

## Dairy Herd Improvement (DHI) Program in Taiwan<sup>(1)</sup>

C. L. Chang<sup>(2)</sup>, C. Y. Tseng<sup>(2)</sup>, S. J. Lee<sup>(2)</sup>, J. Y. Chen<sup>(2)</sup>,  
Y. C. Huang<sup>(3)</sup>, S. C. Lee<sup>(3)</sup>, H. L. Chang<sup>(3)</sup>  
and M. C. Wu<sup>(2)</sup>

Received Mar. 10, 2001 ; Accepted Aug. 31, 2001

### Abstract

The Dairy Herd Improvement (DHI) Program is one of the most important projects for the dairy industry in Taiwan. It provides reports to dairy farmers for making selection and management decisions. Reports of milk constituents, cows' performance information and farm management efficiency are published monthly for the dairymen. In 2000, there were 217 dairy herds, 13,989 milking cows enrolled. The average herd size for milking cows was 64 head per herd with average parities of 2.57; the average 305-2X-ME milk yield was 6,623 kg and the average daily milk yield was 21 kg. The average percentage of fat, protein and lactose in milk were 3.57, 3.11 and 4.55, respectively. The average somatic cell count in milk was 523,000/ml. Reproduction data of 9,712 cows in 1999 revealed that the interval from calving to first service was 117 days and the days open was 178 days. As the Internet is gradually becoming popular, the DHI program in Taiwan is furnishing internet (<http://www.angrin.tlri.gov.tw>) with the Microsoft IE5.0 browser. Active Server Pages (ASP), VB Script and Microsoft SQL have been used in developing dynamic homepage. Each dairyman has his own farmer code and password to input his dairy herd performance data and print out the management reports with different color remarkings to illustrate the importance of information via the internet. These reports can be used to improve farm management practices and milk quality.

Key words : Dairy Herd Improvement, Performance, Internet.

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(1) Contribution No. 1080 from Taiwan Livestock Research Institute, Council of Agriculture, Executive Yuan.

(2) Hsinchu Branch Institute, COA-TLRI, Hsinchu 300, Taiwan, R.O.C.

(3) Dept. of Animal Breeding, COA-TLRI, Hsinhua, Tainan 712, Taiwan, R.O.C.

## Introduction

The Dairy Herd Improvement (DHI) Program is one of the most important projects for dairy industry in Taiwan and in all dairy developed countries (Mao, 1987). It is a project of dairy herd data collecting and processing, which provides the uniform, accurate, and essential reports to farmers for making precise management decisions so as to increase net profit for farmers. It is also a kind of test practice for individual dairy cattle performance which includes weighing and sampling and/or analyzing of milk sample so that the farmer knows the performance of all individual cows in his herd. The assembled DHI records will form a national dairy database for the use of management improvement program, extension, research, and education. Because this project has been conducted since 1977, dairy herd performance in Taiwan has been improved year by year (Chang *et al.*, 1997). Chang (1988) used DHI database and analyzed the causes of culling and herd life of cows. Cows sold for breeding purpose made up 0.75% of the total, culled for old age accounted for 5.15%, and the others were all culled for a particular reason. The most important culling reasons were diseases: 28.29% reproductive problem, 24.98% udder problem, 11.31% calving trouble problem. The mean of the herd life was 2.76 lactations. Because the herd life of the cows was very short, dairy farm management was affected directly.

## Materials and Methods

### *Structure of DHI in Taiwan*

Farmers, technicians, milk laboratory and records processing center are the main components of DHI program. Each component plays an important role in determining if each record is appropriate for its intended use and assures quality records that can serve farmers' needs. The farmers' responsibility is to keep the updated recording in his herd. DHI technicians are the persons approved and employed by the DHI program to certify the performance data collected on the farm. Now there are 11 technicians employed by Dairy Development Association of R.O.C. (DDAC) DDAC is an association consisting of dairy farmers, dairy processing plants, scholars and specialists in dairy area. The Milk Laboratory is approved by the government, through quality certification to analyze components of milk samples. Dairy Records Processing Center (DRPC) is an organization approved by the government to electronically process records and comply with approved procedures for records calculations. Both Milk laboratory and dairy records processing center are located in Hsin-chu branch, Taiwan Livestock Research Institute. This institute belongs the Council of Agriculture (COA), Executive Yuan. Forage testing laboratory at this institute is cooperated with DHI to test and to provide dairy farmers with fast, accurate results on forage nutrients.

