

**PRODUCTION CHANGES RELATED TO LABOR  
MANAGEMENT IN VIRGINIA DAIRY HERDS**

by

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(ABSTRACT)

A 1979 survey of labor practices of 321 randomly selected Virginia dairy herds was analyzed and labor data were combined with DHI records to determine for Holstein herds the relationship of labor management with subsequent enrollment in the Dairy Herd Improvement program, and the effect of labor management variables on the change in production variables through eight subsequent years. Employees classified as herds person received the highest monthly cash wage (\$964) and those classified as calf person received the lowest wage (\$562). Herds persons were the most educated type of employee with 65% having at least a high school education and half of those having attended college. The percent of farms remaining on DHI was influenced by cash wage, 67% for under \$300/mo and 87% for above \$999/mo. For production, 31% of the low production herds remained on DHI versus 84% for high production. In 1978, herds persons trained before hiring were associated with 955 kg more fat corrected milk per year. Herds where herds persons worked many hours for low pay had the largest increase in days open from 1978 to 1986. Milkers with more education were associated with a larger increase in fat corrected milk, but employment status for herds persons was more influential than for milkers in reducing mastitis. Increase in \$100 in pay benefits for feeders working many hours resulted in 300 kg more milk. Feeders who were qualified before hiring also increased milk yield. High pay and many hours of work for fieldmen led to a significant 4 d reduction in days open, while low pay and many hours were related to increased breedings per conception. The importance of employees being trained before hiring was beneficial for most types of employees and several production variables. Difficulty keeping good workers, though detrimental to remaining on DHI, was associated with improved production,

possibly because of a demand for quality efforts. Availability of educational programs was associated with reduced production, while availability of reading materials was beneficial to many DHI variables. Though not all results can be explained, several models had squared correlations between 50 and 80%.

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Dedicated to:

With all my love.

# Introduction

Labor management is important to the success of a dairy farm business. The manager, hired workers, and family members must work as a team to achieve a successful dairy operation.

The demand for qualified dairy labor has been increasing. The average dairy producer in Virginia spends 15% of receipts or about \$20,000 each year for hired labor, and dairy producers in Virginia pay \$30 million a year for labor, one of the major resources of productive farms. The labor enterprise involves the operator, family members, and hired employees, including both part-time and full-time workers. Labor management involves the interaction of employers and employees as well as the planning and organizing of work in such a way that available resources are used efficiently, returning economic benefits to the overall farm business.

For successful operation of the business it is important to attract and retain productive farm workers. This requires an owner to be knowledgeable and offer wages, fringe benefits, and working conditions which are competitive with other farm and non-farm businesses.

Managing labor is one of the most difficult management problems facing farmers, and is critical to the success of a dairy farm business. Good information and suggestions on labor management practices on farms has been scarce and generally without any measures of success. There is a need for a closer look at this phase of farm management to develop methods of improving labor management on farms.

## *Objectives*

The objectives of this study were to:

1. Relate measures of dairy labor management with subsequent enrollment in the Dairy Herd Improvement Program (DHI).
2. Determine the relationship of labor management variables with differences between herds.
3. Determine the effect of labor management variables on the change in production variables in subsequent years.

## **Review of Literature**

Censuses show that dairy farms in the United States have changed in the last few decades. In the past, the average dairy farm was small, family owned, and labor intensive. The trend has been to larger, more specialized operations with substantial substitution of capital for labor.

Dairy farm managers operate differently in various parts of the country, in that the demand for labor is different if the farm is located near large cities or in rural areas. To study labor we must take into consideration regional farm differences, land and buildings, and capital.

## *Regional Farm Differences*

A recent study (18) showed that the United States experienced a large decline in farm population since 1940. While farm population declined only from 32.0 million to 30.5 million for the 1910 to 1940 period, it declined to 9.3 million by 1975, (Table 1). From 1940 to 1975 the percent of farm population of the total United States population declined from 23.2% to 4.3%.

In 1940, the rural nonfarm sector represented 20% of the population or slightly less than the farm sector. In all later census periods the rural nonfarm sector represented a larger segment of the rural population than the farm sector, and today the number of rural nonfarm residents is five times greater than the number of farm residents. However, the era of rapid farm population decline slowed in the 1970 to 1975 period when the estimated annual rate of decline was only 0.8% compared with a 4.8% annual rate in the preceding 5-year period.

Nott, Kauffman and Speicher (20) conducted a study of trends in the management of dairy farms since 1956 and founded diversity from 1956 to 1980. Just as every region has its own land resource and climate, dairy farmers in those regions have their own management styles. Nott et al. (20) studied the impact of land and buildings, labor, capital, and management techniques on management of dairy farms to determine what directions may be evident for the next quarter century. In the forecasts he reported that the big unknown is the impact of the energy crisis, expecting to see more papers on alternatives for energy consumption on dairy farms such as energy prices probably will continue to increase relative to the price of other inputs, causing dairy farms managers to reconsider their farm locations, input combinations, and amount of milk produced. Methane and ethanol production on dairy farms could become significant. Public decision makers probably will demand more stringent quality control of dairy products. With the increasing world income, grain prices could rise relative to other inputs and cause U. S. dairy farmers to feed less grain.

Table 1. Farm population change in the United States from 1910 to 1975.<sup>1</sup>

Period	Farm population at end of period	Proportion of farm population at end of period	Annual rate of net migration of the farm population	Annual rate of change of the farm population
	Thousand		Percentage	
(Era of modest decline)				
1910	32,007	34.9	-	-
1910-15	32,440	32.4	-1.4	+ 0.3
1915-20	31,970	30.1	-2.0	-0.3
1920-25	31,190	27.0	-2.1	-0.5
1925-30	30,529	24.9	-1.9	-0.4
1930-35	32,161	25.3	-0.2	+ 1.0
1935-40	30,547	23.2	-2.3	-1.0
(Era of rapid decline)				
1940-45	24,420	17.5	-5.8	-4.5
1945-50	23,045	15.3	-2.8	-1.2
1950-55	19,078	11.6	-5.4	-3.8
1955-60	15,635	8.7	-5.2	-4.0
1960-65	12,363	6.4	-5.7	-4.7
1965-70	9,712	4.8	-5.5	-4.8
(Period of modest decline)				
1970-75	9,316	4.3	-1.2	-0.8

<sup>1</sup>Source: Leuthold and McManus 1976 (18).

The National Milk Producers Federation (9) reported man-hours per cow and per 100 lbs milk, Table 2. There was a tendency to decline in the number of man-hours per cow and per 100 lbs milk since 1930, and there was a larger decline in labor in the last few decades.

## *Land and Buildings*

Nott et al. (20) reported census data showing California, Wisconsin, and New York to be the states that produce the most milk; each state is representative of its respective region (Table 3). Dairy farm managers operate differently in various parts of the country. California dairy farms have more cows and fewer hectares of land than do those in the other two states. Differences increased during the past 25 years. Wisconsin and New York managers have 2.6 ha per cow while those in California operate with less than .5 ha per cow. The important factor is that California farm managers buy most of their feed whereas the others grow their own roughage and some concentrates. In some areas of the United States dairy farm managers have specialized to the point that they no longer manage land for crop production. In other areas there has been little change over the past 25 years; land availability and feed production still dictate herd size.

Nott et al. (20) reported that across the United States, dairy cows are housed in a variety of barn types ranging from outdoor corrals to freestall barns to traditional stall or stanchion barns. Freestall housing was first used in the United States in 1960, and Table 4 shows that by 1971 it was used on 11% of dairy farms. However, stanchion barns predominate at 62%. Dairy calves and replacement heifers are also housed in many type of structures. The type of housing has a great influence on labor requirements, as freestall housing requires less attention to individual cows as they are handled in groups.

**Table 2. Labor on farms, per cow, and per 100 pounds milk, 1930 - 84.<sup>1</sup>**

year	Man - hours	
	Per Cow	Per 45.5 kg milk
	(Hours)	
1930	147.1	3.26
1940	147.5	3.19
1950	125.5	2.36
1960	99.7	1.42
1970	68.1	.70
1980	35.4	.30
1984	23.8	.19

<sup>1</sup>Source: Dairy producer highlights 1986 (9).

**Table 3. Agricultural census data on numbers of dairy farms with annual sales greater than \$2,500.<sup>1</sup>**

	1954	1964	1974
<b>Number of farms:</b>			
California	12,452	5,571	3,046
Wisconsin	107,350	71,754	46,951
New York	49,182	30,841	17,247
United States	397,977	349,244	196,057
<b>Hectares per farm:</b>			
California	60.3	89.5	113.4
Wisconsin	63.2	78.5	92.7
New York	85.0	105.7	129.6
United States	65.3	94.3	111.7
<b>Cows per farm:</b>			
California	58	125	245
Wisconsin	19	27	36
New York	25	35	50
United States	20	37	48

<sup>1</sup> Adapted from Nott, Kauffman and Speicher 1981 (20).

**Table 4. Distribution of milk cow housing facilities on dairy farms 1971.<sup>1</sup>**

Type of barn	California	Wisconsin	New York	United States
	(%)			
Loafing barn, loose housing	9	4	3	19
Freestall, loose housing	10	3	9	11
Stanchion barn	21	90	85	62
Dry lot	57	2	1	6
Other dairy housing	3	1	2	2
Total	100	100	100	100

<sup>1</sup> Adapted from Nott, Kauffman and Speicher 1981 (20).

## *Labor*

Nott et al. (20) examined the expenses on a dairy farm and found that labor is usually the second largest expense if all unpaid labor is charged against the business at its opportunity cost. Dairy farmers have improved their labor efficiency over the last 25 years. Table 5 shows that milk produced per hour of labor for New York dairy farmers increased more than 2.5 times in the last 25 years. This occurred because milk per cow was rising and because labor hours per cow were declining. New technology including freestall barns and improved milking systems was a major factor. The superior labor efficiency of freestall systems is apparent in Table 6. Milk produced per hour was about twice as much in freestall barns as in stanchion barns for farms studied during 1978. Although the data come from New York researchers, it is expected that results would be reproducible anywhere in the United States.

## *Capital*

Dairy herd managers like U. S. agriculture in general have substituted machinery for labor wherever practical. Table 6 shows that labor productivity increased more rapidly with freestall barns than with stanchion barns. The parlor design, milking equipment, and feed handling equipment that go with freestall barn systems were probably the causal factors. Table 7 indicates the extent to which dairy herd managers had adopted milking parlors by 1971. Since the 1971 census, other parlor de-

Table 5. Labor use, productivity, and profitability, New York cost account project.<sup>1</sup>

Year	Labor per cow	Milk per labor hour	Return per labor hour
	(h)	(kg)	(\$)
1978	50	136.1	9.01
1977	54	119.7	5.07
1976	55	119.2	6.73
1975	51	130.2	6.29
1974	54	118.8	5.94
1973	52	119.7	5.30
1972	50	122.5	4.79
1971	53	118.8	4.44
1970	54	113.4	4.34
1969	55	117.0	4.64
1968	54	112.5	4.46
1967	59	99.3	3.03
1966	60	95.3	2.41
1965	63	94.3	1.85
1964	64	90.7	1.60
1963	70	83.0	1.68
1962	76	73.9	1.45
1961	79	69.8	1.93
1960	86	61.2	1.74
1959	86	60.8	2.22
1958	91	59.4	2.34
1957	93	52.5	1.85
1956	91	51.3	1.46

<sup>1</sup> Adapted from Nott, Kauffman and Speicher 1981 (20).

Table 6. Dairy herd size, productivity, and labor efficiency, two barn types, New York.<sup>1</sup>

Item	Stanchion barn	Freestall barn
Average herd size		
1978	51	203
1977	53	193
1976	48	188
1975	55	194
1974	67	185
Labor per cow, h		
1978	89	44
1977	90	46
1976	92	48
1975	78	46
1974	71	48
Milk per hr of labor, kg		
1978	73	158
1977	68	142
1976	67	139
1975	71	148
1974	82	136
Return per hr of labor, \$		
1978	3.83	10.78
1977	1.69	6.56
1976	2.55	8.28
1975	1.88	7.64
1974	3.73	7.01

<sup>1</sup> Adapted from Nott, Kauffman and Speicher 1981 (20).

signs and specialized equipment have been put to use. The designs include rotary, herringbone, polygon, and trigon milking systems.

## *Management*

Nott et al.(20) have stated that management input on the dairy farm, even larger farms, usually comes from the owner and the owner's immediate family. The individual or family team has control over many decisions at the farm level, but public policy makers have set up many laws and guidelines that the individual must accept as fixed. Although the dairy manager can influence policy through group action, the market structure and price is pretty much beyond control of the local producer.

Goodger, Ruppanner, Slenning, and Kushman (15) examined an approach to scoring management on large-scale dairies, and found that two dairies with genetically similar herds of the same size in similar environments can have markedly different milk outputs. It is thought that this objective measurable difference in productivity may be due to a difference in management between the two operations. An index was constructed to include 12 major management components representing a broad range of decisions and activities from herd health to finances. The index can be applied to different samples of dairies Table 8 shows the 12 categories that are dairy site sanitation, identification method, ability to detect heat, record use, financial practices, feeding procedures, herd managers attitudes, drug use, milking parlor system, herd health, calf management, and housing design and use. Some of these are much more objective and easily observed than others, so four indicators were developed as subsections under each category to have a meaningful score for that category by site inspection and by interview with the dairy producer. Each of the four indicators

**Table 7. Distribution of milking facilities on U.S. dairy farms, 1971.<sup>1</sup>**

Facility type	Califor- nia	Wis- consin	New York	United States
	%			
Stanchion barns:				
Pail milkers	17	87	80	66
Pipeline	50	11	12	16
Milking parlors:				
Herringbone	9	1	6	7
Side opening	10	1	1	6
Walk through	9	-	1	4
Other milking facilities	5	-	-	1
Totals	100	100	100	100

<sup>1</sup> Adapted from Nott, Kauffman and Speicher 1981 (20).

was assigned a scale from 0 to 20 points for a maximum of 80 points per category and 960 for all 12 categories. A trained non-expert should be able to predict accurately the relative rankings experts would give to dairies, thus making it feasible to apply the method to many dairies at relatively low cost. The index also ideally may be used by others wishing to evaluate dairy performance and may serve as a device for training dairy evaluators. The usefulness of any approach to measure management depends on its reliability or consistency in replication. A number of studies regarding supervisory practices of hired labor on dairy farms indicate that managers should consider the following important factors to achieve an optimum productivity and effective supervision.

## *Acquisition of Employees*

For hiring farm labor it is necessary to consider the three basic steps: recruitment, interviewing, and selection. Recruitment is the process of finding prospective employees and reaching them. Interviewing is the process that provides opportunity for the employer to meet the prospective employee and to obtain more information on the applicant's background and job experience, and for the applicant to learn more about the farm and responsibilities. Selection among the applicants is the final step in hiring a person with the desired characteristics.

**Table 8. Management practice categories and indicators used to score management.<sup>1</sup>**

Management Category
Indicators
1. Dairy site sanitation
a) Retains sanitary equipment
b) Maintains clean corrals
c) Buildings in good repair
d) Standardized milk handling procedures
2. Identification method
a) Records authentic identification
b) System updated routinely
c) Numbers visible from distance
d) Replacements identified upon arrival
3. Ability to detect heat
a) Knowledge of signs
b) Scheduled observation time
c) Method to check accuracy of heat detection system
d) Knows first post-partum heat
4. Record use
a) Current barn sheet
b) Member DHIA system
c) Utilizes breeding records
d) Detailed medical records
5. Financial practices
a) Current financial records
b) Possesses management skills
c) Knowledge of operating costs
d) Pays attention to budget
6. Feeding procedures
a) Utilizes group feeding
b) Weighs feed accurately
c) Consults with nutritionist
d) Maintains condition of feedbunk contents
7. Herdsmen's attitudes
a) Developed cow sense
b) Responsible job performance
c) Incentive to learn
d) Ability to manage personnel
8. Drug use
a) Vaccination program in use
b) Reputable drug sources
c) Condition of drug storage
d) Knowledge of treatment procedures
9. Milking parlor system
a) Plans for expansion
b) System cleaning capabilities
c) Efficient labor use
d) Degree of automation
10. Herd health
a) Raises own replacements
b) Scheduled veterinary services
c) Uses veterinary services
d) Mastitis under control
11. Calf management
a) Good calf manager
b) Adequate calf housing
c) Care first two weeks
d) Percent death loss
12. Housing design and use
a) Efficient traffic flow
b) Ability to segregate animals
c) Design toward individual cow
d) Corral slope and shape

<sup>1</sup> Source: Goodger, Ruppanner, Slenning and Kushman 1984 (15).

## Recruiting

The owner has to make use of his/her imagination in finding the best source of labor and methods of reaching them. Wells (26) described a variety of sources of labor and methods of reaching them. Newspaper ads tend to attract respondents who are not adequately qualified for the position. Ministers can give information on people looking for jobs. Current employees are a good source of information especially if they like their current employment. Farmers can take advantage of modern techniques and contact a more specialized labor force by utilizing the services of the Employment Security Commission, high school, community colleges, technical institutes, and university placement offices. Sons or other members of the family might be interested in working on the farm. Women make equally good employees, especially where strength is not required, such as in a mechanized milking parlor. Teenagers can do some jobs on the farm, but they need to be selected carefully and supervised properly. Minority groups can provide labor for farmers in particular areas.

Gamroth (14) summarized the results of a survey of Oregon farmers. Finding qualified employees was the most serious problem in completing farm work. Oregon employees found work through word of mouth, friends, neighbors, inseminators, and salesmen. This system of referrals might work well at times, but it is necessary that managers be more professional in locating labor. They need to plan ahead for the loss of employees and begin looking for a replacement immediately when the need is foreseen.

Erven (12) found that recruitment is one of the most important skills of a labor manager. This applies to family farms or large dairies. He believes that recruitment success is more than luck; It is finding the "right person" for the position, not merely filling the position. Erven (12) offered recruitment guidelines to use as a measure of past performance and a basis for future recruitment. The manager should know himself or herself, the business, the advantages and disadvantages of the job, and should think in terms of selling an opportunity to a capable person who has several alternatives for employment.

## **Interviewing**

Before an interview takes place, a manager should find all information about the applicant so time is not wasted reviewing personal factors. Prior to the interview the manager needs to select a comfortable, quiet place conducive to few interruptions.

Wells (26) pointed out some important considerations for a properly conducted interview. It should take place in a quiet, relaxed setting making the applicant feel at ease. Questions should be phrased diplomatically, avoiding employer biases and soliciting information about the prospect's stability, industriousness, perseverance, loyalty, self-reliance, ability to get along with others, and leadership. The manager should sell the job opening.

Erven (12) suggested that the manager interview for several hours, showing the prospective employee around the farm, and giving the potential employee time alone with current employees. He emphasized that a written job description is absolutely essential, including title, hours, benefits, responsibilities, rules, and so forth.

