$20,573 if the opportunity cost were 5 percent, about equal to savings in a bank.

It is important in evaluating the forgoing results that few livestock farms worldwide cover all costs and a substantial portion also have a negative net income when family labor is taken into consideration. Some reasons are that many operators, like the one in this analysis, believe that through technological adoption and increase in size, income per product produced can be improved and that costs can be reduced. Also, many believe their land will appreciate in value and want to keep it as an investment. Others are satisfied with a relatively low return in monetary terms in order to enjoy a “way of life” they like.

Annual Net Income per Lactating Cow

Annual net income per cow in inventory is \$253 when only direct production costs are taken into account. It is \$122 when ownership costs and family labor are included.

Cost per Kg of Milk Produced

Cost per kg of milk produced is \$0.16 when direct costs only are taken into consideration. It grows slightly to \$0.18 when ownership cost and family labor are included and \$0.35 when all costs are taken into account.

Discussion and International Comparisons

Review of the economic analysis leads to the conclusion that even though this dairy farm is medium size, its net income figures show that it is a very good business. The owner is a good manager, and very interested in production efficiency enhancement, productivity improvement and cost reduction. However, because his operation is relatively new and he has capital constraints, he has decided that the next steps are to expand by doubling the size of the herd (primarily by using his own female calves). This is also a method of technology adoption as he is artificially inseminating his cows with semen from top quality bulls. He can adopt other productivity enhancing practices as milking herd quality improves, such as grouping cows according to milk yield for feeding purposes. At that time he will improve rations fed, milking methods, and so forth.

All indications from analysis of the business, and technology readily available, is that milk yield per cow can increase significantly in the next few years, primarily through breed improvement. Sensitivity analysis reveals that with just a 10 percent increase in milk yield from the current 5,266 kg per cow in inventory to 5,793 kg, net income above direct costs would increase to \$69,447, a 44 percent increase from the current level. As a comparison,

milk yield per cow in lactation averaged 2,046 kg in China in 2003, 6,909 kg in Japan, 8,504 in the United States and 10,400 kg in Israel. The average yield in China is very low because a substantial portion of cows considered as milking cows are still in the three other types of production systems mentioned earlier in this article.

In contrast to \$0.18 per kg, when direct, ownership and family labor costs are taken into account, on the farm analyzed, the cost is about \$0.60 per kg in Japan, and \$0.24 in the United States. The average price of milk received by dairy farmers in Japan is about \$0.77 per kg, \$0.30 per kg in the United States, and \$0.20 by the farm analyzed.

The operation analyzed is in Northeastern China in the heart of the major maize growing area so that feedstuffs costs are low compared with other areas of the country. Thus, costs and returns would be different in those areas. Nevertheless, the analysis presented in this article reveals that with the farmer's good management, current favorable milk prices and cost advantages in feedstuffs he, at least, can compete with other countries on a raw milk production basis.

TABLE 1-A DATA ENTRY
GONGSHULING, JILIN, CHINA

MEDIUM SIZE MODERN DAIRY FARM
US DOLLARS 2004

CURRENT (ACTUAL) INVENTORY		
COWS IN LACTATION	HEAD	166
DRY COWS	HEAD	25
TOTAL MILKING COWS	HEAD	191
HEIFERS (> 2 YEARS)	HEAD	0
HEIFERS (1-2 YEARS)	HEAD	53
BULLS	HEAD	1
TOTAL	HEAD	436
PERCENT ON PASTURE		
PASTURE	PERCENT	0
STOCKING RATE	HA	0
OTHER LAND	HEAD/HA	0
TOTAL LAND	HA	3
DEATHS AND LOSSES		
WEANED CALVES	HA	0
HEIFERS FOR REPRODUCTION	PERCENT	0
CALF CROP (BIRTHS)	PERCENT	82
NUMBER OF CALVES PER YEAR	HEAD	136.1
CALVING INTERVAL	MONTHS	14.2
FIRST CALVING	MONTHS	24
REPLACEMENT AGE	YEARS	8
REPLACEMENT RATE	PERCENT	16.7
NUMBER OF REPLACEMENTS	HEAD	28
COWS ARTIFIC. INSEMINATED	PCT	100
MILK		
PER LACTATING COW/DAY	KG	20.0
PER COW IN INVENTORY/DAY	KG	17.4
PROPORTION SOLD	PERCENT	100
LACTATION PERIOD	DAYS	310
ANNUAL YIELD PER COW IN LACTATION	KG	6,200
ANNUAL YIELD PER COW IN INVENTORY	KG	5,266
AMOUNT PRODUCED	KG	1,029,200
PRICE/KG	US \$	0.20
KG MILK/KG CONC/LACT COW	KG	2.1
OTHER FEEDSTUFFS PER MONTH		
GRASS HAY	KG	60,000
COST/KG	US \$	0.0
#2 PURCHASED	KG	0
#2 COST/KG	US \$	0.0