### *Procedures of DHI*

All essential data from dairy farms are presented with a uniform record format folder. DHI technicians visit the farms once a month routinely with a minimum of interference. They will collect farm's data and write down the barn sheets printed by the DRPC.

#### I. Cows to be identified

All cows in the herd enrolled on DHI record plan are given the same herd code and must be identified with a permanent identification number or a herd number. If the metal ear-tag is not on the ear, the number must be cross-referred to herd number. Herd number can be frozen branded the herd number or ear-tag or electronic identification system. All identification system is visible from a distance of several feet so that the technician can identify the cow quickly and accurately during milking. A cow calved, bred, dried or left the herd in the period between test days will be recorded. The actual birth date, the identification number and the parents of calf, the complete code number of mated sire and breeding date, the dry date and the main reasons of cow leaving herd will also be recorded.

#### II. Milk weighing and sampling

Cows calved for over six or more days will have her first milk weighed and sampled beginning at the evening milking, and then the morning milking, counting the day of calving as the first day. Weighing and sampling devices are carried and supplied by technician according to the manufacturer's written instructions. To ensure the highest quality of milk samples and to prevent the infection of disease, it is strongly recommended that the farmer have his own weighing devices. Milk sample should be representative of the milk yield of the cow at any one milking. Test day data along with milk samples will be shipped by private freight transportation company. If farmers do data collection and milk sampling by themselves because technicians are not available, they are on unsupervised tests. The farmer will have the responsibility for accurate data collection in accordance with these uniform procedures.

#### III. Milk components test

Milk components such as fat, protein, lactose, and somatic cell count (SCC) are determined from milk sample by the assigned milk laboratory. Solids-not-fat (SNF) is calculated directly based on milk components. Milk laboratory then passed the results to the DRPC to be combined with other data collected.

#### IV. Records processing

DRPC organizes all data collected and generate reports for farmers. DRPC's most important work is to calculate the lactation milk yield totals and standardize the milk yields to 305-2X-ME yield so that yield of different cows can be compared (Chyr, 1977) and culling decision can be made.

*Reports for the farmer*

DHI program provides information to both dairy farmers and dairy industry. There are four kinds of reports from DHI service for the farmers:

- I. Monthly reports include Dairy herd performance and the results of milk component tests. The milk yield information for the farmer includes the daily milk yield and SCCS in the previous 9 test day and current test day, calving date, days in milk, the yield and percentage of fat and protein in the test day, and yield totals, projected 305-2X-ME milk, fat, and protein in current lactation. Other information included in the report are days dry, breeding date, sire code mated, breeding interval, days open and service times as well as abnormal data code. The second main report provides information on the daily milk yield, the percentage of fat, protein, lactose, total solid and Somatic Cell Count per ml of all individual cows as well as the average of the herd for the above components.
- II. Management reports are sorted and derived by computer from the main data file and printed out for a specific purpose. These types of optional reports add value to the basic DHI records and aid in making farm management decisions. The Management reports include:
  - somatic cell count (mastitis monitoring) programs
  - action reports for cows to breed, pregnancy check, dry off, freshen, cull
  - individual cow lifetime summary
  - multi-year herd summary
  - group analysis report
  - persistency analysis
  - lactation curve
- III. Operation efficiency reports are herd summary reports which summarize the herd's general status for the past 12 month. It includes rolling herd average, somatic cell summaries, reproductive statistics and many other useful information.
- IV. Other statistics reports are published on Dairy Farming Newsletter bimonthly issued by Hsin-chu branch, TLRI. These reports include the top 50 individual cows on milk yield, fat yield, and protein yield, the top 50 farms on lowest SCC in milk, the top 50 farms on herds average of milk yield, and the top 3 farms on the average of milk yield within each of the 11 counties in Taiwan.

## Results and Discussion

*Enrollment of DHI*

DHI project in Taiwan was launched in 1977. Table 1. shows the 344 herds, 3250 cows participated in DHI program in 1981. From 1981 through 1984, the enrollment percentages were over 30% for herds and over 20% for milking cows. Originally, there were 23 technicians working for data collection. They used portable scale to measure milk yields and went to the milk collecting station near by to test the fat percentages by simple fat test equipment. In 1986, many farmers replaced their milking equipment with pipeline machines but without milk test meters along with machine. Due to inconvenience in milk weighing, the number of herds and cows in DHI decreased dramatically and only 13 technicians remained in DHI program. From 1987 through 1990, enrollment in DHI increased again, but the percentage was still low. Before 1989, only monthly DHI report was available to the farmer. In 1989, Hsin-chu branch, TLRI established a milk test laboratory with advanced equipment, all DHI milk samples were analyzed thereafter. Since the DHI program was a government project, the farmer needs not to pay, but from 1991, the program started to charge farmers NT\$20 for each milk sample tested, and the enrollments decreased again. But after the monthly DHI reports and SCC information were available for the farmers, the enrollment increased again. Owner sampling program started in 1992. From June, 1999, the milk pricing system included milk SCC, many farmers enrolled in order to obtain the SCC information to cull the trouble cows. The number of enrollment increased dramatically and 22% of cows in Taiwan were enrolled in 2000. The expected enrollment in next 5 year will reach 40%.