## **Selection**

A review of existing literature reveals the necessity to consider three prerequisites to proper selection. Robbins and Moore (22) found that it is important to describe the position first, then establish the qualifications, and finally structure the recruitment interviews. Wells (26) reported that it is highly desirable to set a definite time at which a decision about employment is to be made. Deferring a decision too long may cause the applicant to lose interest or suggest a lack of interest by the manager.

## **Wages and Fringe Benefits**

It is important for the labor manager to develop a compensation plan which includes a cash salary, fringe benefits, and possibly various types of incentives to improve performance and to attract and retain motivated farm employees.

Shapley (23) explained that high turnover is one of the primary problems in paying lower wages than the competition, forcing employers to train new people constantly. Shapley also noted that if a manager is not paying a competitive wage, it can be difficult to find the type of employee suited for the job. Robert Rice, as cited by Woodbury, 1983 (30), explained that the growth of wage supplements is due to different factors; preferential treatment under federal personal income tax laws; savings made possible by group purchase of some benefits, notably insurance; efforts to reduce turnover in the face of rising costs of labor; and unionization. Woodbury (30) found that larger establishments pay a smaller proportion of their benefits as wages. This supports the hypothesis that large firms are able to provide fringe benefits at a lower cost than are smaller firms or that large

firms put more into wages. Workers prefer fringe benefits defined as health and life insurance plus pensions, over fringe benefits defined as health and life insurance contributions only, which suggests that retirement income plans are a better substitute for current wages than are health and life insurance benefits.

Kohl and Bratton (16) suggested that fringe benefits have become an important part of employment terms. They found that approximately three out of four employees in 1976 received housing with fuel and electricity. Common items such as meat and milk were received by most employees. When employers and employees were asked to assign a dollar value to fringe benefits, total earnings (cash wage plus fringe benefits) averaged \$10,500 a year per worker or equivalent to about \$200 per week or \$3.20 per hour, and fringe benefits made up about 30 percent of the total wage package received by 48 workers.

## **Labor Incentive Programs**

An incentive program compensates workers for their productivity on the farm. Boehlje and Eidman (6) suggested that the purposes of an incentive program are 1) to promote higher performance by the employee, 2) to attract better qualified employees and encourage them to develop their skills and capabilities, 3) to encourage employees to continue in the present job and provide the tenure that will be helpful to both employer and employee, and 4) to provide adjustments in salaries to reflect the profit situation of the business.

Buffington and Reaves (8) reported that incentives which appeared to be most easily understood involved a third party. The third party for herd production goals was the Dairy Herd Improvement

Association (DHIA); for monthly milk shipped, the plant receipt; for bacteria counts, the laboratory report; and for pregnancies, the veterinarian. Greater understanding could be achieved by workers and owners when a third party was associated with the incentive system.

Robbins and Moore (22) stated that after hiring the best person available, that employee should be encouraged to use initiative in performing the duties of the position. Basic to any plan for the individual to provide the highest productivity possible is employee commitment to the firm's goals. It should be possible for the employee to attain personal goals by helping achieve the owner's goals. High salary alone is not sufficient. A good attitude and fair pay, pay for performance not presence on the job, is more reasonable. Subsequently, he suggested seven steps to successful motivation: 1) allow high productivity, 2) implement incentives, 3) control critical incidents, 4) organize time effectively, 5) keep commitments, 6) appraise and coach, 7) review regularly.

According to Bishop and Holts (29), for any incentive program to work, the employee must be on a base pay schedule that rewards work accomplished regardless of production of the herd or any other problems encountered on the dairy.

A basic feature of an incentive plan, according to Bratton (7), is that the worker's earnings are based on accomplishments over which he or she has some control. An incentive can provide motivation for an employee to perform well. For the employer it can help attract and hold capable workers, enable delegation of responsibility, and improve efficiency. Another important finding by Bratton (7) was a list of six essentials for success of an incentive plan: 1) reward the worker for performing in the interest of the employer, 2) base the incentive on performance largely within the control of the worker, 3) pay enough in extra wages to provide a real incentive for the worker to perform well, 4) make the plan simple and easy to compute, 5) pay the incentive soon after the requirements are met, 6) put the agreement in writing.

Bratton (7) classified incentive plans into four groups: 1) payment based on production, illustrated by payment on pounds of milk sold; 2) rewards for specific practices, such as raising calves or

getting cows bred; 3) opportunities to build equity through livestock ownership, allowing the employee to raise several heifers each year; 4) shares of the farm's net returns, paying a base wage plus a percentage of the farm's profit.

Robbins and Moore (22) proposed that a workable incentive program is one in which both parties understand and agree in writing on 1) the purpose, 2) each party's responsibilities, 3) method of calculating payment, 4) duration of agreement, 5) method for arbitrating disputes, 6) payments beyond the normal basic wage, 7) stated payment interval, 8) worker knowledge of the extent and limit of payments, and 9) worker awareness that job performance will influence the size of the incentive payment. According to Robbins and Moore (22), the incentive pay occasionally makes up the largest portion of an employee's pay, but is usually less than ten percent of the total figure. The more confident and secure an individual becomes, the more likely payment will be preferred based on performance.

## **Training**

Although little information has been published on training dairy labor, each new farm employee should receive initial on-the-job training to perform satisfactorily. Periodic training may be necessary for even long-time employees to learn modern techniques. Extension short courses, field days, and vocational schools can be used for employee training.

Wells (27) reported benefits to be gained from properly instructing employees: 1) increased output per person, 2) reduced costs per unit, 3) improved quality of product, 4) improved morale through performing the job well, and 5) reduced labor turnover.

According to Wells (27), personnel management experts have divided the job of instructing employees into four basic steps: 1) Preparing the employee. Find out what the employee knows about the job and explain the importance of the job. Get the employee interested in learning the job. 2) Teaching the employee the job. Explain carefully and completely all the duties, being patient and understanding. 3) Trying the employee out. Let the new employee perform the task and give guidance if necessary. 4) Following up. After starting the new employee on the job, check often and encourage questions. These basic steps will increase the employer's chances of getting the job done properly and in a timely manner.

A review of existing literature reveals that almost all emphasize that dairy farms with a small work force use training techniques, development, and advancement different from businesses of a complex industrial setting. According to Kohl (17) the size of the labor force has much bearing upon the way training, development and supervision are carried out. In addition, many experts agree that larger farms often find it easier to delegate responsibility because the farm operation can be divided and responsibilities assigned to different employees.

Birnbaum (3) discussed the importance of skill development, initial on-the-job training, and career origins as direct determinants of the level of earnings. That an individual started in a high skill sector might mean he or she simply had more human resources initially. Individuals starting in the middle, low and unskilled sectors during the depression did not recuperate, indicating that individuals whose career origins were in an occupation which provided access to generalizable skills, the individual's earnings in all later occupations were higher for a given level of education.

Work has been done by Armstrong (1) on providing dairy labor training. The course was for an eight-week period (320 h) equally divided between classroom instruction and on the job training. Instruction was primarily in milk handling, nutrition, calf management, milking practices and records. The average age of the trainee was 28 yr, education 9.3 yr, wage before training \$1.51 per h in 1965 farm experience 2.6 yr for those with farm experience. They developed a pool of locally available workers to help dairy farmers on an occasional or emergency basis.

## *Employer-Employee Relations*

A good relationship with employees is one of the most important tasks a labor administrator should master. Research has sought a direct measurement of the needs. Motivational studies suggest that an employee puts forth effort trying to satisfy certain needs. Wells (28) reported no limits to one's needs, all needs are not of the same importance, and that these needs change throughout one's lifetime. An employer can successfully motivate an employee by helping the employee satisfy personal maintenance and motivational needs.

Optimum productivity and effective supervision are easier to achieve when the employee is properly motivated. In a dairy labor survey in Oregon by Gamroth (14), respondents, dairy managers and employees, were asked to rank by importance employment factors shown in Table 9. Salary and working conditions were most important in satisfying employees. Employers must be aware of employee needs and help satisfy basic needs like food, clothing, shelter, and transportation before striving for employee self-fulfillment and self-esteem.

**Table 9. Interview rank of employment factors.<sup>1</sup>**

Item	Dairy- manager Ranking	Employee Ranking
Job security	4	5
Interesting work	5	3
Good working conditions	2	2
Concern and attention	3	6
Wages	1	1
Responsibility	6	4

<sup>1</sup>Source: Gamroth 1976 (14).

Research by Speicher, et al. (24) on ten functions of personnel management reported functions receiving most attention from dairy owners and managers were hiring, training and development, and wage administration.

Murrill and Pelissier (19) reported a study to determine labor management relations and personnel management practices conducted in 1964 with 41 Kern County dairies participating. This study revealed that the average tenure of dairy labor was 12 mo. Factors found to contribute most to the high labor turnover and poor employer - employee relations were: 1) the nature and requirements of dairy labor; 2) conditions which prevent job satisfaction; and 3) the lack of incentive for long tenure. The results of this survey were in substantial agreement with a similar study conducted in the San Joaquin Valley by Fuller and Viles in 1953. On the basis of the recent survey, Kern county milk producers initiated a program to improve labor - management relations in order to reduce the relatively high labor turnover within the industry. This program gives major consideration to reasons given by employees for job dissatisfaction, and to their suggestions for improving employee - employer accord on such factors as days off, compensation, housing, responsibilities, personnel management practices, supervision, and training.

## *Labor Record Systems*

Labor record keeping practices are a critical aspect of labor management on dairies. It was reported by Kohl (17) that government rules and regulations have placed strict penalties on individuals and

businesses who do not maintain complete and accurate records. Furthermore, labor records give the manager an indication of expenditures for the labor input portion of the operation.

Sutter (25) determined that adequate records must be kept for hours worked by each employee, wages paid, deductions and allowances to allow checking of compliance with the minimum wage law. Dairy producers who keep financial records current are in a much better position to make effective management decisions.

## *Labor Efficiency and Economics*

Labor efficiency depends on many factors, not just the skills of the workers, but the size of the farm, the application of modern technology, and the capital available to increase productivity. It was reported by Palmer (21) that labor efficiency often is measured by man hours required to produce 100 kg of milk, the annual number of man hours per cow, number of cows per worker, and annual milk production per worker. The use of these concepts allows measurement of labor efficiency and comparison of results between dairies.

Palmer (21) found that the average man - hours required to produce 100 kg of milk has decreased from 7 h in 1940 to 0.7 h in 1980 (Table 10). This increase in labor efficiency is a result of increases in number of cows per man and increased production per cow. The annual number of man hours per cow decreased from 147.6 to 35.0 in 40 yr. This decrease in hours per cow allows each worker to care for approximately four times as many animals. During this period the average milk pro-

duction per cow increased by 258%. The dramatic increase in milk per cow allowed the national dairy herd to decrease by 45% and total U. S. milk production to increase by over 17%.

Kohl (17) has shown that one of the measures of labor efficiency on a dairy farm is pounds of milk sold per man. Table 11 lists various levels of milk sales per man and the corresponding wage package. Farms that sold over 227,272 kg of milk per man paid their employees an average cash wage of \$181 per wk and a total wage package of \$247. The farms that were less efficient had a substantially smaller wage package. Very little difference was found in the wage package between those farms selling 136,363 to 227,272 kg and those farms under 136,363 kg per man. Labor efficiency seemed directly correlated with wages paid, as farms that were more efficient offered a larger wage package.

According to Palmer (21), mechanization of large milking parlors can increase the efficiency of milkers. The efficiency of the milker can change the labor required to milk a dairy herd. Operators vary tremendously in how they choose the next "chore activity" and in how much time is required to complete the activity. Some are even too fast in tasks like cow preparation. Table 12 shows the time required by different types of milkers to accomplish different activities. The "cautious operator" moved slowly and spent too much time completing each task; he/she required 2 min per cow and milked a maximum of 30 cows per h. The "ideal operator" was knowledgeable about good milking practices, observant, quiet and gentle with cows and followed a well organized sequence of motions; he/she took 1.6 min per cow and milked a maximum of 37 cows per h. The "too fast operator" was always in a hurry and failed to follow good milking practices; he/she required 1 min per cow and milked a maximum of 60 cows per h. Milker efficiency can be increased when milking clean cows, and when cows are grouped by production and speed of milking.

Work has been done on time and motion to measure milking parlor performance. Armstrong and Quick (2) used case studies of time and motion to improve quality and quantity of milking performance, with evaluation of parlor design, mechanization, milking procedures, and milk production. If maximum efficiency of a milking parlor is desired, dairy producers need to evaluate their

**Table 10. U. S. annual labor usage per cow.<sup>1</sup>**

Year	Number Cows (Mil.Head)	Milk Produced (Bil.Kg)	Man Hours per	
			Cow	100 Kg milk
1940	23.7	49.7	147.6	7.0
1950	21.9	53.0	125.3	5.2
1960	17.5	55.9	99.7	3.1
1970	12.0	53.2	68.1	1.5
1972	11.7	54.5	61.6	1.3
1974	11.2	52.5	54.5	1.2
1976	11.0	54.7	48.1	1.0
1978	10.8	55.2	41.7	0.8
1980	10.8	58.4	35.0	0.7

<sup>1</sup>Source: Palmer 1981 (21).

**Table 11. Milk sold per man and the wage package for 48 New York State dairy farms, 1975.<sup>1</sup>**

Milk sold per Man (kg)	Number of Farms	Average Weekly Wage	
		Cash	Total Value
Over 227,272	17	\$181	\$247
136,363 to 227,272	16	126	180
Under 136,363	15	128	181
<b>Total or Average</b>	<b>48</b>	<b>\$145</b>	<b>\$203</b>

<sup>1</sup>Source: Kohl 1977 (17).

**Table 12. Influence of type of operator on milking labor.<sup>1</sup>**

Chore Activity	T Y P E O F O P E R A T O R		
	Cautious	Ideal	Too Fast
	(Time per cow in seconds)		
<b>BEFORE MILKING</b>			
Preparing the Udder	20	20	12
<b>DURING MILKING</b>			
Apply Unit	11	11	8
Adjust Unit	5	3	0
Checking and Stripping Udder	28	16	10
Remove Unit	9	9	6
<b>AFTER MILKING</b>			
Dipping teats	8	5	0
Changing Cows	22	18	14
Miscellaneous	4	2	0
Operator Idle Time	13	13	10
<b>TOTAL</b>	<b>2 min</b>	<b>1.6 min</b>	<b>1 min</b>
<b>Max. Cows/Operator/Hour</b>	<b>30</b>	<b>37</b>	<b>60</b>

<sup>1</sup>Source: Palmer 1981 (21).

milking parlor routine. In designing milking parlors, peak milk production and future milk production should be considered. Malfunction associated with milking equipment such as low vacuum reserve, worn liners, or poor liner type can produce excessive milking unit detachment and readjustment and could be diagnosed by knowledgeable and alert employees.

Blake, McDaniel and King (4) dealt with flow rate, labor, and machine inputs to milk harvest to evaluate the efficacy of selection and managerial approaches to improved economy of milk harvest. The results suggest that direct selection of cows for reduced labor inputs to milking would not be practical. Reduction of overmilking, a function of labor management, would be a less costly alternative than direct selection for reducing average cost of milk harvest.

Blake and McDaniel (5) investigated associations of labor, machine, and flow rate characters with subjective type traits and measurements of udders and teats of Holstein and Jersey cows. They estimated the effect of selection for improved udder conformation on labor and machine inputs to milking. Among the udder type traits of cows of the same herd, parity, stage of lactation, and PM milk yield, only udder quality and udder support were associated with labor inputs to milking. Indirect selection for improved labor economy of milking by improving udder type appears to be of little importance. Study of udder type, udder, and rear teat measurements showed small associations with labor and machine inputs to milking. Results show that larger udder and teat size require more labor and machine time.

## *Labor Expenses*

Edgar (10) obtained data from 73 Virginia Grade A dairy farms who were members of the Virginia Agribusiness Management Association (VAMA). The information contained in Table 13 shows that for 1978 all farms averaged 13.9% of the cash operating expenses for hired labor and 14.1% of milk sales. It is interesting to note that the average dairy farm has a hired labor cost per cow of \$209 and a hired labor cost/cwt milk of \$1.58. The number of full - time (2400 h/yr) workers was 3.63 with a wage rate of \$3.11/h, 28 cows/person, and 166,978 kg milk sold/person. From the category farm size (number of cows) less than 60 cows the low cost/cwt milk \$0.95 should be noted because they averaged 8.2% of the cash operating expenses due to more work done by owner of family. The low producing farms paid less for labor (\$2.54/h) and sold 141,505 kg less milk per person. It is interesting to note that in the category net operating profit, high profit farms had the highest percent of hired labor (16.1%) in relation to total cash operating expenses and sold more milk per person.

Edgar, Chang and Graves (11) published data obtained from 56 grade A dairies in 1985, all of whom were clients of Mountain States Management Services, Inc. (MSMS, formerly VAMA), Table 14. Many of these farms are also in Table 13. Hired labor as a percent of operating expenses was higher in 1985 (15.5%) than in 1978 (13.9%). Cost per cow, and cost per cwt milk were up substantially. The number of full-time employees was also higher compared with 1978. The wage rate increased from \$3.11/h to \$4.21/h and kg of milk sold/man increased from 166,978 kg milk in 1978 to 204,513 kg milk in 1985. The cost/cwt milk in a high milk producing herd category was less (\$1.84) than in the low milk producing herd category (\$2.48). The number of cows/person was greater (31) in large herds than in small herds (22). The high profit herd category spent 13.7% of the cash operating expenses for hired labor, higher than the low profit herd category at 13.2%.

Table 13. Labor expenses for Virginia dairy herds in 1978.<sup>1</sup>

HIRED LABOR

Herd Category	% of Expenses	% of milk Receipts	cost/cow	cost/cwt Milk	No. of Full-time people	Wage/h	Milk sold/ person	Number Cows/ person
Virginia	13.9	14.1	209	1.58	3.63	3.11	166,978	28
High Milk	14.4	13.8	234	1.47	3.44	3.21	203,720	28
Low Milk	13.7	14.1	181	1.75	3.51	2.85	134,851	29
Many Cows (> 125)	15.1	15.4	233	1.73	5.44	3.24	185,208	30
Few Cows (< 60)	8.2	8.7	119	.95	2.03	2.54	141,505	25
High Profit	16.1	15.2	233	1.71	4.47	3.19	179,248	29
Low Profit	13.7	15.1	203	1.64	3.05	2.85	153,529	27

<sup>1</sup>Source: Edgar, T.R. 1979 (10)

Table 14. Labor expenses for Virginia dairy herds in 1985.

Herd Category	HIRED LABOR							Milk sold/person	Number cows/person
	% of Expenses	% of Receipts	cost/cow	cost/cwt Milk	No. of Full-time people	Wage/h			
Virginia	15.5	14.8	319	2.05	4.12	4.21	204,513	29	
High Milk	15.6	13.5	295	1.84	4.31	4.19	225,825	31	
Low Milk	16.4	18.1	382	2.48	3.86	3.88	152,827	22	
Many Cows (> 125)	18.1	17.3	370	2.41	5.41	4.31	217,960	31	
Few Cows (< 60)	11.8	11.5	237	1.54	2.96	3.79	155,787	22	
High Profit	13.7	12.9	305	1.73	4.09	3.88	206,247	26	
Low Profit	13.2	12.5	206	1.76	2.57	4.08	196,681	37	
High Debt	11.1	12.2	252	1.69	3.27	3.79	180,438	27	
Low Debt	16.5	15.2	321	2.07	4.38	4.21	190,210	27	

<sup>1</sup>Source: Edgar, T.R., L.Chang, and H.C. Graves 1986 (11).