TABLE 1-B. DATA ENTRY
GONGSHULING, JILIN, CHINA

MEDIUM SIZE MODERN DAIRY FARM
US DOLLARS 2004

ITEM	UNITS	BASIC MODEL
CONCENTRATE		
PER ANIMAL PER DAY		
LACTATING COWS & BULLS	KG	9.5
DRY COWS	KG	4.5
HEIFERS (>2 YEARS)	KG	0.0
HEIFERS (1-2 YEARS)	KG	2.3
BULLS	KG	0.0
MALE AND FEMALE CALVES	KG	0.0
FEEDING PERIOD		
LACTATING COWS & BULLS	DAYS	310
DRY COWS	DAYS	55
HEIFERS (>2 YEARS)	DAYS	0
HEIFERS (1-2 YEARS)	DAYS	365
BULLS	DAYS	0
MALE AND FEMALE CALVES	DAYS	0
TOTAL PURCHASED/YEAR	KG	539,551
COST/KG	US \$	0.20
FORAGE/ANIMAL/DAY (APART FROM PASTURE)		
		SILAGE
LACTATING COWS AND BULLS	KG	25.0
DRY COWS	KG	25.0
HEIFERS (>2 YEARS)	KG	0.0
HEIFERS (1-2 YEARS)	KG	15.0
MALE CALVES	KG	0.0
FEMALE CALVES	KG	0.0
TOTAL PER YEAR	KG	1,752,125
PURCHASED FORAGE OF TOTAL	PERCENT	100
TOTAL FORAGE PURCHASED	KG	1,752,125
COST/KG OF PURCHASED FORAGE	US \$	0.02
SALT		
PURCHASE PER MONTH	KG	0
FED/ADULT/DAY	GRAMS	0
COST/KG	US \$	0.00
MINERALS		
PURCHASE PER MONTH	KG	80
FED/ADULT/DAY	GRAMS	11
COST/KG	US \$	1.45
MOLASSES		
PURCHASE PER MONTH	KG	0
COST/KG	US \$	0.00
MANURE		
MANURE/ANIMAL/YEAR	TONS	2.76
TOTAL/YEAR	TONS	683
SALE OR USE VALUE/KG	US \$	0.00

TABLE 1-C. DATA ENTRY
GONGSHULING, JILIN, CHINA

MEDIUM SIZE MODERN DAIRY FARM
US DOLLARS 2004

ITEM	UNITS	BASIC MODEL
FERTILIZER		
AMOUNT PURCHASED	KG/YEAR	0
PRICE/KG	US \$	0.00
LABOR (NUMBER OF PERSONS)		
CONTRACTED		
FULL TIME	PERSONS	28
DAY LABOR	DAYS/YEAR	750
FOREMAN OR SUPERVISOR	PERSONS	3
FAMILY LABOR	PERSONS	3
LABOR (INCLUDING BENEFITS)		
CONTRACTED		
COST/PERSON/MONTH	US \$	62.89
COST/PERSON/DAY	US \$	2.41
FOREMAN/MONTH	US \$	84.34
FAMILY LABOR/PERSON/MONTH	US \$	120.48
SALE WEIGHT OF ANIMALS		
CULL COWS	KG/HEAD	600
BULLS	KG/HEAD	0
HEIFERS (>2 YEARS)	KG/HEAD	0
HEIFERS (1-2 YEARS)	KG/HEAD	520
MALE AND FEMALE CALVES	KG/HEAD	50
SALE PRICE/KG		
CULL COWS	US \$	0.54
BULLS	US \$	0.00
HEIFERS (>2 YEARS)	US \$	0.00
HEIFERS (1-2 YEARS)	US \$	3.01
MALE AND FEMALE CALVES	US \$	14.46
SALE PRICE/HEAD		
CULL COWS	US \$	325
BULLS	US \$	0
HEIFERS (>2 YEARS)	US \$	0
HEIFERS (1-2 YEARS)	US \$	1,566
MALE AND FEMALE CALVES	US \$	723
ANNUAL SALES		
CULL COWS (ACTUAL)		
NUMBER	HEAD	28.0
TOTAL WEIGHT	KG	16,800
BULLS		
NUMBER	HEAD	0
TOTAL WEIGHT	KG	0
HEIFERS (>2 YEARS)		
NUMBER	HEAD	0
TOTAL WEIGHT	KG	0