Table 1. Dairy cows enrollment in DHI from 1981 to 2000

Year	Number of herds in Taiwan*	Number of herds in DHI	Percentage of herd enrollment	Number of cows in Taiwan*	Number of cows in DHI	Percentage of cow enrollment
1981	699	344	49	12159	3250	27
1982	769	396	51	13920	4239	30
1983	765	391	51	15361	4878	30
1984	845	381	45	18195	4902	27
1985	1020	414	41	22752	5546	24
1986	1149	345	30	27309	5448	20
1987	1222	215	18	33986	3660	11
1988	1283	175	14	40140	3740	9
1989	1261	189	15	44926	3920	9
1990	1128	210	19	46342	5124	11
1991	1113	160	14	49433	5115	10
1992	1065	177	17	53295	6539	12
1993	1045	183	18	57652	7908	14
1994	989	169	17	58812	7662	13
1995	968	199	21	66377	9132	14
1996	940	193	21	62846	9634	15
1997	886	192	22	65284	9066	14
1998	867	187	21	66514	9431	14
1999	839	228	27	66175	11862	18
2000	829	217	26	64331	13989	22

\* From agricultural statistics yearbook (1990, 2000).

*Milk yield and components in milk*

Table 2. shows the averages of daily milk yield and 305-2X-ME yield as well as herd size enrolled in DHI since 1981. The milk production was increasing from 1981 with a stable rate. Though the number of dairy cows in Taiwan increased over the past two decades, the average amount of milk produced per cow has also increased steadily. But from 1995 until now, the improvement of milk yield was very small. There must be some bottleneck that needs to be solved, may be the hot and humid environment.

Table 2. The averages of daily and 305-2X-ME milk and herd size from 1981 to 2000

Year	Number of DHI herds	Number of tested cows	305-2X-ME milk yield	Daily Milk yield	Herd size
	herd	head	kg	kg	head/herd
1981	344	3250	5308	15.1	9.4
1982	396	4239	5634	15.3	10.7
1983	391	4878	5689	14.6	12.5
1984	381	4902	5437	14.6	12.9
1985	414	5546	5480	15.0	13.4
1986	345	5448	5283	14.3	15.8
1987	215	3660	5798	15.7	17.2
1988	175	3740	5862	16.0	18.4
1989	189	3920	5941	16.3	20.4
1990	210	5124	6135	17.1	23.2
1991	160	5115	6258	18.3	31.9
1992	177	6539	6364	19.1	36.9
1993	183	7908	6386	19.5	43.2
1994	169	7662	6348	19.4	45.2
1995	199	9132	6499	19.8	45.8
1996	193	9634	6536	20.3	49.9
1997	192	9066	6437	19.8	47.2
1998	187	9431	6596	20.6	50.4
1999	228	11862	6567	20.1	56.3
2000	217	13989	6623	21.0	64.5

Table 3. The distribution of parity of milking cows in DHI

Lactation number	Number of cows	Frequency	Cumulative frequency
1	4564	0.33	0.33
2	3528	0.25	0.58
3	2405	0.17	0.75
4	1607	0.11	0.86
5	970	0.07	0.93
6	507	0.04	0.97
≥7	408	0.03	1.00
Total	13989	1.00	

The average of parity is 2.57

Table 3. shows the distribution of parity of milking cows in DHI with the average parities 2.57 in 2000. Cows with parity less 3 counted 75%. It indicated that one third of cows were culled before parity 3 and farmers need to keep at least 33% of yearling heifers to replace the cows each year. It also indicated that farmers need to raise much more young heifers with no incomes from them. The more the farmers raise young heifers, the more the cost of milk production per kilogram and the less the farmers benefit.