## *Delegation of Decisions on the Farm*

Effective division of labor on farms is an issue of importance. Murrill (29) has promoted the use of job images and titles and has shown the importance of human relations and labor management practices in a successful dairy enterprise.

Successful managers find that careful analysis of the decision process is very important. Errington (13) reported that the decision process is central to management, and that this process is based on three conceptually distinct phases: decision-making, decision-taking, and decision-implementing. In the first phase, decision-making, information comes from either outside or from within the business; verbal or written. In the second phase of the decision process the decision-maker makes use of the assembled information and evaluates alternative courses of action available, tempered with personal judgement. In the final phase of the decision process, the decision-maker may either take the necessary action or assign someone else to take it.

Most studies indicated that few hired employees are eager to be decision makers. According to Appleman (29), employees view decisions as added responsibilities that lead only to conflict. Because decisions are reflected in the profitability of the enterprise, the farmer/manager has to take care in assigning people to make decisions without reference to higher authority.

The role that centralization plays in the delegation of decisions on the farm has been studied by several investigators. Errington (13) proposed some criteria for distinguishing different types of decisions; technical or economic relative to resource use and financial consequences. Furthermore, based on the criterion of reversability of the decision, some decisions are less likely to be delegated. However, with the increase in size of dairies, farmers would need to delegate more decisions to others. It was found that younger farmers were more likely to delegate.

## Materials and Methods

### *Data Collection*

This study required two data sets, labor data collected in the spring of 1979 and herd DHI records on production variables from September 1978, 1982, and 1986.

The original labor data set was a survey questionnaire conducted on 321 randomly selected dairy herds, choosing half of all Virginia DHI herds with more than 60 cows. These farms were on the DHI production testing program and employed one or more full-time workers. Information on each herd included county and herd code number, as well as all labor survey and DHI variables. DHI herds were desirable because DHI supervisors helped distribute and collect surveys, and DHI management information could be related to the labor information received from the survey.

The survey form was four pages (Appendix A). Most questions could be answered easily by checking off appropriate choices in about 30 min. The survey was designed to provide general information about the dairy, a profile of the labor force, a personal profile of up to three full-time hired workers, wages and fringe benefits, working conditions and schedules, incentive programs, recruitment, training, general labor management practices and some supplemental information not available from other sources. Surveys were delivered by DHI supervisors in February and individual responses were returned by mail in confidential envelopes. Follow up on non-returns was through the supervisors.

Herds were distributed in four herd sizes and five geographical regions of Virginia (Figure 1). Those are listed in Table 15 with the number of herds surveyed in each area and the number of returns received. About 53% or 173 of the 321 dairy producers returned the four-page questionnaire, including information on 359 full-time employees and over 300 part-time workers.

Although production was not involved in herd selection, Table 16 is a profile of Holstein herds in each production level. There was a clear tendency for higher producing herds to return the survey. Herds from the central region were least likely to return the survey. This may have been a result of supervisor interest in checking non-returns.

Herd DHI production records were assembled for the years of 1978, 1982, and 1986, chosen to be equally spaced four years apart. The intent was to relate differences in labor variables to differences in DHI variables when the herds were surveyed, and to changes in DHI variables in subsequent years. Three years were selected to inspect linear and quadratic changes in production variables. Table 17 shows that there were 321 farms with DHI records in 1978. In 1982 there were 265 farms still on DHI and in 1986 there were only 201 farms on DHI, 62% of the original herds surveyed.

Farms that remained in the final data set were required to have been enrolled at least 8 yr on DHI beginning in 1978 and having returned the survey. The study from this point was restricted to Holsteins.

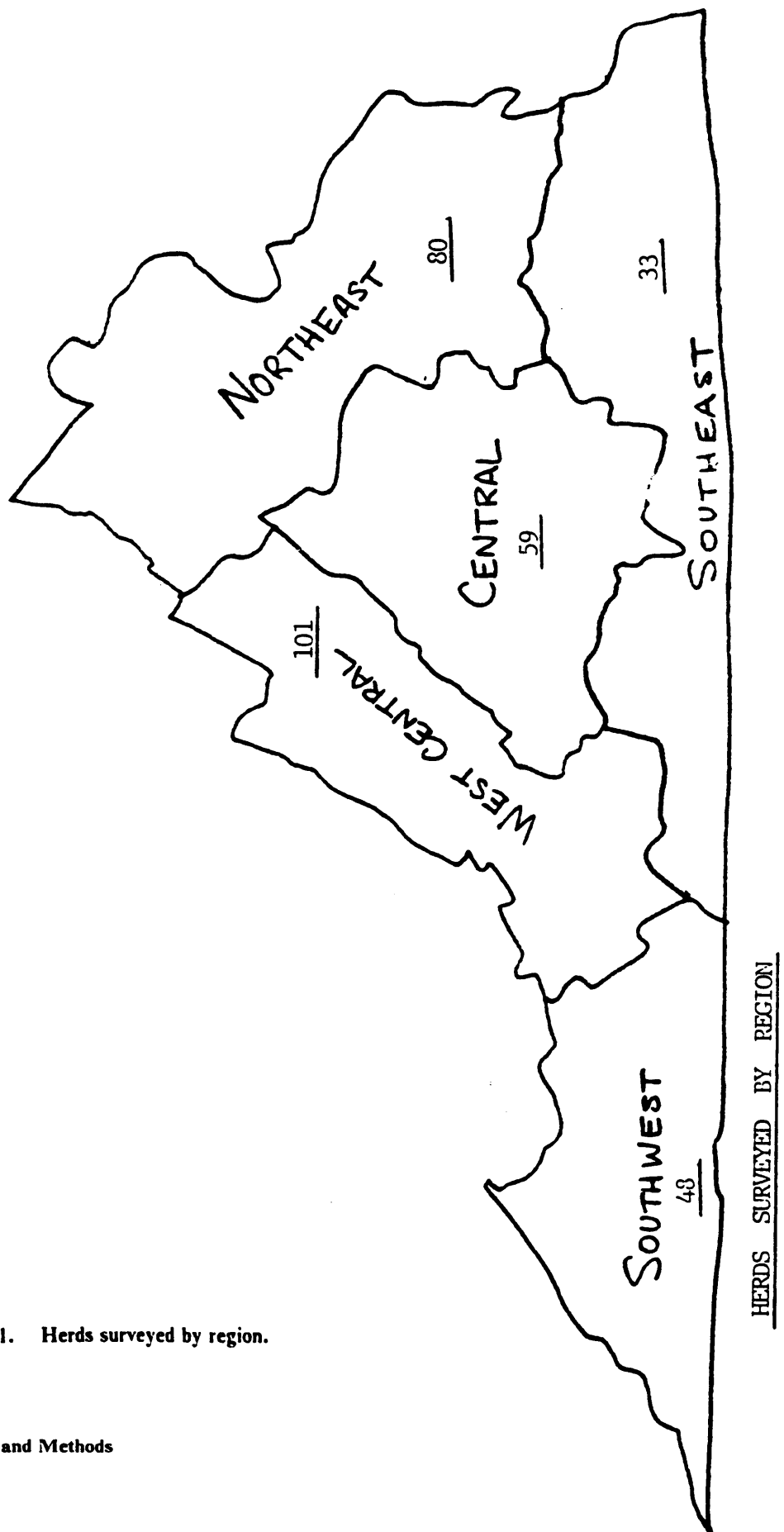


Figure 1. Herds surveyed by region.

**Table 15. Number of DHI herds surveyed and rate of return.**

Area	HERD SIZE (cows)				All Sizes	Number Returned	Percent Returned
	60- 89	90- 119	120- 149	150- up			
Northeast	31	16	15	18	80	39	49
Central	30	12	7	10	59	21	36
West- Central	53	27	14	7	101	65	64
Southwest	25	14	6	3	48	26	54
Southeast	14	10	3	6	33	22	67
All areas	153	79	45	44	321	173	53
Returned	77	51	22	23	173		
Percent	50	65	49	52	53		

**Table 16. Frequency of Holstein herds returning surveys, categorized by rolling yearly production per cow.**

Milk yield (kg)	Herds Surveyed	Herds Returned	Percent Returned
Less than 5,909 kg	81	33	41
5,909 to 6,817 kg	104	56	54
6,818 to 7,726 kg	88	53	60
7,727 and above	32	21	66

**Table 17. Herds remaining on DHI, categorized by survey**

Remaining Through Year	Survey Returned		Survey not Returned		Herds	All %
	Herds	%	Herds	%		
1978	173	100	148	100	321	100
1982	153	88	112	75	265	82
1986	125	72	75	50	201	62

DHI variables were merged by herd with the labor records. Two data sets were formed for different analyses, one containing separate labor records for each herd, and the other containing one labor record for each worker, up to three records per herd. Both sets of data included three years of DHI variables as well as general labor variables.

Some of the labor variables such as pay and hours worked were transformed by interpolation from categories to continuous variables by choosing the midpoint of the category. Cash wages and fringe benefits expressed as dollars per month were summed to measure total pay and then divided into total pay categories.

To analyze the relationship of labor management with herds remaining on DHI through 1986, frequency analyses were developed to test the independence of particular labor variables and the number of herds remaining on DHI after eight years. Independence of variables from time on DHI since 1978 was tested with chi-square statistics.

The second objective was to find the influence of labor variables reported in 1978 on differences between herds in 1978 and on changes in production variables in subsequent years. Workers were categorized into their main responsibility of milker, herds person, cow feeder, or field person. Calf person was excluded for lack of sufficient numbers. The manager had ranked these five responsibilities for each employee. For these analyses the employee was assigned the responsibility ranked number one.

Two types of dependent variables were selected for analysis; 1) 1978 herd DHI averages, and 2) 1986 herd DHI averages minus 1978 averages. These DHI variables are in Table 18.

The dependent DHI variables (Table 18) included the following. Annual fat corrected milk (kg/cow) was the rolling yearly herd average of milk adjusted to a 4% fat equivalent ( $FCM = .4 * Milk + 15 * Fat$ ). Days open (d/cow) was the interval between the first day of lactation and the date of conception. Days dry (d/cow) was the interval from the end of one lactation period to the

**Table 18. DHI variables (dependent) in the stepwise model.**

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Fat corrected milk 1978
Income minus feed cost 1978
Days open 1978
Number of breeding per conception 1978
Days dry 1978
Age at first lactation 1978
Percent of all cows accounted for by cows leaving the herd for reasons other than dairy and low production 1978
Number of cows 1978
Mast2 (mastitis test severe, somatic cell/ml > 800,000) 1978

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beginning of the next lactation. Number of breedings per conception was the number of times cows were bred for each conception. Income minus feed cost (\$) was the lactation income per cow minus feed cost per cow. Age at first lactation (mo) was the age of the cow at first calving. Pctbad (%) was the percentage of all cows accounted for by cows leaving the herd for reasons other than dairy and low production. Mast2 (mastitis test severe) (%) was the percentage of cows with a high frequency of somatic cells in milk. In 1978 and 1982, mast2 was percent of cows with somatic cells greater than 800,000 cells/ml, and in 1986 mast2 was percent of cows with somatic cells greater than 1,130,000 cells/ml. The change was due to a change by DHI in reporting somatic cell concentrations in a logarithmic format.

It is important to highlight that production, size of the farm, difficulty hiring workers, difficulty keeping workers, opportunity for educational schools or programs, and provision of agricultural reading materials were survey variables applied to the farm rather than the individual employee.

The following model was used for milkers and herds persons in a stepwise regression analysis, excluding labor variables one at a time until all remaining labor variables significantly ( $p < .05$ ) influenced DHI variables (backward elimination technique). The independent labor variables are in Table 19. The stepwise model was:

$$Y_i = a + \sum b_j X_{ij} + E_i$$

Where:

$Y_i$  = DHI variables (1978 or (1986 minus 1978), Table 18) for herd i.

$a$  = *intercept*

$X_{ij}$  = Labor variable j from survey (Table 19) for herd i.

$b_j$  = Regression of DHI variable on labor variable j.

$E_i$  = Random residual for herd i.

Because fewer employees had the predominant classifications of cow feeder and field person, the stepwise model for those did not include the quadratic labor variables (Table 20).

A classification model was used to test differences in DHI variables for categories of pay and hours after removing effects of herd and year. It was run separately for each type of worker. This model was:

$$Y_{ijkl} = U + P_i + W_j + (PW)_{ij} + H_{(ij)k} + T_l + E_{ijkl}$$

Where:

$Y_{ijkl}$  = DHI herd average in herd k and year l.

$\mu$  = Mean DHI variable

$P_i$  = Effect of pay class i (i = 1,2,3)

$W_j$  = Effect of hours worked class j (j = 1,2)

$(PW)_{ij}$  = Interaction effect of pay and hours

$H_{(ij)k}$  = Effect of herd k (Error term for P, W, PW)

$T_l$  = Effect of year l (l = 1,2,3 for 78, 82, 86)

$E_{ijkl}$  = Residual

The second area of analysis examined pay and hours as related to herd change over time (1978 to 1986) by evaluating regressions of DHI variables on year, year squared, and the products of those

**Table 19. Stepwise Models: Independent variables for milker and herds person.**

---

Milker
Herds Person

---

Total Pay (L, Q)
Hours Worked/Week (L, Q)
Days Paid
Vacation/Year (L, Q)
Time Off Each Month (L, Q)
Years Employed
on the Farm (L, Q)
Age (L, Q)
Years of School (L, Q)
Difficulty Keeping
Good Workers
Training Categories
Attend Educational
Schools or Programs
Provide Agricultural
Reading Materials
Total Pay*Hours Work
Total Pay*Vacation
Total Pay*Time Off
Hours Work*Vacation
Hours Work*Time Off
Vacation*Time Off

---

L = Linear  
Q = Quadratic

**Table 20. Stepwise Models: Independent variables for cow feeder and herds person.**

---

Cow Feeder
Field Person

---

Total Pay
Hours Worked/Week
Days Paid Vacation/Year
Time Off Each Month
Years Employed on the Farm
Age
Years of School
Difficulty Keeping Good Workers
Training Categories
Attend Educational Schools or Programs
Provide Agricultural Reading Materials
Total Pay*Hours Work
Total Pay*Vacation
Total Pay*Time Off
Hours Work*Vacation
Hours Work*Time Off
Vacation*Time Off

---

two with pay, hours worked, and pay by hours worked. Data were obtained from DHI records from September 1978, September 1982, and September 1986. The following model was used to derive curvilinear changes of DHI variables over time. These regressions were within herd and were estimated for each category of pay and hours worked.

$$Y_{ijkl} = a + H_i + b_1T_j + b_2T_j^2 + b_3(TP)_{jk} + b_4(T^2P)_{jk} \\ + b_5(TH)_{jl} + b_6(T^2H)_{jl} + b_7(TPH)_{jkl} + b_8(T^2PH)_{jkl} + E_{ijkl}$$

Where:

$Y_{ijkl}$  = Dependent DHI variables (Table 21)

$H_i$  = Effect Herd  $i$  (absorbed)

$T_j$  = Year  $j$  ( $j = 78, 82, 86$ )

$P_k$  = Pay category  $k$  ( $k = 1, 2, 3$ )

$H_e$  = Hours worked category  $l$  ( $l = 1, 2$ )

$b_1 \dots b_8$  = Regressions of  $Y$  on time by labor category

$E_{ijkl}$  = Random residual

The pay levels originally were six, and hours worked were five. For this study pay plus fringe benefits categories were reduced to three and hours worked were reduced to two (Table 22). The reason for this reduction in categories of pay and hours was because there were few employees in some combinations of pay and hours, particularly high pay and short hours. For herds person the lowest pay category was increased to obtain 18 herds rather than only 3 herds in the combination of low pay and long hours.

**Table 21. DHI Variables (dependent) in the regression analyses over time.**

---

Annual Milk (kg/cow)  
Annual Fat Corrected Milk (kg/cow)  
Days Open (d/cow)  
Days Dry (d/cow)  
Number of Breedings per Conception  
Income minus Feed Cost (\$)  
Age at First Lactation (mo)  
Pctbad (cow leaving the herd for reasons other  
than dairy and low production,%)  
Mast2 (Mastitis Test Severe), more than 800,000 cells/ml in 1978;  
more than 1,130,000 cells/ml in 1986.

---

**Table 22. Combinations of original and modified categories total pay per month and hours worked per week combined for analyses.**

Modified Pay Categories	Herds Person Pay Categories	Original Hours Categories	Analyzed Hours Categories
Under \$600	Under \$800	Under 40	Under 59
\$600 - 999	\$800 - 999	40 - 49	Above 60
\$Above 999	Above \$999	50 - 59	
		60 - 69	
		Above 69	

## Results and Discussion

### *Survey Results*

Table 23 contains the number of Holstein farms surveyed in each production level and herd size. The largest number of farms had 60 to 89 cows across all levels of milk production, and milk yield of 5,909 to 6,817 kg across all combinations of sizes. The highest producing herds were spread most evenly across the four size categories.

A summary of the Virginia dairy labor survey of 1979 (Appendix A) showed an average of 484 total acres owned, including 252 tillable acres. Those who rented land had 230 rented acres. The average farm had been operated for 21 years with .8 fulltime family workers, 2.1 fulltime hired workers, .8 parttime family workers and .9 parttime hired workers. The fulltime hired workers had major responsibilities of milker, herds person, cow feeder, calf person, or field person, where multiple responsibilities were ranked for each employee. Hourly wages for part time employees were \$2.90 for adult and \$2.55 for teenagers or family members.

**Table 23. Numbers of Holstein herds surveyed by herd size and yearly milk production per cow.**

Milk yield (kg)	Herd Size (Cows)				
	60- 89	90- 119	120- 149	150- up	All Sizes
Less than 5,909 kg	42	20	10	8	80
5,909 to 6,817 kg	48	21	17	18	104
6,818 to 7,726 kg	43	23	12	10	88
7,727 and above	12	10	3	7	32
All production	145	74	42	43	304

Only 88% of the workers were receiving fringe benefits, with only 10% of the farms having a written agreement with their fulltime hired labor covering fringe benefits, wages, incentives, and work arrangements. It is also of interest that 34% of the herds which operated incentive programs had programs based on production and only 7% of the incentive programs were based on profit-sharing.

Dairy producers reported that they found workers most often by word of mouth (60%) and least often from the state employment office, and colleges (6% each). Twenty-one percent used newspapers. To evaluate the potential of a prospective employee, 25% used work experience, 19% relied on references, and 5% discriminated on the basis of gender. Wages paid to workers were influenced by competition from other farms and industry (36% each). Wage increases were decided on merit (43%) and on the increase in annual cost of living (31%). Farms reported \$173,379 in value of milk sold, \$143,138 approximate farm operating expenses, and estimated value of farm and herd assets of \$500,000.