TABLE 1-D. DATA ENTRY
GONGSHULING, JILIN, CHINA

MEDIUM SIZE MODERN DAIRY FARM
US DOLLARS 2004

ITEM	UNITS	BASIC MODEL
ANNUAL SALES (CONTINUED)		
HEIFERS (1-2 YEARS)		
NUMBER	HEAD	0.0
TOTAL WEIGHT	KG	0
MALE AND FEMALE CALVES		
NUMBER	HEAD	106
TOTAL WEIGHT	KG	5,287
INVESTMENTS		
LAND	US \$	0
CONSTRUCTIONS & BUILDINGS	US \$	180,723
FENCES	US \$	0
EQUIPMENT AND TOOLS	US \$	6,024
VEHICLES, HORSES	US \$	108,434
DEPRECIATION		
CONSTRUCTIONS & BUILDINGS	YEARS	20
FENCES	YEARS	8
EQUIPMENT	YEARS	10
HORSES	YEARS	10
OPPORTUNITY COST		
LAND	PCT	0
ALL OTHERS	PCT	20
VALUE OF ANIMALS (PER HEAD)		
COWS	US \$	2,229
BULLS	US \$	0
REPAIRS & MAINTAINCE (PER YEAR)		
CONSTRUCTIONS & BUILDINGS	US \$	6,024
EQUIPMENT	US \$	3,614
FENCES	US \$	0
ANIMAL HEALTH (PER MONTH)		
VETERINARIAN SERVICES	US \$	361
PRODUCTS	US \$	542
ARTIFICIAL INSEMINATION	US \$	361
OTHER COSTS (PER MONTH)		
ELECTRICITY	US \$	301
GASOLINE AND OIL	US \$	241
OTHERS, AND MISCELLANEOUS	US \$	120
MARKETING COSTS	US \$	0
OTHER EXPENSES (PER YEAR)		
TAXES	US \$	0
INSURANCE	US \$	205
LAND RENTAL	US \$	843

TABLE 2-A. ECONOMIC ANALYSIS,
GONGSHULING, JILIN, CHINA

MEDIUM SIZE MODERN DAIRY FARM
US DOLLARS 2004

ITEM	BASIC MODEL	
	COST OR	INCOME PERCENT
	US DOLLARS	PERCENT
INVESTMENT		
LAND	0	0.0
CONSTRUCTIONS & BUILDINGS	180,723	22.5
FENCES	0	0.0
EQUIPMENT AND TOOS	6,024	0.7
HORSES	108,434	13.5
BREEDING ANIMALS	508,735	63.3
TOTAL	803,916	100.0
DIRECT COSTS PER YEAR		
PURCHASED FORAGE	42,220	17.0
FERTILIZER	0	0.0
CONCENTRATE	109,210	44.0
SALT	0	0.0
MINERALS	1,388	0.6
MOLASSES	0	0.0
OTHER FEEDSTUFFS	35,566	14.3
REPAIRS & MAINTAINCE	9,639	3.9
VETERINARIAN SERVICES	4,337	1.7
VETERINARY PRODUCTS	6,506	2.6
ARTIFICIAL INSEMINATION	4,337	1.7
ELECTRICITY	3,614	1.5
GASOLINE AND OIL	2,892	1.2
OTHERS, MISCELLANEOUS	1,446	0.6
MARKETING COSTS	0	0.0
LABOR		
DAY & PERMANANT	22,939	9.3
FOREMAN/ADMINISTRATION	3,036	1.2
LAND RENTAL	843	0.3
TOTAL DIRECT COSTS	247,974	100.0
OTHER COSTS PER YEAR		
OWNERSHIP COSTS		
DEPRECIATION	20,482	10.2
TAXES	0	0.0
INSURANCE	205	0.1
SUBTOTAL	20,687	10.3
FAMILY LABOR	4,337	2.2
CAPITAL COSTS		
LAND	0	0.0
CONSTRUCTIONS,EQUIPMENT	59,036	29.4
BREEDING STOCK	101,747	50.7
OPERATING CAPITAL	14,878	7.4
SUBTOTAL	175,662	87.5
TOTAL OTHER COSTS	200,686	100.0
TOTAL, ALL COSTS	448,659	

TABLE 2-B. ECONOMIC ANALYSIS,
GONGSHULING, JILIN, CHINA

MEDIUM SIZE MODERN DAIRY FARM
US DOLLARS 2004

ITEM	BASIC MODEL	
	COST OR	INCOME PERCENT
	US DOLLARS	PERCENT
ANNUAL INCOME		
MILK	210,800	71.1
CULL ANIMALS	9,108	3.1
CALVES	76,432	25.8
MANURE	0	0.0
TOTAL	296,340	100.0
INCOME PER YEAR ABOVE:		
DIRECT PRODUCTION COSTS	48,367	
DIRECT PRODUCTION COSTS AND OWNERSHIP COSTS	27,680	
DIRECT PRODUCTION COSTS, OWNERSHIP AND FAMILY LABOR COSTS	23,343	
DIRECT PRODUCTION COSTS, OWNERSHIP, FAMILY LABOR AND CAPITAL COSTS WHICH IS ALL COSTS	-152,319	
ANNUAL NET INCOME PER COW IN INVENTORY ABOVE		
DIRECT PRODUCTION COSTS	253	
DIRECT PRODUCTION COSTS AND OWNERSHIP COSTS	145	
DIRECT PRODUCTION COSTS, OWNERSHIP AND FAMILY LABOR COSTS	122	
ALL COSTS	-797	
COST PER KG OF MILK PRODUCED		
DIRECT PRODUCTION COST	0.16	
DIRECT PRODUCTION COSTS AND OWNERSHIP COSTS	0.18	
DIRECT PRODUCTION COSTS, OWNERSHIP AND FAMILY LABOR COSTS	0.18	
ALL COSTS	0.35	
DIRECT COSTS AS A PERCENT OF ALL COSTS		55.3