Table 4. The summary of components of milk sample in DHI program in the recent 5 years

Year	SCC	Fat	Protein	Solid
	10 <sup>3</sup> /c.c.	%		
1996	605±1.84	3.74±0.01	3.27±0.01	12.87±0.01
1997	637±1.74	3.74±0.01	3.21±0.01	12.05±0.01
1998	603±1.74	3.69±0.01	3.26±0.01	12.33±0.01
1999	543±1.63	3.68±0.01	3.16±0.01	12.20±0.01
2000	523±1.63	3.57±0.01	3.11±0.01	12.10±0.01

Table 4. indicates the average component of milk sample and SCC from 1996 to 2000. Milk component was stable but the percentage was lower than milk sampled in US (Cassell,1990). SCC in milk was high at the beginning, over 605 thousand. Since 1998, the government has conducted a project that subsidized farmers to cull cows with lower production and higher SCC, and as a result, the average of SCC lowered.

Table 5. The distribution of SCCS in DHI herds by months from July, 1999 to June, 2000

SCCS	SCC	Goal	1999						2000					
			Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
	(10) <sup>3</sup>		%											
0	0~18	11	4.3	3.2	1.9	2.9	4.3	12.7	9.7	3.2	1.6	9.1	7.0	13.4
1	19~35	16	8.5	10.3	10.7	11.5	12.8	10.0	7.7	21.6	6.3	13.1	13.4	9.3
2	36~71	11	12.6	14.4	14.1	15.3	14.9	13.8	16.7	21.4	21.3	17.4	16.5	13.0
3	72~141	12	14.7	16.4	16.8	15.7	15.8	15.1	16.4	17.9	20.3	18.2	16.7	14.6
4	142~283	13	17.4	16.7	16.7	16.3	15.7	13.7	14.8	14.4	17.3	16.0	15.5	15.4
	Total	63	57.5	61.0	60.2	61.7	63.5	65.3	65.3	78.5	66.8	73.8	69.1	65.7
5	284~565	11	14.7	13.8	13.5	13.2	13.1	12.4	12.5	10.3	13.6	11.9	12.3	13.6
6	566~1130	10	11	10.5	10.5	10.6	10.6	9.1	10.0	6.5	9.3	7.7	8.7	9.4
7	1131~2262	6	8.5	7.6	8.2	7.3	7.2	7.3	6.8	3.1	6.3	4.0	5.8	6.5
8	2263~4523	5	5.6	4.8	5.2	4.9	3.9	4.0	3.8	1.5	2.9	2.1	3.0	3.4
9	4524~9999	5	2.6	2.3	2.6	2.4	1.8	1.8	1.5	0	1.1	0.5	1.0	1.0
	Total	37	42.4	39	40	38.4	36.6	34.6	34.6	21.4	33.2	26.2	30.8	33.9

SCC calculation ranges from several thousand to several ten million. Instead, in DHI reports, the SCCS with a range from 0 to 9 were used. The results for SCCS and SCC are shown in Table 5. These figures are higher than that of DHI reports in US. (Heuven *et al.*, 1988 ; Schutz *et al.*, 1990). In 1988, when Dr. R. E. McDowell visited Taiwan and went through the SCC in DHI files. He suggested that an ideal percentage for each SCCS be set as the goal for DHI herd in Taiwan. From Jun to Oct, the percentages of SCCS over 4 were higher than the goal suggested by McDowell (1988). How to lower SCC in hot months is an urgent problem to be solved. Figure 1. shows the relationship of the average of daily milk yield and SCC in milk in different months from 1996 to 2000. It apparently shows a negative effect of SCC on daily milk yield.

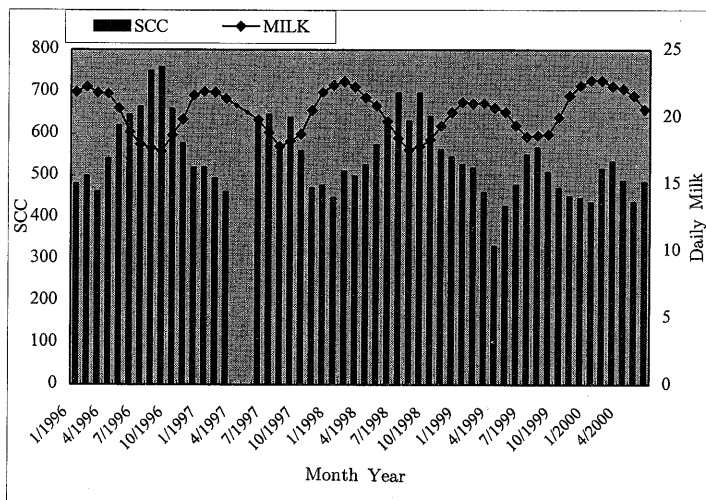


Fig. 1. SCC and daily milk yield by month from 1996 to 2000.