Labor package statistics for the five primary types of workers are listed in Table 24 with means and standard deviations for each variable. Total pay per month included cash wages plus value of fringe benefits, but not incentives. Total pay per month was highest for workers classified as herds person (\$964/mo) and lowest for calf persons (\$563/mo). Herds persons generally have the most leadership responsibilities, whereas the calf persons are often family members or those less involved in other aspects of the farming operation. Hours worked per week were similar for all types of workers, but herds persons worked the most hours (55 h/wk), and calf persons worked the least (46.6 h/wk), consistent with the rank of their pay. Days of paid vacation per year were also higher for herds persons (8.3 d/yr), and lower for calf persons (6.8 d/yr), while time off each month was highest for field persons (4.2 d/mo), and lowest for herds persons (3.4 d/mo). Herds persons are generally around more because of broad decision-making responsibilities, while field persons are engaged in more intermitent and seasonal work. Years employed were highest for field persons (11.9 yr) and lowest for milkers (7.1 yr), showing relative turnover rates of the two jobs. Oldest employees were

field persons (40.2 yr), and youngest were calf persons (31.4 yr). Workers with most years of school were herds persons (11.4 yr), and least educated were calf persons with only 7.9 yr of school.

Table 25 contains percents and numbers of workers by type which attended educational programs, were provided with reading materials, and were trained before hiring or trained directly by the owner or manager. It must be noted that only the training questions were answered for individuals. The other two questions were answered on a herd basis, so their percentages pertain to herds reporting those types of workers. A herd may be counted twice, for instance, if it reported two milkers. It is interesting that herds reporting milkers were least likely to provide chances to attend educational programs or provide agricultural reading materials. Herds with calf persons or herds persons had the highest percent attending educational programs and having reading materials. Training categories differed little by type of employee, but the least qualified before hiring were the calf persons and the most qualified before hiring were the field persons. The herds person was most frequently trained by the owner or manager and the calf person was least frequently trained by the owner or manager. Note the calf person received least attention relative to qualifications or training.

Table 17 shows the number of survey herds in the DHI program in 1978, 1982, and 1986. From 173 herds that returned the survey only 72% remained on DHI 8 yr later while only 51% of the 147 herds that did not return the survey remained in the DHI program. Proportions of herds leaving DHI by 1982 relative to between 1982 and 1986 were similar whether the survey had been returned or not.

An analysis of percentage of herds remaining on DHI in 1986 utilized independent labor variables of cash wages, production and herd size, difficulty hiring and keeping workers, and offers of educational programs. Table 26 presents the percent of farms remaining on DHI in 1986 by cash wage of the different workers. It shows a slight tendency for farms with higher pay rates to remain in DHI, particularly for milkers. It appears that the cash wage did not make any difference for herds persons and cow feeders. Herds paying intermediate wages were most likely to drop from DHI,

**Table 24. Labor package means by primary job responsibility.<sup>1</sup>**

Variable	Milker	Herds Person	Cow Feeder	Calf Person	Field Person
Number	97	55	31	13	33
Total Pay (\$/Mo)	782 (250)	964 (275)	778 (285)	563 (157)	744 (263)
Hours Worked (h/Wk)	52.8 (11.2)	55.0 (9.6)	52.7 (11.4)	46.6 (12.6)	51.6 (10.2)
Paid Vacation (d/Yr)	7.4 (4.7)	8.3 (5.6)	7.2 (4.9)	6.8 (5.6)	7.1 (5.1)
Time off each Month (d/Mo)	3.9 (2.1)	3.4 (2.1)	3.9 (2.4)	3.6 (2.7)	4.2 (2.6)
Years employed (Yr)	7.1 (8.3)	9.8 (8.8)	9.3 (8.5)	7.6 (10.1)	11.9 (8.9)
Age (Yr)	35.3 (13.8)	33.5 (12.1)	35.7 (14.3)	31.4 (16.1)	40.2 (14.8)
Years of School (Yr)	8.8 (3.1)	11.4 (3.1)	8.5 (3.2)	7.9 (2.7)	8.3 (2.9)

<sup>1</sup>Standard Deviations in parentheses.

**Table 25. Percentages of herds providing educational opportunities and training individuals on the farm.**

Type	Attend Educational Programs	Provide Reading Material	Training	
			Qualified Before Hiring	Directed by Owner or Manager
Milker	43.7	64.1	26.6	63.8
Herds Person	62.7	77.5	26.6	68.8
Cow Feeder	52.6	67.5	20.0	68.0
Calf Person	71.4	80.0	18.1	54.5
Field Person	53.4	69.7	32.3	58.8
Average	52.2	69.1	26.3	64.1
Number	151	202	55	134

possibly indicating that those paying lowest wages had other working arrangements which appealed to workers.

Milk production and herd size were important for herds staying in the DHI program. Table 27 clearly shows that herds with lower milk production in 1978, independent of size, were more likely to drop from the DHI program than herds with high production. It is interesting that intermediate herd sizes with high production all remained in the DHI program.

Seventy-eight percent of farms reporting no difficulty in hiring or keeping hired employees remained in the DHI program, while those with difficulty hiring averaged 65% remaining. Educational programs also were important, showing that 80% of the farms that offered opportunities to attend educational programs remained in the DHI program, while of the farms that did not have educational programs only 63% remained. This was expected because having workers attend educational programs ought to provide benefits for the farm through new ideas and possibly increased production.

Means and standard deviations of DHI variables were calculated for 125 Holstein herds returning the survey and still on DHI in 1986 to see changes from 1978 to 1986 (Table 28). There was a 13.7% increase in milk production from 6,845 to 7,785 kg and a 5.2% increase in fat corrected milk, indicating a decrease in fat percent. The most substantial change was a loss in efficiency of reproduction, where days open increased from 126.3 d to 130.0 d. Number of breedings per conception increased from 1.8 to 2.0, a likely contributor to the increase in days open. A 21 d cycle, coupled with an increase of .2 breedings, would cause an increase of 4.2 days open. Days dry also increased from 63.2 d to 64.9 d.

Income minus feed cost is not a very accurate measure on DHI because the feeds fed and values reported by dairy producers are often inaccurate. Standard deviations increased substantially, il-

**Table 26. Percentges of farms remaining on DHI in 1986 by cash wage and type of employee.**

Cash Wage (\$/mo)	Milker	Herds Person	Cow Feeder
Under \$300	67	83	89
\$300-449	71	62	64
\$450-599	61	74	71
\$600-740	73	67	80
\$750-999	78	90	86
Above \$999	87	83	80

**Table 27. Percentges of farms remaining on DHI in 1986 by herd size and milk yield per year.**

1978 Production	Herd Size (cows)			
	60- 89	90- 119	120- 149	150- up
Less than 5,909 kg	38	25	27	37
5,909 to 6,817 kg	65	86	82	72
6,818 to 7,726 kg	74	78	50	60
7,727 and above	67	100	100	71

**Table 28. Means of DHI variables for 125 Holstein herds returning surveys and still on DHI in 1986.**

DHI variables	1978	1982	1986
Milk (kg)	6845 (859)	7240 (907)	7785 (997)
Fat Corrected Milk (kg)	6463 (817)	6798 (858)	7260 (884)
Days Open	126.3 (22.8)	127.4 (19.1)	130.0 (23.1)
Days Dry	63.2 (8.1)	64.8 (8.8)	64.9 (9.6)
Number of Breedings per Conception	1.8 (0.3)	1.9 (0.4)	2.0 (0.5)
Income minus Feed Cost (\$)	927 (178)	1356 (287)	1108 (477)
Age at First Lactation (mo)	30.0 (2.5)	29.5 (2.7)	30.2 (2.9)
Pctbad (%)	21.9 (7.7)	21.6 (7.2)	24.3 (7.5)
Mast2 (%)	11.3 (8.1)	8.3 (6.3)	7.8 (5.5)

Standard deviations in parentheses.

Pctbad (%) = Percent of all cows accounted for by cows leaving the herd for reasons other than dairy and low production.

Mast2 (%) = mastitis test severe.

lustrating differences among producers in reporting figures. Some probably did not change their reported prices or quantities over those years.

Age at first calving remained at an average of 30 mo. Pctbad, cows leaving the herd for reasons other than dairy and low production, increased from 21.9 to 24.3% of herd.

Mast2 (mastitis test severe) decreased from 11.3 to 7.8% of cows, but here it is important to highlight that DHI changed this calculation between 1982 and 1986. In 1978 mast2 was the percentage of cows with somatic cell counts above 800,000 cells/ml of milk, but in 1986 mast2 was the percentage of cows with somatic cell counts exceeding 1,130,000 cells/ml due to the change to logarithmic scaling of scores. Still there appears to have been a reduction of mast2 from 1978 to 1982. Awareness of the program and use of the information increased during those years.

A stepwise regression analysis was performed to take a broad look at the influence of labor responses in 1978 to DHI variables from 1978 to 1986. Tables were developed showing the regression coefficients of labor variables significantly ( $p < .05$ ) influencing production variables in 1978 and those influencing the difference in production variables of 1986 minus 1978. Each analysis was separate for milker, herds person, cow feeder, and field person, using all herds reporting each type of worker. A herd therefore could appear in more than one type of worker analysis but each worker occurred only once. The stepwise analysis removed labor variables from the model until all remaining variables were significant ( $p < .05$ ). The percentage of variation in the DHI variables which can be accounted for by labor variables is the squared correlation at the bottom of each table column. These results will focus on models with large squared correlations.

## *Differences between herds in 1978.*

Table 29 shows the regression coefficients of labor variables significantly ( $p < .05$ ) influencing differences between herds in fat corrected milk (FCM) in 1978. The squared correlations show that working arrangements for cow feeders and herds persons had the most influence on fat correct milk differences. Regressions indicate that herds with older cow feeders employed only a short time had lower FCM. Pay had little effect on fat corrected milk when feeders worked 53 h/wk, but when working 70 h/wk each \$100/mo was associated with 300 kg more FCM. Hours worked per week though significant, had little practical effect. When herds persons were or had to be trained by the manager, FCM was 955 kg less. Herds which paid the herds person \$1000/mo as contrasted to \$1500/mo had FCM production of 600 kg more, not easily explained. The maximum production of FCM was reached when the herds person was paid \$950/mo in cash and value of fringe benefits. The minimum FCM at was at 60 h/wk. Herds with the herds person working 70 h/wk as opposed to 60 h/wk produced 250 kg more FCM. Field persons had less influence on FCM, but showed that an increase in 1 day off per mo resulted in 576 kg less FCM. This may be related to less specialization in forage production and hence lower quality feed.

Table 30 shows labor variables significantly ( $p < .05$ ) influencing income minus feed cost (IOFC) in 1978 were mostly a function of herds person and cow feeder with reasonable squared correlations each. Herds persons which were older or had more schooling were employed by herds with higher IOFC. For instance, 33 yr age and 10 yr schooling represented the minimum IOFC. No difficulty keeping good employees cost \$128 while the necessity to train on the farm cost \$249 IOFC. For cow feeders, training on the farm cost \$223 IOFC.

Table 31 presents labor variables significantly ( $p < .05$ ) influencing days open in 1978. Cow feeders may have an influence on days open because they can detect cows in heat. Herds that paid \$100/mo more to the cow feeder tended to have 6 fewer days open except at high hours per week.

**Table 29. Labor variables significantly ( $p < .05$ ) influencing fat corrected milk 1978.**

Stepwise Variables	Milker	Herds Person	Cow Feeder	Field Person
Intercept	4991.91798	17351.06182	15102.94641	6057.51724
Total Pay (L)	-	-	-10.72911	-
Hours/week (L)	-	-326.50324	-109.27305	-
Paid Vac. (L)	254.36996	-227.95227	-	-
Days Off (L)	-	-	-	-576.03612
Years Employed (L)	-	-	55.99853	-
Age (L)	-	-	-41.91605	-
Years of School (L)	-	-	-	-
Total Pay (Q)	-.00165	-.00198	-	-
Hours/week (Q)	-	2.71737	-	-
Days Paid Vac. (Q)	-	-	-	-
Days Off (Q)	-	-	-	-
Years Employed (Q)	-	-	-	-
Age (Q)	-	-	-	-
Years of School (Q)	-	2.72676	-	-
Difficulty Keeping (1 = yes, 2 = no)	-	-	-	-
Training (1 = qualified, 2 = trained)	-	-955.24583	-	-
Educational Programs (1 = yes, 2 = no)	-	-	-	-
Reading Materials (1 = yes, 2 = no)	-	-	-	-
Pay*Hours	.06631	-	.15278	-
Pay*vacation	-	.31029	.30739	-
Pay*Time Off	-	.35213	.26104	-
Hours*Vacation	-5.20643	-	-6.78055	-
Hours*Time Off	-	-	-	13.00329
Vacation*Time Off	-	-28.98044	-	-
Squared Correlation	.22	.62	.80	.33

L = Linear  
Q = Quadratic

**Table 30. Labor variables significantly ( $p < .05$ ) influencing income minus feed cost 1978.**

Stepwise Variables	Milker	Herds Person	Cow Feeder	Field Person
Intercept	1370.02894	3273.04888	1490.22757	872.61235
Total Pay (L)	-	-	-.32988	-
Hours/week (L)	-18.10722	-	-	-
Days Paid Vac. (L)	-	-113.19612	-	-
Days Off (L)	-	-	-	-120.88429
Years Employed (L)	-	-	-	-
Age (L)	-	-32.31352	-5.51929	-
Years of School (L)	-	-143.8267	-	-
Total Pay (Q)	-.00069	-	-	-
Hours/week (Q)	-	.08793	-	-
Days Paid Vac. (Q)	-	-	-	-
Days Off (Q)	-	-	-	-
Years Employed (Q)	.22723	-	-	-
Age (Q)	-	.49129	-	-
Years of School (Q)	-	7.37294	-	-
Difficulty Keeping (1 = yes, 2 = no)	-	-127.54855	-	-
Training (1 = qualified, 2 = trained)	-	-249.21271	-222.78102	-
Educational Programs (1 = yes, 2 = no)	-	-	-	-
Reading Materials (1 = yes, 2 = no)	-	-	-	-
Pay*Hours	.02305	-.01966	-	-
Pay*vacation	-	.10573	-	-
Pay*Time Off	-	-	-	-
Hours*Vacation	-	-	-	-
Hours*Time Off	-	-	-	2.62021
Vacation*Time Off	-	-	-	-
Squared Correlation	.19	.52	.50	.28

L = Linear  
Q = Quadratic

Cow feeders working an hour less tended to be in herds with 3 fewer days open. Herds paying \$100 more for 10 fewer hours had 11 fewer days open. Herds that reported difficulty keeping employees had 24 fewer days open. Their standards may be high, therefore few employees are satisfactory. Field persons when paid \$100 more had 3 fewer days open, not easily explained.

Table 32 contains labor variables significantly ( $p < .05$ ) influencing number of breedings per conception in 1978, with most influence coming from herds person and field person. Though the coefficients are significant for age and years, the actual effect on breedings per conception was quite small. In herds reporting a herds person attendance at educational programs, breedings per conception were .36 lower. Breedings were fewest in herds where the herds person worked 55 h/wk. An increase of 10 h/wk, from 60 to 70, was related to an increase of .32 services per conception. These people may have been too busy to breed cows properly or at the appropriate time. Though having a high correlation with breeding success, the influence of the field person is difficult to explain.

Table 33 lists values for the labor variables significantly ( $p < .05$ ) influencing days dry in 1978. Herds person had a higher squared correlation than milker, primarily due to the herds person deciding when to dry off cows. Herds that offered educational programs had more days dry by 6 d and those that offered reading materials had less days dry by 8 d. Written materials would represent more frequent reinforcement of recommended principles.

Table 34 presents results of labor variables significantly ( $p < .05$ ) influencing age at first lactation in 1978. Field person had the highest squared correlation. When given more days off there was a decrease in age at first lactation, possibly a result of less field work and more time for care of heifers. Herds in which cow feeders were paid \$500/mo more showed 2 mo less age at first calving, may be due to those highly paid employees feeding heifers too.

Table 35 summarizes labor variables significantly ( $p < .05$ ) influencing the percent of cows leaving the herd for reasons other than dairy and low production (PctBad) in 1978. Herd differences seem

Table 31. Labor variables significantly ( $p < .05$ ) influencing days open 1978.

Stepwise Variables	Milker	Cow Feeder	Field Person
Intercept	273.50486	-111.86567	545.65763
Total Pay (L)	-	.25132	-.51109
Hours/week (L)	-2.75086	4.12776	-4.75039
Days Paid Vac. (L)	-17.89809	-17.84355	-
Days Off (L)	-	-	-
Years Employed (L)	-	-	2.77983
Age (L)	-	-	-2.43176
Years of School (L)	-	-	-3.87231
Total Pay (Q)	-	-	-
Hours/week (Q)	-	-	-
Days Paid Vac. (Q)	.25931	-	-
Days Off (Q)	-1.20167	-	-
Years Employed (Q)	-	-	-
Age (Q)	-	-	-
Years of School (Q)	-	-	-
Difficulty Keeping (1 = yes, 2 = no)	-	24.02644	-
Training (1 = qualified, 2 = trained)	-	-	-
Educational Programs (1 = yes, 2 = no)	-	-	-
Reading Materials (1 = yes, 2 = no)	-	-	-
Pay*Hours	-	-.00541	.00729
Pay*vacation	-	-	-
Pay*Time Off	-	-.00623	.02424
Hours*Vacation	.24518	.42019	-
Hours*Time Off	.18729	-	-.25331
Vacation*Time Off	-	-	-.35081
Squared Correlation	.36	.72	.79

L = Linear  
Q = Quadratic

Table 32. Labor variables significantly ( $p < .05$ ) influencing number of breeding per conception 1978.

Stepwise Variables	Milker	Herds Person	Cow Feeder	Field Person
Intercept	2.38232	4.46009	1.76832	-2.33447
Total Pay (L)	-	-	-	-
Hours/week (L)	-	-.17096	-	.1706
Days Paid Vac. (L)	-	-	-	.53764
Days Off (L)	-	-	-	-.10523
Years Employed (L)	-	-.08866	-	-
Age (L)	-	.11366	-	-
Years of School (L)	-.05127	-	-	-.1447
Total Pay (Q)	-.00006	-	-	-
Hours/week (Q)	-	.00156	-	-
Days Paid Vac. (Q)	-	.00101	-	-
Days Off (Q)	-	-	-	-
Years Employed (Q)	-	.00313	-	-
Age (Q)	-	-.00131	-	-
Years of School (Q)	-	-	-	-
Difficulty Keeping (1 = yes, 2 = no)	-	-	-	-
Training (1 = qualified, 2 = trained)	-	-	-	.66134
Educational Programs (1 = yes, 2 = no)	-	.36538	-	-.5238
Reading Materials (1 = yes, 2 = no)	-.19352	-.47043	-	-
Pay*Hours	.00001	-	-	-.00004
Pay*vacation	-	-	-	.00033
Pay*Time Off	-	.00006	-.00012	-
Hours*Vacation	-	-	-	-.01758
Hours*Time Off	-.00121	-	.00247	-
Vacation*Time Off	.0069	-	-	-
Squared Correlation	.27	.56	.24	.74

L = Linear  
Q = Quadratic

Table 33. Labor variables significantly ( $p < .05$ ) influencing days dry 1978.

Stepwise Variables	Milker	Herds Person
Intercept	67.77528	63.12751
Total Pay (L)	-	-
Hours/week (L)	-	-
Days Paid Vac. (L)	-	-
Days Off (L)	-	-
Years Employed (L)	-	-
Age (L)	-	-
Years of School (L)	-	-
Total Pay (Q)	-	-
Hours/week (Q)	-	-
Days Paid Vac. (Q)	-	-
days Off (Q)	-	-.53064
Years Employed (Q)	-	-
Age (Q)	-	-
Years of School (Q)	-	-
Difficulty Keeping (1 = yes, 2 = no)	-	-
Training (1 = qualified, 2 = trained)	-	-
Educational Programs (1 = yes, 2 = no)	-3.60386	-5.88777
Reading Materials (1 = yes, 2 = no)	-	8.21976
Pay*Hours	-	-
Pay*vacation	-	-.00066
Pay*Time Off	-	.00358
Hours*Vacation	-	-
Hours*Time Off	-	-
Vacation*Time Off	-	-
Squared Correlation	.05	.35

L = Linear  
Q = Quadratic

Table 34. Labor variables significantly ( $p < .05$ ) influencing age at first lactation 1978.

Stepwise Variables	Milker	Herds Person	Cow Feeder	Field Person
Intercept	31.44084	34.95926	30.12414	29.49902
Total Pay (L)	-	-	-.00395	-
Hours/week (L)	-	-.10711	-	-
Days Paid Vac. (L)	-	-	-	-
Days Off (L)	-	-	-	1.4855
Years Employed (L)	-	-	-	-
Age (L)	-	-	-	.04993
Years of School (L)	-	-	-	-
Total Pay (Q)	-	-	-	-
Hours/week (Q)	-	-	-	-
Days Paid Vac. (Q)	-	-	-	-
Days Off (Q)	-	-	-	-
Years Employed (Q)	-	-	-	-
Age (Q)	-	-	-	-
year of School (Q)	-	-	-	-
Difficulty Keeping (1 = yes, 2 = no)	-	-	-	-
Training (1 = qualified, 2 = trained)	-	-	-	-
Educational Programs (1 = yes, 2 = no)	-	-	-	-
Reading Materials (1 = yes, 2 = no)	-	2.11873	-	-
Pay*Hours	-	-	-	-
Pay*vacation	-	-	-	-
Pay*Time Off	-	-.00051	-	-
Hours*Vacation	-	-	.01399	-
Hours*Time Off	-	-.00845	-	-.04311
Vacation*Time Off	-	-	-.09857	.03833
Squared Correlation	.1	.26	.43	.7

L = Linear  
Q = Quadratic

to be a function of labor packages for herds persons and cow feeders. Herds in which the cow feeders worked more hours per week had a larger percent of cows leaving for bad reasons. An increase in paid vacation of 1 d was related to 3% more culling, and 1 day off to 1% increase in culling, little change overall.

Table 36 reveals labor variables significantly ( $p < .05$ ) influencing number of cows in 1978. Herds person and field person were related to the number of cows 1978. The herds that gave the herds person more days off and paid vacation had more cows in 1978, just reflecting differences in herd size. Field persons attended more educational programs in larger herds.

Table 37 shows labor variables significantly ( $p < .05$ ) influencing Mast2 (mastitis test severe) in 1978. Treatment of the herds person had the most influence, showing that \$100 more pay and 10 h/wk fewer were associated with more mastitis. Years of school showed that at 12 y mastitis was maximum and for 16 y of school severe mastitis decreased 6 %.

## *Production changes from 1978 to 1986*

The change in DHI variables from 1978 to 1986 was regressed on the 1979 labor survey variables in a stepwise analysis. Labor variables were excluded from the model one at a time until all remaining labor variables significantly ( $p < .05$ ) influenced the difference between 1978 and 1986. Analyses were separate for each type of worker. Those analyses with squared correlations exceeding 50% included herds person for mastitis, cow feeder for fat corrected milk, income over feed cost, and percent leaving herd for bad reasons, and field person for days open, days dry, and age at first lactation.

Table 35. Labor variables significantly ( $p < .05$ ) influencing percentage of cows leaving the herd for reasons other than dairy and low production 1978

Stepwise Variables	Milker	Herds Person	Cow Feeder	Field Person
Intercept	21.80488	32.37002	21.60227	23.24761
Total Pay (L)	-	-	-	-
Hours/week (L)	-	-	.79366	-
Days Paid Vac. (L)	-	-3.70315	-2.88782	-
Days Off (L)	-	-	6.65062	-
Years Employed (L)	-	-	-	-
Age (L)	-	.17834	-	-
Years of School (L)	-	-	-	-
Total Pay (Q)	.00001	-	-	-
Hours/week (Q)	-	.00558	-	-
Days Paid Vac. (Q)	.09723	-	-	-
Days Off (Q)	-	-	-	-
Years Employed (Q)	-	-	-	-
Age (Q)	-	-	-	-
Years of School (Q)	-	-	-	-
Difficulty Keeping (1 = yes, 2 = no)	-	-	-	7.84047
Training (1 = qualified, 2 = trained)	-	-	-	-
Educational Programs (1 = yes, 2 = no)	-	-	-	-
Reading Materials (1 = yes, 2 = no)	-	-4.57449	7.01814	-9.57142
Pay*Hours	-	-.00052	-	-
Pay*vacation	-.00211	.00362	-	-
Pay*Time Off	-	-	-	-
Hours*Vacation	-	-	-	-
Hours*Time Off	-	-	-.15468	-
Vacation*Time Off	-	-	.61591	-
Squared Correlation	.09	.48	.70	.21

L = Linear  
Q = Quadratic

Table 36. Labor variables significantly ( $p < .05$ ) influencing number of cows 1978.

Stepwise Variables	Milker	Herds Person	Cow Feeder	Field Person
Intercept	99.36917	-737.46934	93.86931	-219.65173
Total Pay (L)	.29946	.34671	-	-
Hours/week (L)	2.95373	14.16594	-	7.45499
Days Paid Vac. (L)	-22.34145	39.65965	-	27.85785
Days Off (L)	-	-	-	-
Years Employed (L)	-	-	-	-4.80129
Age (L)	-1.03031	6.12701	-	4.24476
Years of School (L)	-5.24389	-	-	-
Total Pay (Q)	-	.00018	-	-
Hours/week (Q)	-	-	-	-
Days Paid Vac. (Q)	.50058	-	-	-
Days Off (Q)	-	4.6985	-	-
Years Employed (Q)	-	-	-	-
Age (Q)	-	-.08772	-	-
Years of School (Q)	-	-	-	-
Difficulty Keeping (1 = yes, 2 = no)	-	-27.97304	-	-
Training (1 = qualified, 2 = trained)	-21.71003	-42.35849	-	-
Educational Programs (1 = yes, 2 = no)	-22.28301	-	-	-44.1525
Reading Materials (1 = yes, 2 = no)	-	50.04071	-	-
Pay*Hours	-.00551	-.01142	-	-.00301
Pay*vacation	-	-	-	-
Pay*Time Off	-	-	-	0.05114
Hours*Vacation	.29817	-.47413	-	-.43697
Hours*Time Off	-	-	-	-.40309
Vacation*Time Off	-	-3.62013	.70963	-2.26794
Squared Correlation	.38	.72	.22	.78

L = Linear  
Q = Quadratic

**Table 37. Labor variables significantly ( $p < .05$ ) influencing incidence of mastitis 1978.**

Stepwise Variables	Herds Person
Intercept	-248.09268
Total Pay (L)	.37596
Hours/week (L)	1.97584
Days Paid Vac. (L)	-9.60461
Days Off (L)	-
Years Employed (L)	-
Age (L)	-
years of School (L)	8.55585
Total Pay (Q)	-
Hours/week (Q)	-
Days Paid Vac. (Q)	.14997
Days Off (Q)	-
Years Employed (Q)	-.00869
Age (Q)	-
Years of School (Q)	-.36337
Difficulty Keeping (1 = yes, 2 = no)	-
Training (1 = qualified, 2 = trained)	-
Educational Programs (1 = yes, 2 = no)	-
Reading Materials (1 = yes, 2 = no)	-
Pay*Hours	-.00372
Pay*vacation	-.00762
Pay*Time Off	-.02278
Hours*Vacation	.18369
Hours*Time Off	.15751
Vacation*Time Off	1.16774
Squared Correlation	.86

L = Linear  
Q = Quadratic

Table 38 shows labor variables significantly ( $p < .05$ ) influencing change in fat corrected milk (FCM) from 1978 to 1986. The change in FCM was highly related to employment of the cow feeder and a little to the milker. Difficulty keeping labor was associated with a 415 kg increase in FCM for herds reporting milkers and 1541 kg for herds reporting cow feeders. Cow feeder had the highest squared correlation, with the labor package accounting for 86% of the variation in change in FCM from 1978 to 1986. Cow feeders qualified before hiring showed a 776 kg increase in FCM over those receiving on-farm training. At average hours and pay, each additional 1 d vacation produced 204 kg less FCM, while at 60 hrs and \$1000 pay, 1 d more vacation seemed to cost 366 kg. When the feeder was 10 y older FCM increased 200 kg, and an additional 10 y employed meant a loss of 540 kg FCM. The trend may be that older workers fairly new on the job generated more FCM over time. Minimum change for milkers was at 10 yr of schooling. Increasing from 10 to 16 y of school increased FCM 661 kg. When the age of the milker changed from 30 y to 40 y, then 119 kg less FCM was produced.

Table 39 contains labor variables significantly ( $p < .05$ ) influencing the difference in income minus feed cost (IOFC) from 1978 to 1986. Cow feeder had the greatest influence ( $R^2 = .76$ ). Prior training was worth \$541, and again herds having difficulty keeping employees increased \$893. For cow feeders, the time off was significant but not large in effect (\$5/d). When the employee increased 10 y in age, IOFC increased \$157, and 6 y more school increased IOFC by \$300. For milkers the maximum change in IOFC was at \$888/mo total pay. The minimum IOFC change was at 61 h/wk.

Changing 60 to 70 h netted an increase of \$71 in IOFC. The age of minimum IOFC was 38 y and increasing from 20 to 30 yr of age cost \$200 IOFC and from 40 to 50 yr of age increased \$120 IOFC. Educational programs available in herds reporting milkers represented a drop in IOFC of \$256 over 6 yr.

Days open changes from 1978 to 1986 were influenced primarily by field person ( $R^2 = .81$ , Table 40). Total pay, hours worked, days paid vacation, days off, years employed, age, and years of school were significant variables. The relationship of the field person to days open is not easily explained unless the field person has other jobs also. A \$100/mo pay increase at average h/wk

**Table 38.** Labor variables significantly ( $p < .05$ ) influencing fat corrected milk difference (1986 minus 1978).

Stepwise Variables	Milker	Herds Person	Cow Feeder
Intercept	3845.00948	1458.17371	1927.53708
Total Pay (L)	-	-	-
Hours/week (L)	-	-	-
Days Paid Vac. (L)	-	-	691.60148
Days Off (L)	-	-	-
Years Employed (L)	-	-	-53.95383
Age (L)	-	-	20.05476
Years of School (L)	-367.39137	-	-
Total Pay (Q)	-	-	-
Hours/week (Q)	-	-	-
Days Paid Vac. (Q)	5.68105	-	-
Days Off (Q)	14.71599	-	-
Years Employed (Q)	-	-	-
Age (Q)	-.17034	-	-
Years of School (Q)	17.96904	-	-
Difficulty Keeping (1 = yes, 2 = no)	414.84495	-443.27511	-1540.87686
Training (1 = qualified, 2 = trained)	-	-	-775.7977
Educational Programs (1 = yes, 2 = no)	-	-	-
Reading Materials (1 = yes, 2 = no)	-	-	-
Pay*Hours	-	-	.04857
Pay*vacation	-.08986	-	-.36623
Pay*Time Off	-	-	-
Hours*Vacation	-	-	-11.53197
Hours*Time Off	-3.07477	-	-
Vacation*Time Off	-	-	35.00639
Squared Correlation	.33	.10	.86

L = Linear  
Q = Quadratic

Table 39. Labor variables significantly ( $p < .05$ ) influencing income minus feed cost difference (1986 minus 1978).

Stepwise Variables	Milker	Herds Person	Cow Feeder
Intercept	3180.45449	731.12362	1444.77184
Total Pay (L)	3.34894	-	-
Hours/week (L)	-108.4217	-	-
Days Paid Vac. (L)	-	-	-
Days Off (L)	-	-	270.42812
Years Employed (L)	-	-	-49.88692
Age (L)	-60.3806	-	15.72123
Years of School (L)	-	-	75.02201
Total Pay (Q)	-.00188	-	-
Hours/week (Q)	.88871	-	-
Days Paid Vac. (Q)	-	-	-
Days Off (Q)	-	-	-
Years Employed (Q)	-	-	-
Age (Q)	.80004	-	-
Years of School (Q)	-	-	-
Difficulty Keeping (1 = yes, 2 = no)	-376.9096	-326.50824	-893.13471
Training (1 = qualified, 2 = trained)	-	-	-540.5946
Educational Programs (1 = yes, 2 = no)	256.07669	-	-
Reading Materials (1 = yes, 2 = no)	-	-	-
Pay*Hours	-	-	-
Pay*vacation	-	-	-
Pay*Time Off	-	-	-
Hours*Vacation	-	-	-
Hours*Time Off	-	-	-4.99879
Vacation*Time Off	-	-	-
Squared Correlation	.35	.11	.76

L = Linear  
Q = Quadratic

produced 2.5 more days open, while a \$100 pay increase at 60 h/wk produced a reduction of 4.0 days open. An increase of 10 hours worked per week at an average pay reduced days open by 8.9 d, and the same 10 hour increase in hours at \$1000/mo pay resulted in a reduction of 30 d, probably higher than reasonable. The net result was that longer hours with higher pay reduced days open. An additional day off per mo resulted in 25 fewer days open, and 10 y increase in age resulted in 31 more days open, not very reasonable. Six years more schooling resulted in 52 more days open, again not very reasonable. Milkers had a respectable  $R^2$  of .39. An additional day off each mo resulted in 12 fewer days open. An increase of \$100 pay and fringe benefits with average hours and vacation increased days open by 2.6 d, whereas with 70 h/wk the same \$100 pay increase produced 3.1 fewer days open. Days paid vacation, though significant, did not have a large effect. The minimum days open change occurred at 53 h/wk with average pay and time off. Increasing from 60 h to 70 h and adding \$100 in pay resulted in 8 more days open. Although longer hours with more pay for field persons reduced days open, it increased days open when applied to milkers.

Table 41 contains labor variables significantly ( $p < .05$ ) influencing change in number of breedings per conception from 1978 to 1986. Only the milker had significant variables, but the  $R^2$  of .23 was too low to consider the model seriously.

Similar to days open, days dry changes within herds over time were influenced by field persons and milkers (Table 42). In herds reporting field persons, difficulty keeping good workers showed a 7 d reduction in days dry while provision of reading materials showed a 7 d increase. Milkers were not very explainable because large changes were related to age and years of school. The minimum change in days dry occurred at total pay of \$941/mo versus \$782 average pay for milkers, but the effect of changing pay was very small. The maximum change in days dry occurred when milkers were 44 y of age. Increasing from 30 y to 40 y of age added 3 days dry, while increasing from 50 y to 60 y of age subtracted 4 days dry. Maybe younger milkers have some influence on drying cows off sooner. The minimum change in days dry occurred when milkers had 10 y of school. Six more years of school, from 10 y to 16 y, added 8 days dry. Hours of work per week made little difference, though significant statistically.

**Table 40. Labor variables significantly ( $p < .05$ ) influencing days open difference (1986 minus 1978).**

Stepwise Variables	Milker	Herds Person	Cow Feeder	Field Person
Intercept	-165.2138	-106.88004	-	-466.57582
Total Pay (L)	.29486	-	-	0.45921
Hours/week (L)	-	3.48387	-	5.31003
Days Paid Vac. (L)	9.69198	-	-	7.39167
Days Off (L)	-	-	-	-24.35698
Years Employed (L)	-	-	-	-2.53799
Age (L)	-	-	-	3.12725
Years of School (L)	-	-	-	8.75756
Total Pay (Q)	-	.00008	-	-
Hours/week (Q)	.03488	-	-	-
Days Paid Vac. (Q)	-	-	-	-
Days Off (Q)	1.62483	-	-	-
Years Employed (Q)	-	-	-	-
Age (Q)	-	-	-	-
Years of School (Q)	-	-	-	-
Difficulty Keeping (1 = yes, 2 = no)	-	-	-	-
Training (1 = qualified, 2 = trained)	-	-	-	-
Educational Programs (1 = yes, 2 = no)	-	-	-	-
Reading Materials (1 = yes, 2 = no)	-	-	-	-
Pay*Hours	-.00341	-.00312	-	-.00834
Pay*vacation	-.01184	-	-	-.00686
Pay*Time Off	-	-	-	-
Hours*Vacation	-	-	-	-
Hours*Time Off	-.2657	-	-	.50165
Vacation*Time Off	-	-	-	-
Squared Correlation	.39	.14	-	.81

L = Linear  
Q = Quadratic

**Table 41. Labor variables significantly ( $p < .05$ ) influencing number of breedings per conception difference (1986 minus 1978).**

Stepwise Variables	Milker
Intercept	.58782
Total Pay (L)	-
Hours/week (L)	-
Days Paid Vac. (L)	-
Days Off (L)	-
Years Employed (L)	-
Age (L)	-
Years of School (L)	-
Total Pay (Q)	.00001
Hours/week (Q)	.00028
Days Paid Vac. (Q)	-
Days Off (Q)	-
Years Employed (Q)	-
Age (Q)	-
Years of School (Q)	.00187
Difficulty Keeping (1 = yes, 2 = no)	-.38296
Training (1 = qualified, 2 = trained)	-
Educational Programs (1 = yes, 2 = no)	-
Reading Materials (1 = yes, 2 = no)	-
Pay*Hours	-.00003
Pay*vacation	-
Pay*Time Off	-
Hours*Vacation	-
Hours*Time Off	-
Vacation*Time Off	-
Squared Correlation	.23

L = Linear  
Q = Quadratic

Table 42. Labor variables significantly ( $p < .05$ ) influencing days dry difference (1986 minus 1978).