#### *Reproductive efficiency of DHI herds*

The reproductive status also plays a large impact on production and profitability. Reproductive problems result in excessively long lactation or long dry periods or both. Both are costly to the dairy producers. Table 6. shows a summary of reproduction efficiency of DHI herds in 1998 and 1999. The average days open was 178 days. Compared with ideal figure, 110 days, it lasted 68 more days. The average services per conception was 2.7. It is higher than ideal figure by 0.5 service (Grusenmeyer and Hillers, 1989). Reproductive problem is another important issue in Taiwan.

Dairy Farming Newsletter is a bimonthly magazine issued by Hsin-chu branch, TLRI for all dairy farmers, dairy extension people, researchers and students in Taiwan. This magazine started its distribution in February 1994 and now 41 issues have been published. The DHI reports which included the top 50 individual cows in milk yield, fat yield, and protein yield, the top 50 farms with the lowest SCC in milk, the top 50 farms in herds average of milk yield, and the top 3 farms in the average of milk yield within each of 11 counties in Taiwan are the most important content on each issue of the newsletter.



Table 6. Summary of reproduction efficiency of DHI herds

Days open (days)	Percentage (%)		Services/ Conception	Percentage (%)	
	1998	1999		1998	1999
Below 61	12.2	10.3	1	21.5	24.6
61~90	19.1	19.8	2	25.1	22.6
91~120	12.4	19.1	3	23.6	20.5
121~150	12.4	15.5	4	14.8	15.7
151~180	13.9	12.9	5	8.2	9.5
181~210	12.9	10.0	6	3.7	3.8
Above 210	11.7	13.3	>6	3.1	3.2

*The future of DHI in Taiwan*

Taiwan is applying for membership to the WTO. Milk production efficiency must be continuously improved in order to compete with the global market. Farmers should apply the available management information to their specific farm situations. DHI records and reports should assist farmers in making daily management decisions.

Because the Internet is getting popular and popular in Taiwan in recent years. DHI is going to use Internet with the Microsoft IE 5.0 browser as a tool for dairymen to input and to get herd information from the plan. A team of researchers in TLRI is doing efforts in updating DHI data processing system with Active Server Pages (ASP), VB Script and Microsoft SQL to develop dynamic software. The website is <http://www.angrin.tlri.gov.tw>. This website provides an information delivery system to disseminate dairy farming management information which include newsletter, extension bulletins, and the reports of meeting and seminars as well as the related dairy organization. Each farmer will have his own farmer code and password. He can access easily and routinely to update his monthly herd and cow test day data to the DRPC database and print out with color marking on his management reports to illustrate the importance of information via internet. Updated systems will provide the farmer with a comprehensive, well-organized record-keeping system. Rather than having several sets of records, i.e., one set for production information, one for breeding and health records, new system will put it all together in an easy-to-use, powerful system. Any of reports can be modified and even be designed by the farmer on his PC computer via Internet to meet his specific needs. Reports are in pocket form. Farmer can carry them all of the time when he need information on a particular cow so that he can make better decisions immediately and might get more profits. Another feature of the reports via the internet will be the ease to use and more understandable graphs, which help farmer to see the trends and relationships which may go unnoticed. One can see how well the farmer is doing immediately. Such kind of graphs may include the following. Individual cow graph can show the milk production, fat, protein, somatic cells, breeding and health information for a cow's current lactation. Lactation curve comparison graphs will show how an individual cow compares to the other cows in the herd. Past 25 month graphs are herd summary statistic reports. The information of AI frozen semen will also be

included in DHI files to help the farmer to maintain a current list of all available sires on hand through the internet and the number of units for each sires can be purchased. Their current breeding values and pedigrees can be easily acquired via hyper-link. When the farmer inputs breeding data, the units of semen are automatically deducted from the semen inventory. Yet, the most important for the successful DHI internet is that the farmer has to record herd's data accurate, keep data currently, update them into the DHI database promptly so that every report is accurate and useful.