Stepwise Variables	Milker	Field Person
Intercept	9.96861	-17.98261
Total Pay (L)	-.09407	-
Hours/week (L)	.42482	-
Days Paid Vac. (L)	3.18246	1.82797
Days Off (L)	-	3.91357
Years Employed (L)	-	-
Age (L)	1.50731	-
Years of School (L)	-4.57628	-
Total Pay (Q)	.00005	-
Hours/week (Q)	-	-
Days Paid Vac. (Q)	-	-
Days Off (Q)	-	-
Years Employed (Q)	-	-
Age (Q)	-.01711	-
Years of School (Q)	.23056	-
26		
Difficulty Keeping (1 = yes, 2 = no)	-	6.89981
Training (1 = qualified, 2 = trained)	-	-
Educational Programs (1 = yes, 2 = no)	-	-
Reading Materials (1 = yes, 2 = no)	-	-7.447267
Pay*Hours	-	-
Pay*vacation	-	-
Pay*Time Off	-	-
Hours*Vacation	-.06241	-
Hours*Time Off	-	-
Vacation*Time Off	-	-.34854
Squared Correlation	.42	.57

L = Linear  
Q = Quadratic

Table 43 presents labor variables significantly ( $p < .05$ ) influencing change in age at first lactation. Field persons may have influence on how heifers are raised, and have some influence on decisions regarding feed supply for heifers. Herds with field persons where educational programs were provided had 2 more mo age at first calving, and when employed longer and working more hours per week, age at first lactation was reduced.

Changes in the percent of cows leaving the herd for reasons other than dairy and low production were due to all types of workers (Table 44). Cow feeders at average pay, vacation, and time off, reduced PctBad by 12% for each 10 h more work per week. At average pay, vacation, and hours worked there was a slight increase of 2% per day off. Herds reporting difficulty keeping good workers reduced PctBad by between 5% and 10%. Having cow feeders with more years of school resulted in 7% increase in PctBad for each year of schooling. Herds with field persons having access to reading materials reduced PctBad by 13%. Educational programs resulted in 7% increase in PctBad. None of these relationships to field persons seems very logical. A herds person qualified when hired resulted in an 8% reduction in PctBad.

Changes in herd size were unrelated to labor status in 1978 as even a few significant cow feeder labor variables had extremely small practical effect (Table 45).

Table 46 summarizes labor variables significantly ( $p < .05$ ) influencing Mast2 (mastitis test severe) differences from 1978 to 1986. All significance rested with the herds person and not the milkers. This seems to indicate that management strategies play an important role in controlling mastitis over time. Training, educational programs, and reading materials had great influence. In general, more pay, fewer hours per week, and less vacation all played roles in reducing mastitis. For herds person, the maximum increase in Mast2 occurred at \$954/mo pay and fringe benefits, which was slightly above average. Pay above \$954 such as an increase of \$100 from \$1000 to \$1100 resulted in an 8% reduction in Mast2. Minimum Mast2 change occurred at 56 h/wk. From 60 h to 70 h there was a 10% increase in Mast2, showing that long hours were not helpful. Difficulty keeping good workers, having a herds person qualified at hiring, and providing educational programs re-

**Table 43. Labor variables significantly ( $p < .05$ ) influencing age at first lactation difference (1986 minus 1978).**

Stepwise Variables	Milker	Field Person
Intercept	-1.38185	6.06912
Total Pay (L)	-	-
Hours/week (L)	-	-.14611
Days Paid Vac. (L)	-	-
Days Off (L)	.40798	-
Years Employed (L)	.54198	-.12103
Age (L)	-	-
Years of School (L)	-	-
Total Pay (Q)	-	-
Hours/week (Q)	-	-
Days Paid Vac. (Q)	-	-
Days Off (Q)	-	-
Years Employed (Q)	-.02071	-
Age (Q)	-	-
Years of School (Q)	-	-
Difficulty Keeping (1 = yes, 2 = no)	-	-
Training (1 = qualified, 2 = trained)	-	-
Educational Programs (1 = yes, 2 = no)	-	-2.32466
Reading Materials (1 = yes, 2 = no)	-	-
Pay*Hours	-	-
Pay*vacation	-.00024	-.00077
Pay*Time Off	-	.00165
Hours*Vacation	-	.02551
Hours*Time Off	-	-
Vacation*Time Off	-	-.13669
Squared Correlation	.20	.70

L = Linear  
Q = Quadratic

**Table 44. Labor variables significantly ( $p < .05$ ) influencing percentage of cows leaving the herd for reasons other than dairy and low production difference (1986 minus 1978).**

Stepwise Variables	Milker	Herds Person	Cow Feeder	Field Person
Intercept	18.59315	10.84861	79.73295	18.2672
Total Pay (L)	-	-	-	-.01099
Hours/week (L)	-	-	-2.87706	-
Days Paid Vac. (L)	-	-.61475	13.48469	-
Days Off (L)	-1.39367	-	-20.92141	-
Years Employed (L)	-	-	-	-
Age (L)	-	-	.34699	-
Years of School (L)	-	-	2.24166	-
Total Pay (Q)	-	-.00003	-	-
Hours/week (Q)	-	-.01302	-	-
Days Paid Vac. (Q)	-	-	-	-
Days Off (Q)	-	-	-	-
Years Employed (Q)	-	-	-	-
Age (Q)	-	-	-	-
Years of School (Q)	-	-	-	-
Difficulty Keeping (1 = yes, 2 = no)	-5.99561	-	-9.77992	-10.20815
Training (1 = qualified, 2 = trained)	-	7.80742	-	-
Educational Programs (1 = yes, 2 = no)	-	-	-	-7.06051
Reading Materials (1 = yes, 2 = no)	-	-	-	13.93882
Pay*Hours	-	.00128	.00141	-
Pay*vacation	-	-	-.00495	-
Pay*Time Off	-	-	-.00572	-
Hours*Vacation	-	-	-.20147	-
Hours*Time Off	-	-	.51998	-
Vacation*Time Off	-	-	-	-
Squared Correlation	.14	.36	.78	.48

L = Linear  
Q = Quadratic

Table 45. Labor variables significantly ( $p < .05$ ) influencing number of cows difference (1986 minus 1978).

Stepwise Variables	Milker	Cow Feeder
Intercept	-37.37452	-40.42106
Total Pay (L)	.21585	-
Hours/week (L)	-	-
Days Paid Vac. (L)	-	-38.36828
Days Off (L)	-	55.42525
Years Employed (L)	-	-
Age (L)	-.88128	-
Years of School (L)	-	7.70293
Total Pay (Q)	-.00009	-
Hours/week (Q)	-	-
Days Paid Vac. (Q)	-	-
Days Off (Q)	-	-
Years Employed (Q)	-	-
Age (Q)	-	-
Years of School (Q)	-	-
Difficulty Keeping (1 = yes, 2 = no)	-	-
Training (1 = qualified, 2 = trained)	-26.95889	-
Educational Programs (1 = yes, 2 = no)	-	-
Reading Materials (1 = yes, 2 = no)	-	-
Pay*Hours	-	-
Pay*vacation	-	-
Pay*Time Off	-	-
Hours*Vacation	-	.82166
Hours*Time Off	-	-1.17088
Vacation*Time Off	-	-
Squared Correlation	.16	.37

L = Linear  
Q = Quadratic

sulted in an increase in Mast2, not very meaningful. Providing reading material resulted in a decrease in Mast2. Optimum age of herds person was 38 y. Younger or older herds persons resulted in more Mast2. A large effect in Mast2 change occurred with days of paid vacation, where more vacation was related to more Mast2, 3.5% per day of additional vacation.

Two points need to be reiterated. Because the survey of labor programs was only in 1979, the accurate interpretation of a labor variable influencing production change is that herds offering different labor packages had different rates of progress over the subsequent six years. For instance, when more pay is said to reduce days open, it means that herds paying more in 1979 had a larger reduction in days open from 1978 to 1986. Second, as the first stepwise analysis related production differences between herds in September 1978, the second stepwise analysis looked at production changes from 1978 to 1986, and the next analysis will investigate the profiles of change of DHI variables from 1978 to 1986 as they related to pay and hours worked.

### *Production profiles by pay and hours*

To find out if DHI variables changed at different rates depending on the level of pay and hours worked, two types of analyses were run for milkers, herds persons, cow feeders, and field persons.

The first was a model containing categories of pay and hours, their interaction, herd within pay by hour combinations, and years. Least squares means, within herd and year, are in Tables 47 through 50 for all six combinations of pay and fringe benefits per month and hours per week. Average

**Table 46.** Labor variables significantly ( $p < .05$ ) influencing incidence of mastitis difference (1986 minus 1978).

Stepwise Variables	Herds Person
Intercept	170.42372
Total Pay (L)	.53966
Hours/week (L)	-6.69181
Days Paid Vac. (L)	-12.81512
Days Off (L)	-
Years Employed (L)	-
Age (L)	-7.42033
Years of School (L)	-
Total Pay (Q)	-.00042
Hours/week (Q)	.05963
Days Paid Vac. (Q)	-.17509
Days Off (Q)	-
Years Employed (Q)	-
Age (Q)	.09878
Years of School (Q)	-
Difficulty Keeping (1 = yes, 2 = no)	-18.18686
Training (1 = qualified, 2 = trained)	-14.56066
Educational Programs (1 = yes, 2 = no)	-33.75616
Reading Materials (1 = yes, 2 = no)	15.11552
Pay*Hours	-
Pay*vacation	.02209
Pay*Time Off	.02317
Hours*Vacation	-
Hours*Time Off	-
Vacation*Time Off	-1.69479
Squared Correlation	.83

L = Linear  
Q = Quadratic

standard errors based on herd mean squares are also included. Because of the large variation among herds, none of the means was significantly different from others.

The second model was to investigate the changes in DHI variables through the six years from 1978 to 1986 by pay and hours. Herd effects were absorbed prior to fitting a model regressing on years, linear and quadratic, and their interactions with pay and hours, also linear and quadratic. It should be noted that normal pay categories included the value of fringe benefits divided as low (less than \$600/mo), medium (\$600 to \$1000), and high (\$1000 and more). For herds person analyses only, the low pay category was changed to less than \$800 so that the combination of low pay and long hours (more than 60 h/wk) would contain 18 herds rather than only 3 herds as with the normal categories. All significant regressions are graphed in the accompanying figures. Regression coefficients for analyses which had significant regressions (different from zero) are in Tables 51 and 52. Significant regressions from these models are plotted in Figures 2 through 7. Because herd effects were absorbed, intercepts were constructed such that the predicted DHI variables averaged for years 1978, 1982, and 1986 were identical to the least squares means in Tables 47 through 50.

Figure 2 shows the significant effect of milker pay on days open across the six years. The lower level of pay showed a slight decline (4 d) in days open from 1978 to 1986. The medium level of pay increased slightly (6 d), and the high pay increased more substantially (23 d). Herds paying milkers the most in 1978, had lowest days open, but by 1986 had highest days open, an unusual reversal. It is not clear how milkers would affect days open significantly, except to provide some help in detection of cows in heat.

The combination of pay and hours significantly affected days open in the herds person analysis (Figure 3). The low pay level is less than \$800/mo, the medium pay level extends from \$800 to \$1000/mo, and the high pay level is above \$1000/mo. The category of low total pay and long hours contained 18 herds. Clearly lowest pay and longest hours (more than 60) showed the largest increase in days open (about 30 d). Herds in all other categories remained about the same, decreasing about 2 days to 1982 then increasing back to 1978 level. Medium pay had lowest days open.

Table 47. Least squares means for categories of pay and hours worked used to construct intercepts in time trend models for milker.

Categories <sup>1</sup> Pay Hours	DHI VARIABLE							
	FCM <sup>2</sup>	IOFC <sup>3</sup>	DO <sup>4</sup>	BPC <sup>5</sup>	DD <sup>6</sup>	AFL <sup>7</sup>	PCTBAD <sup>8</sup>	MAST2 <sup>9</sup>
Low Low	6420	1001	127.7	1.7	63.9	29.4	25.2	9.7
Low High	6227	906	121.6	1.7	67.3	28.2	25.4	8.6
Med. Low	6676	1124	129.0	1.9	63.2	29.9	23.3	9.8
Med. High	6798	1098	126.2	1.8	65.1	29.4	24.2	8.7
High Low	6347	941	133.7	1.8	64.6	29.4	21.9	10.6
High High	7023	1048	123.0	1.9	63.1	31.5	26.3	6.2
Average SE	78	74	5.0	0.1	2.3	0.5	1.9	1.7
Herd MS	178029	163932	772.0	0.3	172.0	12.0	122.0	65.0

<sup>1</sup>Refer to Table 22 for details.

<sup>2</sup>FCM = Fat Corrected milk

<sup>3</sup>IOFC = Income over feed cost

<sup>4</sup>DO = Days open

<sup>5</sup>BPC = Number of breedings per conception

<sup>6</sup>DD = Days dry

<sup>7</sup>AFL = Age at first lactation

<sup>8</sup>PCTBAD = Percent of cows leaving the herd for reasons other than dairy and low production

<sup>9</sup>MAST2 = Mastitis test severe

**Table 48.** Least squares means for categories of pay and hours worked used to construct intercepts in time trend models for herds person.

Categories <sup>1</sup> Pay Hours	DHI VARIABLE							
	FCM <sup>2</sup>	IOFC <sup>3</sup>	DO <sup>4</sup>	BPC <sup>5</sup>	DD <sup>6</sup>	AFL <sup>7</sup>	PCTBAD <sup>8</sup>	MAST2 <sup>9</sup>
Low Low	6553	1066	124.1	1.9	67.0	29.7	22.4	7.1
Low High	6393	1081	131.5	1.9	66.6	29.0	20.9	9.0
Med. Low	6766	1119	123.7	2.0	63.5	29.2	23.4	8.9
Med. High	7019	1103	127.3	1.9	65.1	29.9	23.0	6.1
High Low	6856	1155	132.1	2.1	65.3	30.2	22.9	10.3
High High	6827	1116	129.2	2.0	61.7	29.3	21.6	9.3
Average SE	395	75	4.71	0.1	1.9	0.7	1.5	1.7
Herd MS	1507579	151933	600	0.3	129.0	15.8	71.7	68.1

<sup>1</sup>Refer to Table 22 for details

<sup>2</sup>FCM = Fat Corrected milk

<sup>3</sup>IOFC = Income over feed cost

<sup>4</sup>DO = Days open

<sup>5</sup>BPC = Number of breedings per conception

<sup>6</sup>DD = Days dry

<sup>7</sup>AFL = Age at first lactation

<sup>8</sup>PCTBAD = Percent of cows leaving the herd for reasons other than dairy and low production

<sup>9</sup>MAST2 = Mastitis test severe

**Table 49.** Least squares means for categories of pay and hours worked used to construct intercepts in time trend models for cow feeder.

Categories <sup>1</sup> Pay Hours	DHI VARIABLE							
	FCM <sup>2</sup>	IOFC <sup>3</sup>	DO <sup>4</sup>	BPC <sup>5</sup>	DD <sup>6</sup>	AFL <sup>7</sup>	PCTBAD <sup>8</sup>	MAST2 <sup>9</sup>
Low Low	6880	1182	119.1	1.8	63.1	29.8	21.1	9.0
Low High	6600	832	160.0	2.0	72.0	29.6	17.2	9.0
Med. Low	6561	1054	128.9	2.0	68.3	30.1	24.3	7.5
Med. High	7335	1315	128.7	2.0	64.7	29.7	23.3	8.3
High Low	6419	1014	119.2	1.6	64.8	28.2	18.7	9.1
High High	6211	959	129.6	1.9	59.1	30.3	21.5	15.3
Average SE	415	132	7.7	0.1	2.6	1.0	2.7	2.0
Herd MS	1957310	199195	692.0	0.2	86.0	12.0	91.0	32.8

<sup>1</sup>Refer to Table 22 for details.

<sup>2</sup>FCM = Fat Corrected milk

<sup>3</sup>IOFC = Income over feed cost

<sup>4</sup>DO = Days open

<sup>5</sup>BPC = Number of breedings per conception

<sup>6</sup>DD = Days dry

<sup>7</sup>AFL = Age at first lactation

<sup>8</sup>PCTBAD = Percent of cows leaving the herd for reasons other than dairy and low production

<sup>9</sup>MAST2 = Mastitis test severe

**Table 50.** Least squares means for categories of pay and hours worked used to construct intercepts in time trend models for field person.

Categories <sup>1</sup> Pay Hours	DHI VARIABLE								
	FCM <sup>2</sup>	IOFC <sup>3</sup>	DO <sup>4</sup>	BPC <sup>5</sup>	DD <sup>6</sup>	AFL <sup>7</sup>	PCTBAD <sup>8</sup>	MAST2 <sup>9</sup>	
Low Low	6393	1063	131.0	1.8	62.0	29.5	24.4	10.6	
Low High	6314	1059	121.8	2.1	65.5	28.4	21.4	13.5	
Med. Low	6780	1123	125.9	2.1	63.9	29.4	22.2	8.5	
Med. High	6140	973	136.0	1.7	72.3	30.5	28.6	11.0	
High Low	7529	1269	133.1	1.9	64.0	27.1	23.1	4.0	
High High	7314	1113	133.8	2.7	68.5	27.5	20.7	4.8	
Average SE	505	167	8.6	0.1	6.0	1.1	3.5	3.7	
Herd MS	1777573	195304	524.0	0.4	268.0	9.0	90.0	85.1	

<sup>1</sup>Refer to Table 22 for details.

<sup>2</sup>FCM = Fat Corrected milk

<sup>3</sup>IOFC = Income over feed cost

<sup>4</sup>DO = Days open

<sup>5</sup>BPC = Number of breedings per conception

<sup>6</sup>DD = Days dry

<sup>7</sup>AFL = Age at first lactation

<sup>8</sup>PCTBAD = Percent of cows leaving the herd for reasons other than dairy and low production

<sup>9</sup>MAST2 = Mastitis test severe

Table 51. Regression coefficients within herd to predict production variables from 1978 to 1986 for herds person.

Labor Variables	DHI PRODUCTION VARIABLE			
	FCM <sup>1</sup>	AGEFL <sup>2</sup>	PCTBAD <sup>3</sup>	DO <sup>4</sup>
Year	-202.7747	-8.5817	-13.3728	-33.9476
Year (Q)	1.9092	0.0532	0.0836	0.2060
Hw*Yr			*	
Low	56.0303	0.1341	-0.0215	-0.4330
High	0.0000	0.0000	0.0000	0.0000
Hw*Yr(Q)			*	
Low	-0.6958	-0.0017	0.0002	0.0053
High	0.0000	0.0000	0.0000	0.0000
Pay*Yr	*	*		
Low	-19.9260	-0.0042	0.6105	-3.7592
Med.	-36.0309	0.4550	0.7007	-0.2974
High	0.0000	0.0000	0.0000	0.0000
Pay*Yr(Q)	*	*		
Low	0.2383	0.0000	-0.0073	0.0457
Med.	0.4388	-0.0055	-0.0085	0.0036
High	0.0000	0.0000	0.0000	0.0000
Pay*Hw*Yr				*
Low Low	-85.6238	-0.3100	-1.0138	4.2908
Low High	0.0000	0.0000	0.0000	0.0000
Med. Low	-9.4267	-0.3682	-1.3200	0.6599
Med. High	0.0000	0.0000	0.0000	0.0000
High Low	0.0000	0.0000	0.0000	0.0000
High High	0.0000	0.0000	0.0000	0.0000
Pay*Hw*Yr(Q)				*
Low Low	1.0653	0.0038	0.0123	-0.0523
Low High	0.0000	0.0000	0.0000	0.0000
Med. Low	0.1147	0.0044	0.0161	-0.0080
Med. High	0.0000	0.0000	0.0000	0.0000
High Low	0.0000	0.0000	0.0000	0.0000
High High	0.0000	0.0000	0.0000	0.0000
Squared Correlation	0.88	0.73	0.56	0.62

\*Significantly different from zero ( $p < .05$ ).

<sup>1</sup>FCM = Fat corrected milk

<sup>2</sup>AGEFL = Age at first lactation

<sup>3</sup>PCTBAD = percent of cows leaving the herd for reasons other than dairy and low production

<sup>4</sup>DO = Days open

Table 52. Regression coefficients within herd to predict production variables from 1978 to 1986 for milker and field person.

Labor Variables	Milker Days Open	Field Person BPC. <sup>1</sup>
Year	9.8061	-1.1323
Year (Q)	-0.0408	0.0074
Hw*Yr		
Low	0.6266	5.5048
High	0.0000	0.0000
Hw*Yr(Q)		
Low	-0.0076	-0.0339
High	0.0000	0.0000
Pay*Yr	*	
Low	2.0786	-3.2085
Med.	1.7127	4.0653
High	0.0000	0.0000
Pay*Yr(Q)	*	
Low	-0.0260	0.0195
Med.	-0.0216	-0.0251
High	0.0000	0.0000
Pay*Hw*Yr		*
Low Low	2.1636	0.0033
Low High	0.0000	0.0000
Med. Low	0.3737	-9.5234
Med. High	0.0000	0.0000
High Low	0.0000	0.0000
High High	0.0000	0.0000
Pay*Hw*Yr(Q)		*
Low Low	-0.0263	0.0000
Low High	0.0000	0.0000
Med. Low	-0.0044	0.0585
Med. High	0.0000	0.0000
High Low	0.0000	0.0000
High High	0.0000	0.0000
Squared Correlation	0.58	0.79

\*Significantly different from zero ( $p < .05$ ).

<sup>1</sup>BPC = Number of breedings per conception.

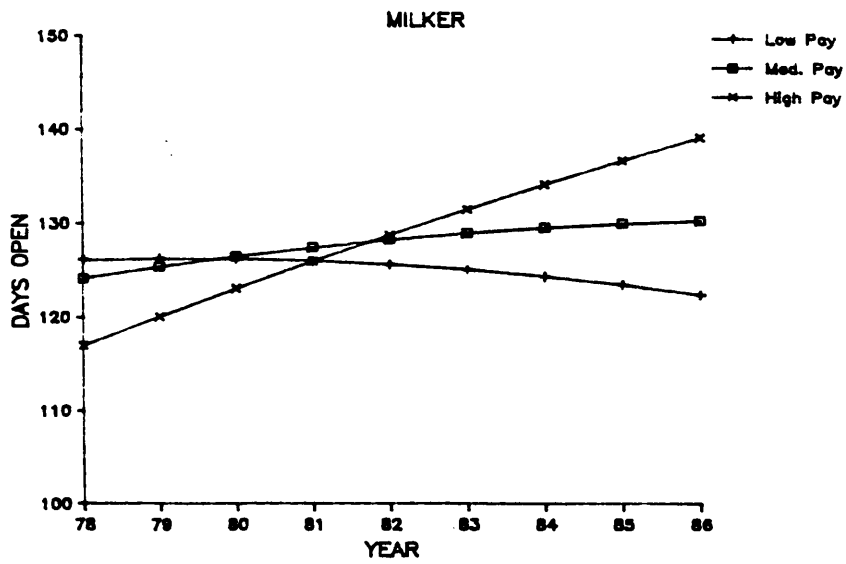
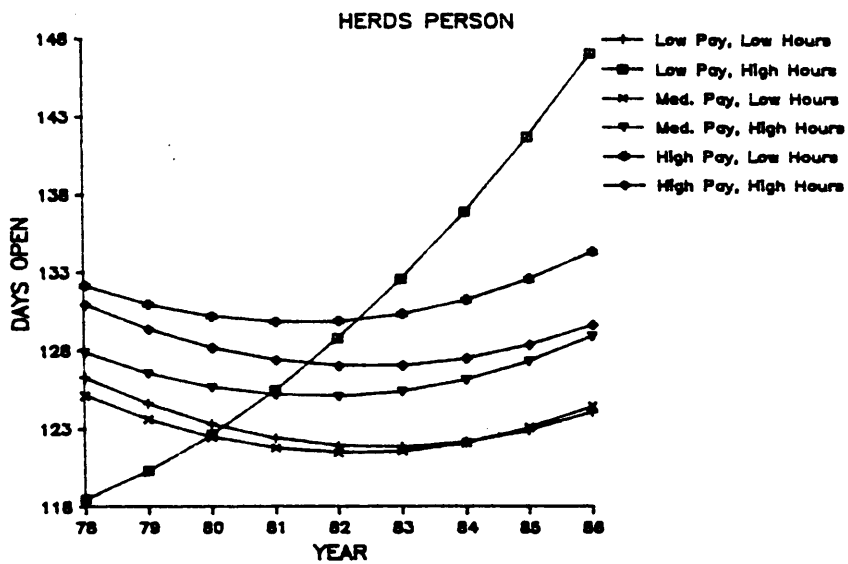


Figure 2. Change in days open by level of pay of milkers.



**Figure 3.** Change in days open by level of pay and hours worked of herds person.

Figure 4 shows the effect of pay on FCM for herds person. There was an increase in FCM for all three levels of pay. Herds paying little to herds persons in 1978 produced substantially less FCM, but increased at the most rapid rate in subsequent years. High pay herds increased at the slowest rate, leaving medium herds with highest FCM in 1986.

Herds paying the least to the herds person had lowest age at first lactation in 1978, but highest by 1986 (Figure 5). The effect of medium pay was to decrease age at first lactation about 1.5 mos to 1982 then to level off to the lowest age of any category in 1986. Overall low pay increased the most (2 mos), while high pay increased age at first calving only slightly.

Figure 6 shows that herds with herds persons working low hours per week in 1978 increased substantially in percent of cows leaving the herd for reasons other than dairy and low production (PctBad). Herds with high hours per week decreased in PctBad only slightly.

Figure 7 represents the last production variable which differed significantly by pay and hours worked. It is the number of breedings per conception for the labor package of the field person. Breedings per conception were particularly high (2.5 to 3.0) for high pay and long hours, both in 1978 and subsequent years. One might assume the field work was important, time consuming, and diverted attention from the breeding program. Low pay and long hours had the largest increase in breedings per conception from 1982 to 1986. Medium pay and long hours, however, had fewest breedings per conception in both 1978 and 1986, so long hours alone do not seem to decrease breeding efficiency.

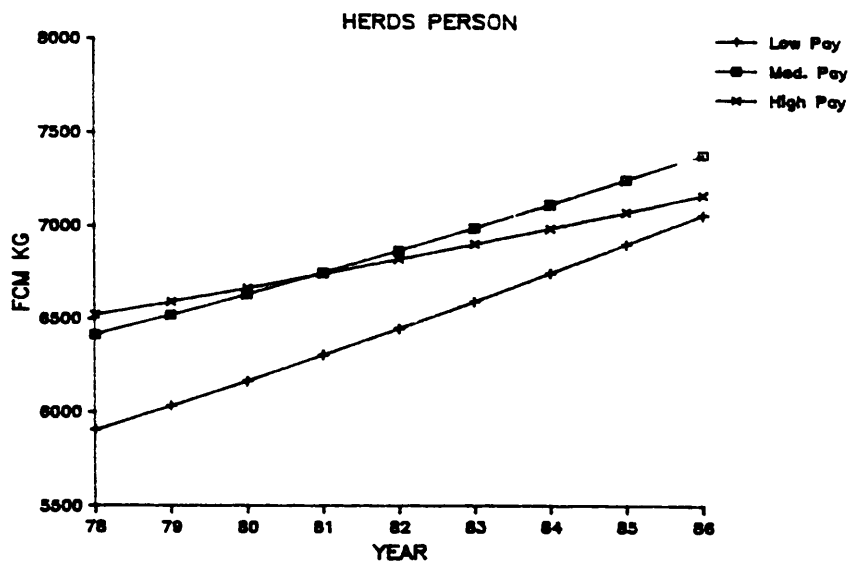


Figure 4. Change in fat corrected milk by level of pay of herds person.

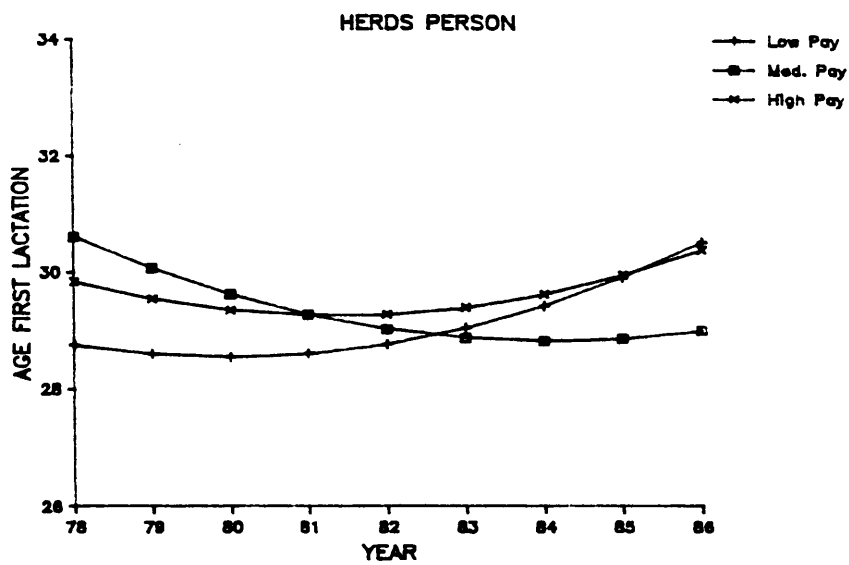


Figure 5. Change in age at first lactation by level of pay of herds person.

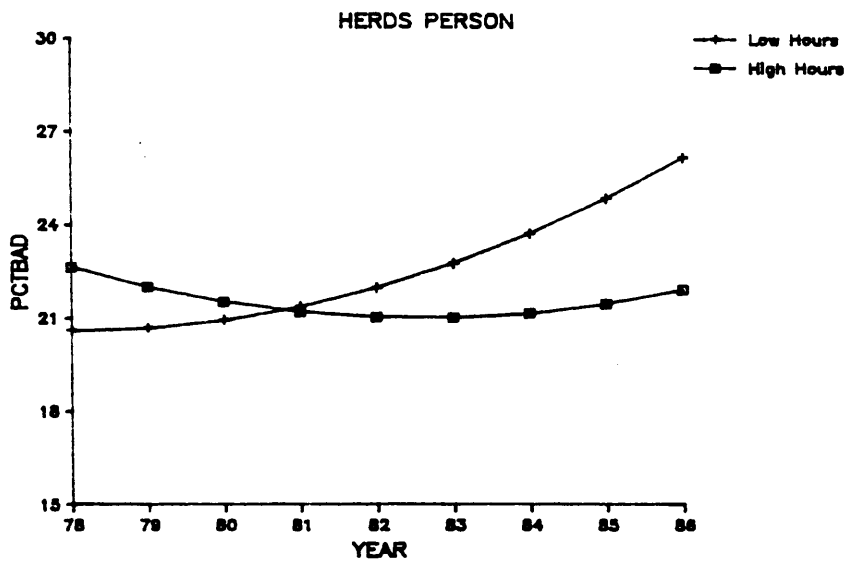


Figure 6. Change in percent of cows leaving the herd for reason other than dairy and low production by hours worked of herds person.

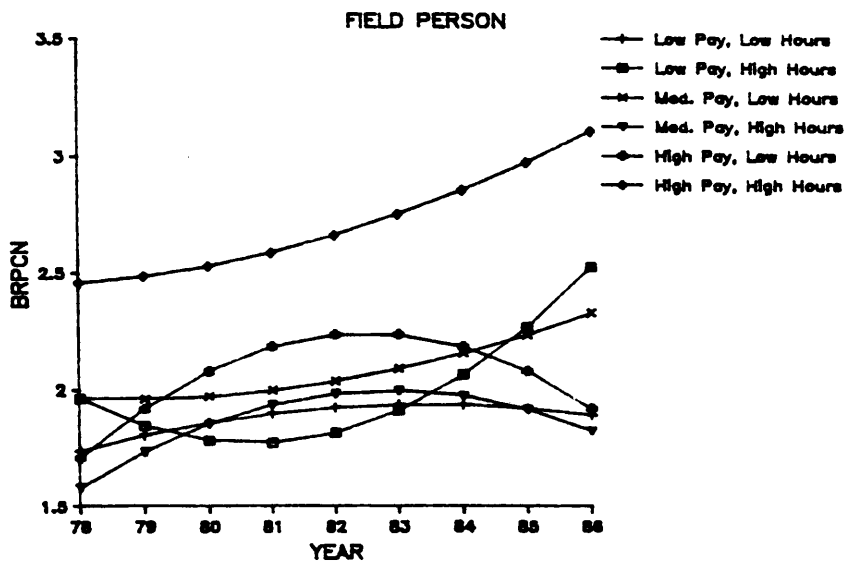


Figure 7. Change in breeding per conception by level of pay and hours worked of field person.

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## Summary

Labor records collected in the spring of 1979 from 321 dairy farms in Virginia were combined with annual Dairy Herd Improvement records of September 1978, 1982, and 1986 to determine the relationship of labor management variables with differences between herds, and the effect of labor management variables on the change in production variables in subsequent years.

A stepwise regression of production on labor variables estimated regression coefficients for labor variables significantly ( $p < .05$ ) influencing production variables in 1978 and those influencing the difference in production variables of 1986 minus 1978. Each analysis was separate for milkers, herds persons, cow feeders, and field persons, using all herds reporting each type of worker.

An analysis across years was used to identify the rate of change of production variables depending on pay/mo and hours/wk for milkers, herds persons, cow feeders, and field persons. Of two models, the first contained categories of pay and hours, their interaction, herd within pay by hour combinations, and year. Because of the large variation among herds, none of the means for pay and hour categories was significantly different from other categories. The second model was to investigate the changes in DHI variables through the eight years from 1978 to 1986 by pay and hours in 1978.

Herd effects were absorbed prior to fitting a model regressing production on years, linear and quadratic, and their interactions with pay and hours, also linear and quadratic.

While several production variables were found to be related with which herds remained in the DHI program, of most importance was milk production. Herds with low milk production in 1978, independent of size, were more likely to drop from the DHI program than herds with high production. Seventy-eight percent of farms reporting no difficulty in hiring or keeping hired employees remained in the DHI program, while 65% of those with difficulty hiring remained. Educational programs also were important showing that 80% of the farms that offered opportunities to attend educational programs remained in the DHI program, while of the farms that did not offer educational programs, 63% remained.

Analysis of the influence of labor responses in 1978 on DHI variables from 1978 to 1986 revealed that milkers influenced fat corrected milk from 1978 to 1986, but not differences between herds in 1978 alone. The minimum change for milkers was at 10 y of schooling, and a within herd change from 10 to 16 y of school increased FCM 661 kg. When the age of milkers was 40 y instead of 30 y, 119 kg less FCM was produced. Milkers influenced IOFC differences (1986 minus 1978). When educational programs were available in herds reporting milkers, IOFC declined \$256 over 8 y. Milkers influenced days open differences (1986 minus 1978) as an additional day off each mo resulted in 12 fewer days open. There was a significant effect of milker pay on days open across the eight years. Herds paying milkers the most in 1978, had lowest days open, but by 1986 had highest days open. Terms of employment for milkers had no effect on incidence of mastitis.

Herds persons with training before hiring were associated with 955 kg more FCM in 1978. Maximum production of FCM was reached when the herds person was paid \$950/mo in cash and value of fringe benefits. Herds person was related to IOFC in 1978, as herds persons which were older or had more schooling were employed by herds with higher IOFC. Breedings per conception were fewest in herds where the herds person worked 55 h/wk. An increase of 10 h/wk, from 60 to 70, was related to an increase of .32 services per conception and 250 kg FCM. Herds persons influ-

enced days dry in 1978 probably due to the herds person deciding when to dry off cows. Herds that offered educational programs had more days dry by 6 d and those that offered reading materials had less days dry by 8 d. Written materials would represent more frequent reinforcement of recommended principles. Herds person influenced Mast2 in 1978, showing that \$100 more pay and 10 h/wk fewer were associated with more mastitis. Years of school showed that at 12 y mastitis was maximum and for 16 y of school severe mastitis decreased 6%. More pay for the herds person reduced Mast2 differences from 1978 to 1986, indicating that management strategies play an important role in controlling mastitis over time. Training before hiring and educational programs increased mastitis, while providing reading material resulted in a decrease in Mast2. In general more pay, fewer hours per week, and less vacation all played roles in reducing mastitis. Optimum age of herds person was 38 y. Younger or older herds persons resulted in more Mast2. A large effect in Mast2 change occurred with days of paid vacation where more vacation was related to more Mast2, 3.5% per day of additional vacation. In looking at the profile of change over eight years, days open was significantly affected by pay and hours of the herds person. Lowest pay and longest hours (more than 60) were associated with the largest increase days open (30 d). Herds paying low wages to herds persons in 1978 produced substantially less FCM, but increased at the most rapid rate in subsequent years. High paying herds increased at the slowest rate, leaving medium herds with highest FCM in 1986.

Cow feeder influenced fat corrected milk 1978. Pay had little effect on FCM when feeders worked 53 h/wk, but at 70 h/wk each additional \$100/mo was associated with 300 kg more FCM. Cow feeders influenced days open in 1978, possibly because they can detect cows in heat. Herds that paid \$100/mo more to the cow feeder tended to have 6 fewer days open except at high hours per week. Herds that reported difficulty keeping employees had 24 fewer days open. Cow feeder also was related to age at first lactation in 1978. Herds in which cow feeders were paid \$500/mo more showed 2 mo younger age at first calving, possibly due to those highly paid employees feeding heifers too. Feeders working more hours worked in herds with higher culling. Cow feeders influenced FCM differences (1986 minus 1978) in that if qualified before hiring, their herds showed a

776 kg increase in FCM over those receiving on-farm training. Herds having difficulty keeping labor and reporting a cow feeder increased 1541 kg FCM. An additional day of vacation cost 200 to 400 kg FCM. Feeders had the highest squared correlation with change in FCM (.86) and IOFC (.76) from 1978 to 1986. Pay and hours for feeders did not affect DHI trends from 1978 to 1986.