## References

- Appleman, R. and J. Nobel. 1990. Using DHI records to management the dairy herd. Fact sheet I-1. Handbook. National Cooperative Dairy Herd Improvement Program. Columbus, Ohio.
- Cassell, B. G. 1990. Component testing: fat, protein and solids-not-fat. Fact sheet I-5. Handbook. National Cooperative Dairy Herd Improvement Program. Columbus, Ohio.
- Chang, C. L. 1988. The removal reasons and herd life of cows of Taiwan Holstein dairy herds. J. Taiwan Livestock Res. 21(1) : 11.
- Chang, C. L., C. Y. Tseng, Z.Y. Chen, S.J. Lee, J.K. Cheng and M.C. Chen. 1997. The Holstein dairy herd improvement program in Taiwan. J. Taiwan Livestock Res. 30(1) : 55.
- Council of Agriculture, Executive Yuan. 1990. Agricultural Statistics Yearbook. Statistics Office, COA, Executive Yuan, Taipei, Taiwan.
- Council of Agriculture, Executive Yuan. 2000. Agricultural Statistics Yearbook. Statistics Office, COA, Executive Yuan, Taipei, Taiwan.
- Chyr, S. C. 1977. Dairy Herd Improvement - Performance Test : DHI -101 Manual. Dairy Development Association of R.O.C.
- DHI. 1987. Dairyman's DHI Manual. Dairy Records Processing Center at Raleigh, NC.
- Grusenmeyer, D.C. and J.K. Hillers. 1989. Evaluating the dairy herd's reproductive status. Fact sheet I-9. Handbook. National Cooperative Dairy Herd Improvement Program. Columbus, Ohio.
- Heuven, H. C. M., H. Bovenhuis and R.D. Politiek. 1988. Inheritance of somatic cell count and its genetic relationship with milk and composition in Holstein. J. Dairy Sci. 65 : 843.
- Mao, L. I. 1987. Dairy cattle breeding. U.S. Grains Council. Taipei, Taiwan.
- McDowell, R. E. 1988. Some observation in Taiwan dairy farming. Report to COA. Taipei, Taiwan.
- Schutz, M. M., L. B. Hansen, G. R. Steuernagel and J. K. Reneau. 1990. Genetic parameters for somatic cells, protein and fat in milk of Holsteins. J. Dairy Sci. 73 : 494
- Varner, M. A and J. L. Majeskie. 1989. Interpreting indexes of reproductive efficiency. National Cooperative Dairy Herd Improvement Program. Columbus, Ohio.

## 台灣乳牛群性能改良計畫<sup>(1)</sup>

張菊犁<sup>(2)</sup> 曾青雲<sup>(2)</sup> 李素珍<sup>(2)</sup> 陳志毅<sup>(2)</sup>

黃鈺嘉<sup>(3)</sup> 李世昌<sup>(2)</sup> 張秀鑾<sup>(3)</sup> 吳明哲<sup>(2)</sup>

收件日期：90 年 3 月 10 日；接受日期：90 年 8 月 31 日

### 摘 要

乳牛群性能改良 (DHI) 為國內乳業重要計畫之一，提供酪農個別牛隻牛乳品質檢驗及性能檢定月報表及相關的經營效率報表作為選育牛隻及改善牛群管理之參考。2000 年有 217 戶，13,989 頭泌乳牛隻參加本計畫，每戶參檢泌乳牛平均 64 頭，平均胎次 2.6 胎，平均 305-2X-ME 乳量 6,623 公斤。每頭牛之每日產乳量平均 21 公斤，乳脂率 3.57%；乳蛋白質率 3.11%，乳糖率 4.55%，體細胞數每毫升 52.3 萬個。分析 9,712 頭乳牛繁殖性狀資料，分娩後第一次配種日數平均為 117 天，空胎日數平均為 178 天。近年網際網路逐漸普遍，各行業均用之經營其事業，國內 DHI 計畫已用 IE 5.0 為操作環境，HTML 配合 Active Server Pages (ASP) 及用 VB Script 為主要開發語言，配合微軟公司的 Microsoft SQL Server 7.0 資料庫軟體，架構 DHI 資料庫網際網路系統，網址為 <http://www.angrin.tlri.gov.tw/>。酪農戶進入網站，由單一視窗輸入代號及密碼後，就能輸入自己牛群資料、列印管理報表。而管理報表配合顏色分類，酪農可列印報表，及時有效地運用報表改善牛群管理，提升生乳品質。

關鍵詞：乳牛群性能改良、性能、網際網路。

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(1) 行政院農業委員會畜產試驗所研究報告第 1080 號。  
(2) 行政院農業委員會畜產試驗所新竹分所。  
(3) 行政院農業委員會畜產試驗所家畜育種系。