Field person influenced age at first lactation 1978, as more days off led to a decrease in age at first lactation, possibly a result of less field work and more time for care of heifers. The difference between 1986 and 1978 for days open was most influenced by field person ( $R^2 = .81$ ). High pay and high hours reduced days open by 4 d. More hours in general reduced days open. When field persons were employed longer and working more hours per week, age at first lactation was reduced. Reading materials for field persons reduced culling (13%), whereas educational programs increased culling (7%). For field person, pay and hours worked influenced the number of breedings per conception. Low pay and long hours showed the largest increase in breedings from 1982 to 1986, but breeding inefficiency is not associated with long hours alone, because medium pay and long hours had the fewest breedings per conception.

## Conclusions

Labor programs can be quantifiably related to herd success. Several multiple correlations between labor variables and change in DHI variables exceeded 70% ( $R^2 > 50\%$ ).

Differences in 1978 when the survey was administered were most distinct for herds person and cow feeders, with more hours related to more milk but reduced reproductive efficiency. It is difficult to ascertain whether labor management actually influenced production differences between herds or differences in production lead to variation in labor packages.

Changes from 1978 to 1986 were related to field persons, particularly those with high pay and long hours, which reduced days open. There may have been in those herds more division of labor between cows and crops. It is unknown how labor management changed between 1979 and 1986 or how the economy may have influenced these relationships.

The importance of employees being trained before hiring proved beneficial for several production variables. Herds claiming difficulty keeping good workers nearly always fared better in production in subsequent years, likely because they demanded quality efforts. Availability of educational programs was not beneficial on average, but availability of reading materials was beneficial. Finally,

low pay and long hours for herds persons was detrimental to days open and culling over time, and detrimental to FCM at the time the survey was administered.

**Appendix A. Dairy Labor Survey 1979. Summary  
of Dairy Labor Survey 1979.**

Choose your three (or less if not available) most responsible fulltime hired workers. Number them 1, 2, or 3 for use in this questionnaire.

The code number on the last page is for checking non-returns.

Please complete the questionnaire and return it to either:

- 1) Your DHI Supervisor (in sealed envelope)      OR      2) Mike McGilliard  
 Dairy Science  
 VPI & SU  
 Blacksburg, VA 24061

## DAIRY LABOR SURVEY 1979

To be completed by owner/manager  
 (All responses are confidential)

Name (optional) \_\_\_\_\_

Phone (optional) \_\_\_\_\_

### I. GENERAL INFORMATION

- A. Total acres owned on farm? \_\_\_\_\_  
 B. Tillable acres? \_\_\_\_\_  
 C. How many acres do you rent from someone else? \_\_\_\_\_  
 D. How many years have you operated a dairy farm? \_\_\_\_\_

### II. PROFILE OF LABOR FORCE

- A. How many fulltime family (immediate) workers on your farm (excluding owner/manager) \_\_\_\_  
 B. How many fulltime hired workers? \_\_\_\_  
 C. How many parttime family (immediate) workers? \_\_\_\_  
 D. How many parttime hired workers? \_\_\_\_\_

### III. PERSONAL PROFILE OF FULLTIME HIRED WORKERS.

- A. Please rank (1st, 2nd, etc.) the major responsibilities of each worker.

Type of Work	Worker		
	1	2	3
Milker	___	___	___
Herdsmen	___	___	___
Cow Feeder	___	___	___
Calf Man	___	___	___
Field Man	___	___	___

- B. Please check the category which pertains to each worker.

Years employed on your farm	Worker			Age	Worker		
	1	2	3		1	2	3
Under 2	___	___	___	Under 25	___	___	___
2-5	___	___	___	25-34	___	___	___
6-10	___	___	___	35-44	___	___	___
11-20	___	___	___	45-54	___	___	___
Over 20	___	___	___	Over 54	___	___	___

Years of School	Worker			Marital Status	Worker		
	1	2	3		1	2	3
Under 8	___	___	___	Single	___	___	___
8-11	___	___	___	Married	___	___	___
12	___	___	___	Separated	___	___	___
13-15	___	___	___				
Over 15	___	___	___				

Sex	Worker		
	1	2	3
Male	___	___	___
Female	___	___	___

**IV. WAGES AND FRINGE BENEFITS**

A. For each fulltime worker please check the category which best describes the monthly wages and benefits provided by you.

Please check monthly value (\$\$\$\$)

<b>Cash Wages</b>	<b>Worker</b>			<b>\$ Value Housing</b>	<b>Worker</b>			<b>\$ Value Utilities</b>	<b>Worker</b>		
	<b>1</b>	<b>2</b>	<b>3</b>		<b>1</b>	<b>2</b>	<b>3</b>		<b>1</b>	<b>2</b>	<b>3</b>
Under \$300	—	—	—	Zero	—	—	—	Zero	—	—	—
\$300-449	—	—	—	\$1-49	—	—	—	\$1-14	—	—	—
\$450-599	—	—	—	\$50-99	—	—	—	\$15-29	—	—	—
\$600-740	—	—	—	\$100-149	—	—	—	\$30-44	—	—	—
\$750-999	—	—	—	\$150-199	—	—	—	\$45-59	—	—	—
Above \$999	—	—	—	\$200-249	—	—	—	\$60-74	—	—	—
				Above \$250	—	—	—	Above \$75	—	—	—
<b>\$ Value Meat, Milk</b>	<b>Worker</b>			<b>\$ Value Life Insurance</b>	<b>Worker</b>			<b>\$ Value Health Insurance</b>	<b>Worker</b>		
	<b>1</b>	<b>2</b>	<b>3</b>		<b>1</b>	<b>2</b>	<b>3</b>		<b>1</b>	<b>2</b>	<b>3</b>
Zero	—	—	—	Zero	—	—	—	Zero	—	—	—
\$1-9	—	—	—	\$1-9	—	—	—	\$1-9	—	—	—
\$10-19	—	—	—	\$10-14	—	—	—	\$10-14	—	—	—
\$20-29	—	—	—	\$15-19	—	—	—	\$15-19	—	—	—
\$30-39	—	—	—	\$20-24	—	—	—	\$20-24	—	—	—
\$40-49	—	—	—	\$25-29	—	—	—	\$25-29	—	—	—
Above \$49	—	—	—	Above \$29	—	—	—	Above \$29	—	—	—
<b>\$ Value Retirement Program</b>	<b>Worker</b>			<b>\$ Value Other Services</b>	<b>Worker</b>			<b>Days Paid Vacation/Year</b>	<b>Worker</b>		
	<b>1</b>	<b>2</b>	<b>3</b>		<b>1</b>	<b>2</b>	<b>3</b>		<b>1</b>	<b>2</b>	<b>3</b>
Zero	—	—	—	Zero	—	—	—	None	—	—	—
\$1-9	—	—	—	\$1-19	—	—	—	1-6	—	—	—
\$10-14	—	—	—	\$20-29	—	—	—	7-10	—	—	—
\$15-19	—	—	—	\$30-39	—	—	—	11-14	—	—	—
\$20-24	—	—	—	\$40-49	—	—	—	15-20	—	—	—
\$25-29	—	—	—	Above \$49	—	—	—	Above 20	—	—	—
Above \$29	—	—	—								

B. Check your typical or average hourly wage for each type of parttime employee?

<b>Hourly Wage (\$)</b>	<b>Adult</b>	<b>Teenage</b>	<b>Family</b>
Not Paid	—	—	—
Under \$2.50	—	—	—
\$2.50-2.99	—	—	—
\$3.00-3.49	—	—	—
\$3.50-3.99	—	—	—
Above \$3.99	—	—	—

**V. WORKING CONDITIONS AND SCHEDULES**

A. What times of day do you milk? 1st milking \_\_\_\_\_  
 2nd milking \_\_\_\_\_  
 3rd milking \_\_\_\_\_

B. Please check the arrangement which best describes each worker's employment.

<b>Hours Worked/Week</b>	<b>Worker</b>			<b>Time Off Each Month</b>	<b>Worker</b>		
	<b>1</b>	<b>2</b>	<b>3</b>		<b>1</b>	<b>2</b>	<b>3</b>
Under 40	—	—	—	No days off	—	—	—
40-59	—	—	—	1-3 days	—	—	—
50-59	—	—	—	4-6 days	—	—	—
60-69	—	—	—	7-9 days	—	—	—
Above 69	—	—	—	More than 9 days	—	—	—
<b>Day Begins</b>	<b>Worker</b>			<b>Day Ends</b>	<b>Worker</b>		
	<b>1</b>	<b>2</b>	<b>3</b>		<b>1</b>	<b>2</b>	<b>3</b>
Before 5 A.M.	—	—	—	Before 4 P.M.	—	—	—
5-6 A.M.	—	—	—	4-5 P.M.	—	—	—
6-7 A.M.	—	—	—	5-6 P.M.	—	—	—
7-8 A.M.	—	—	—	6-7 P.M.	—	—	—
After 8 A.M.	—	—	—	After 7 P.M.	—	—	—

C. Do you have a written agreement with your fulltime hired labor covering:

Work arrangements	YES _____	NO _____
Wages	YES _____	NO _____
Incentives	YES _____	NO _____
Fringe Benefits	YES _____	NO _____

VI. INCENTIVE PROGRAMS

A. If you have an incentive program, check the arrangements which apply.

- \_\_\_\_\_ 1) Based on production
- \_\_\_\_\_ 2) Based on profit-sharing
- \_\_\_\_\_ 3) Based on reproduction (cows bred, heats, services, days open)
- \_\_\_\_\_ 4) Based on calves or heifers raised
- \_\_\_\_\_ 5) Based on milk quality
- \_\_\_\_\_ 6) Based on years worked
- \_\_\_\_\_ 7) Other (specify) \_\_\_\_\_

B. How often are payments made? Weekly \_\_\_\_\_ Monthly \_\_\_\_\_ Yearly \_\_\_\_\_

C. What were the total incentives (\$) paid by you last year to all workers combined?

- \_\_\_\_\_ 1) Under \$100
- \_\_\_\_\_ 2) \$100-249
- \_\_\_\_\_ 3) \$250-499
- \_\_\_\_\_ 4) \$500-999
- \_\_\_\_\_ 5) Over \$999

D. Have you ever had an incentive program which you stopped offering? YES \_\_\_\_\_ NO \_\_\_\_\_  
if YES, Why?

- \_\_\_\_\_ 1) It didn't help
- \_\_\_\_\_ 2) Employee took unfair advantage of it
- \_\_\_\_\_ 3) Other (specify) \_\_\_\_\_

VII. RECRUITMENT

A. Where do you find workers to hire?

- \_\_\_\_\_ 1) Word of mouth
- \_\_\_\_\_ 2) Newspapers
- \_\_\_\_\_ 3) State employment office
- \_\_\_\_\_ 4) High schools
- \_\_\_\_\_ 5) Colleges and Universities

B. Which items do you use to evaluate the potential of a prospective worker?

- \_\_\_\_\_ 1) References
- \_\_\_\_\_ 2) Recommendations
- \_\_\_\_\_ 3) Appearance
- \_\_\_\_\_ 4) Work experience
- \_\_\_\_\_ 5) Education
- \_\_\_\_\_ 6) Age
- \_\_\_\_\_ 7) Sex

C. Do you attempt to interview the spouse of a prospective employee? YES \_\_\_\_\_ NO \_\_\_\_\_

D. What influences the wage you pay your workers?

- \_\_\_\_\_ 1) Competition from other farms
- \_\_\_\_\_ 2) Competition from industry
- \_\_\_\_\_ 3) Other (specify) \_\_\_\_\_

E. How do you decide on a wage increase?

- \_\_\_\_\_ 1) Annual cost of living increases
- \_\_\_\_\_ 2) Merit
- \_\_\_\_\_ 3) Competition
- \_\_\_\_\_ 4) Profits
- \_\_\_\_\_ 5) Other (specify) \_\_\_\_\_

F. Have you had difficulty hiring good workers? YES \_\_\_\_\_ NO \_\_\_\_\_

G. Have you had difficulty keeping good workers? YES \_\_\_\_\_ NO \_\_\_\_\_

VIII. TRAINING

A. How was each of your fulltime workers trained?

Trained by	Worker 1	Worker 2	Worker 3
Qualified before hiring	_____	_____	_____
Trained himself after hiring	_____	_____	_____
Training directed by Owner/Manager	_____	_____	_____
Training directed by other workers	_____	_____	_____
Formal extension or technical program	_____	_____	_____

IX. GENERAL LABOR MANAGEMENT

- A. Do you use specific job titles for your workers? ALL \_\_\_\_\_ SOME \_\_\_\_\_ NONE \_\_\_\_\_
- B. Do your workers attend educational schools or programs? YES \_\_\_\_\_ NO \_\_\_\_\_
- C. Do you provide agricultural reading material to your workers? YES \_\_\_\_\_ NO \_\_\_\_\_

X. SUPPLEMENTAL INFORMATION

- A. What was the approximate value (\$) of milk sold from your farm last year? \$ \_\_\_\_\_
- B. What were your approximate farm operating expenses for 1978?  
(Exclude management and immediate family labor) \$ \_\_\_\_\_
- C. What is the estimated value of your farm and herd assets?
- \_\_\_\_\_ 1) Under \$100,000
  - \_\_\_\_\_ 2) \$100,000-199,999
  - \_\_\_\_\_ 3) \$200,000-299,999
  - \_\_\_\_\_ 4) \$300,000-399,999
  - \_\_\_\_\_ 5) \$400,000-499,999
  - \_\_\_\_\_ 6) \$500,000-749,999
  - \_\_\_\_\_ 7) \$750,000-999,999
  - \_\_\_\_\_ 8) Over \$1,000,000



COOPERATIVE EXTENSION SERVICE

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

Blacksburg, Virginia 24061

We appreciate your willingness to complete this survey. It will help us develop current labor management information for Virginia dairymen.

Sincerely,

Mike McGilliard  
Extension Specialist  
Dairy Management

David Kohl  
Extension Specialist  
Farm Management

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**SUMMARY OF DAIRY LABOR SURVEY 1979**

M. L. McGilliard and D. M. Kohl

Herds Surveyed: 321 (50% of DHI herds with over 60 cows)  
 Surveys Returned: 179 (56%)  
 Workers Reported: 359

**I. GENERAL INFORMATION**

- A. Total acres owned on farm? 484
- B. Tillable acres? 252
- C. How many acres do you rent from someone else? 230
- D. How many years have you operated a dairy farm? 21

**II. PROFILE OF LABOR FORCE**

- A. How many fulltime family (immediate) workers on your farm (excluding owner/manager) .8
- B. How many fulltime hired workers? 2.1
- C. How many parttime family (immediate) workers? .8
- D. How many parttime hired workers? .9

**III. PERSONAL PROFILE OF FULLTIME HIRED WORKERS**

**A. Major responsibilities (A worker may have more than one.)**

Type of Work	No. of Workers	%
Milker	185	33
Herdsman	85	15
Cow Feeder	98	18
Calf Man	74	13
Field Man	115	21

**B. Worker profiles (%)**

Years Employed on your farm		Age		Years of School		Marital Status		Sex
Under 2	30%	Under 25	30%	Under 8	27%	Single	26%	Male 96%
2-5	26%	25-34	29%	8-11	31%	Married	70%	Female 4%
6-10	17%	35-44	14%	12	28%	Separated	4%	
11-20	12%	45-54	15%	13-15	9%			
Over 20	15%	Over 54	12%	Over 15	5%			

**IV. WAGES AND FRINGE BENEFITS (Dollar Value per month)**

A.	All	Excluding Zeros	% Receiving Benefit
Cash Wages	\$637	--	--
Housing	82	\$128	64%
Utilities	27	54	51
Meat, Milk	24	33	75
Life Insurance	4	18	20
Health Insurance	9	26	33
Retirement Program	4	25	14
Other Services	9	26	36
Fringe Benefits	159	180	88
Cash + Fringe Benefits	796	828	
Days Paid Vacation/Year	7.5	9.0	78

**B. Hourly wages for parttime employees**

Adult	\$2.90
Teenage	2.55
Family	2.55

**V. WORKING CONDITIONS AND SCHEDULES**

- A. Milking intervals. 2x/day: 11:13 hours 96%  
 3x/day: 8:8:8 hours 4%
- B. Hours worked/week. 53 (Judging by when the day begins and ends, must not include  
 Days off each month. 3.6 (4.0 excluding those with no time off) lunch, breaks, etc.)  
 Day begins 6:00 a.m.  
 Day ends 5:45 p.m.

**C. Do you have a written agreement with your fulltime hired labor covering:**

	% Yes	% No
Work Arrangements	9	91
Wages	11	89
Incentives	9	91
Fringe Benefits	10	90

VI. INCENTIVE PROGRAMS

A. Check Arrangements

<u>Based On</u>	<u>% of Herds</u>	<u>% of Herds Which Give Incentives</u>
None	32	--
1) Production	23	34
2) Profit-sharing	5	7
3) Reproduction	8	11
4) Calves or heifers raised	6	9
5) Milk quality	6	9
6) Years Worked	13	19
7) Other	7	11

B. Payments made      Weekly 41%      Monthly 47%      Yearly 12%

C. Value of total incentives paid last year.      \$475

D. Have you ever had an incentive program you stopped offering?      Yes 16%      No 84%

<u>If yes, why?</u>	<u>Reason</u>	<u>%</u>
	It didn't help	48
	Employees took advantage	13
	Employees didn't like	17
	Employee left	13
	Other	9

VII. RECRUITMENT

A. Where do you find workers to hire?

1) Word of mouth	60%
2) Newspapers	21%
3) State employment office	6%
4) High schools	7%
5) Colleges & Universities	6%

B. Which items do you use to evaluate the potential of a prospective worker?

1) References	19%	4) Work experience	25%	6) Age	9%
2) Recommendations	16%	5) Education	8%	7) Sex	5%
3) Appearance	18%				

C. Do you attempt to interview spouse of prospective employee?      Yes 39%      No 61%

D. What influences the wage you pay your workers?

1) Competition from other farms	36%
2) Competition from industry	36%
3) Other	28%

E. How do you decide on a wage increase?

1) Annual cost of living increases	31%
2) Merit	43%
3) Competition	7%
4) Profits	18%
5) Other	1%

F. Have you had difficulty hiring good workers?      Yes 50%      No 50%

G. Have you had difficulty keeping good workers?      Yes 34%      No 66%

VIII. TRAINING

A. How was each worker trained?

<u>Method</u>	<u>%</u>
Qualified before hiring	29
Trained himself after hiring	6
Training directed by Owner/Manager	61
Training directed by other workers	4
Formal extension or technical program	0

IX. GENERAL LABOR MANAGEMENT

A. Do you use specific job titles for your workers?      All 4%      Some 39%      None 57%

B. Do your workers attend educational schools or programs?      Yes 48%      No 52%

C. Do you provide agricultural reading material to your workers?      Yes 69%      No 31%

X. SUPPLEMENTAL INFORMATION

A. Value of milk sold from your farm last year.	\$173,379
B. Approximate farm operating expenses last year.	\$143,138
C. Estimated value of farm and herd assets.	\$500,000

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