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IMPACT OF PDDC MODEL FARM PROGRAMME ON THE SOCIO-ECONOMIC CONDITIONS OF DAIRY FARMERS IN PAKISTAN

(A Case Study of 50 PDDC Model Farmers)

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The present study has been conducted throughout the target area of Pakistan Dairy Development Company (PDDC). Fifty farmers who have joined the PDDC Model Farm Program, representing all the dairying regions of Pakistan, have been selected for the study. This study has shown the impact of the Model Farm Program on the lives of PDDC model farmers and their families. The impact was measured in terms of progress in productivity, profitability, decision making, confidence in the dairy industry, and inclination towards positive change. The impact been measured through the difference between benchmark data (initial data before joining PDDC) and current data. Behavioral changes have been measured through a designed questionnaire through which the farmers and their families were interviewed. The data has been analyzed and this paper will discuss the findings.
Keywords: Dairying, Pakistan, socio-economic aspects

INTRODUCTION

The dairy sector contributes 11 % to the gross domestic product (GDP) of Pakistan. About 50 million dairy animals produce approximately 33 billion litres of milk annually. (PDDC 2006) This is the second largest component (27.7%) of agricultural production, and deserves much more attention as it is the fastest growing sector of the country. Despite the fact that Pakistan is the fifth highest milk producing country, it imports milk and milk products valued at Rs. 1.1 billion (Economic Survey of Pakistan, 2006).

Dairy Pakistan has been established as a public-private partnership under Section 32 of Companies Ordinance, 1984 to co-ordinate dairy development activities. The main objective is the development of the dairy sector by increasing milk production and profitability. At the present time, growth rate of milk production is 2.9 percent and the expected rate is 3.2 percent during next five years. The estimated demand for milk requires at least a growth rate of 5.0 percent of milk (Afzal, 2006).

Poor animal nutrition, poor management of milking animals and negligence of health problems results in late maturity, extended calving intervals and low milk production.

Principles of good management advocated by PDDC

Free access to water/ un-tying of animals: Water is the most important input for dairy cattle production (Beede, 1992; NRC, 2001). High levels of milk production are dependant on having abundant clean fresh water available. Limited water availability depresses milk production (Michael, 2002). Generally cattle consume 2 to 4 litres of water for each kilogram of dry matter consumed (Barney & Van Hoome, 2003) and an additional five litres of water is required per litre of milk produced. (Jacobs and Hargreaves, 1999). Complete water deprivation with a dry hay and dry grain ration results in a decrease in milk yield up to 93% after 24 hours (Little, et.al.1984).

Cows given free access to water will produce more milk and more butterfat than cows allowed drinking only two times per day. The same animal will consume different levels of water due to physiological state. A pregnant or lactating animal will consume more than a non-pregnant, dry animal.

In contrast to traditional practices where farm workers determine when animals have access to water, PDDC Model Farms allow cows and buffalo *ad libitum* access to water through provision of fencing and water troughs.

Green feed

Underfeeding and malnutrition are the major constrains to the development of the livestock sector. According to Younas and Yaqoob (2005), unavailability of adequate feedstuffs is the most limiting factor to an increase in milk production in developing countries. According to The National Commission on Agriculture (NCA) 1988 suggests that if all milking animals receive a full diet which meets their daily nutrient requirements, by improving the quality of the ration, then this alone could increase milk yield by 100 percent. The genetic potential of an animal can only be approached through providing good quality feed and fodder to our dairy stock.

PDDC advisors make regular visits to each of its Model Dairy Farms to assist and advise farmers in their fodder planning and production, thereby facilitating increased production of green fodder. In addition conservation of excess feed is encouraged to overcome periods of feed shortage.

Heat stress

Increasing air temperature, temp-humidity index and rising core body temperature above the critical threshold are related to a decrease in dry matter intake (DMI) and milk yield (West, 2003). Moderate signs of heat stress may occur when the temperature is between 27°C and 32°C with the humidity ranging from 50 to 90 per-cent. (Jodie A. Pennington, 2006).

PDDC farms are fitted with cooling systems which are able to reduce the ambient temperature inside the dairy shed by up to 10 – 12 deg. C during the hottest months, thus reducing the potential for heat stress in the animals.

designed to provide data about changes in production, profitability & confidence over the period the farms had been involved with PDDC Model Farm Program. The impact has been measured through the difference between bench mark data (initial data before joining PDDC) and current data.

b) Regions of survey

The survey was conducted in the five regions throughout Pakistan in which PDDC is working. These are, NWFP, Central Punjab, Northern Punjab, Southern Punjab, Sindh & Balochistan. The first fifty installed Model Farms taken from these regions are, 8, 8, 10, 13, & 11 respectively (see Table 1).

Table 1. No. of farms in survey by region

Region	No. of Farms		
	Small Farms (1-49 animals)	Medium Farms (50-100 animals)	Large Farms (>100 animals)
Northern Punjab	7	3	
Central Punjab	4	2	2
Southern Punjab	8	5	
NWFP	6	2	
Sindh/Balochistan	5	4	2
Total	***30***	***16***	***4***

METHODOLOGY

To identify the effect of the introduction of management infrastructure and amended practices to address the parameters discussed above, a study was conducted on 50 Model Farms established by Dairy Pakistan throughout the country. The farms have completed at least one year collaboration with PDDC. The current data of the farms were collected i.e. feeding status, average milk production, herd size and monthly profit, through a survey. The initial data was retrieved from the PDDC data bank.

For the purposes of this study, profitability was calculated on the basis of income generated from milk sales. The study was conducted in the month of September 2008, and data collected from the farms reflects seasonal conditions including the effect of season on milk production.

The survey did not collect sufficient data to allow the calculation of an annual milk production curve, nor did it illicit any information on the breeding and reproductive performance of the cattle.

a) Survey

The survey was conducted through a designed questionnaire which was trialled on-farm for suitability prior to actual conduct of survey. The survey was

c) Selection of farms

The selection of the farms was done on the basis of first fifty installed Model Farms which had completed a 12 month association with PDDC. Each of the five regions is represented by farms in this survey.

d) Data collection

The data collection was done in a participatory way. Open questions were asked from the farmers through probing techniques. The data were collected by ten PDDC extension staff along with four interns from the University of Veterinary and Animal Science (Lahore) over a time period of two weeks.

e) Data analysis

Data was analyzed statistically by paired t-Test, at 95 percent confidence level.

RESULTS AND DISCUSSION

The data were split into 3 groups, i.e. small farms (1-49 animals), medium farms (50-99 animals) and large farms (>100 animals). The sample size was 30, 16 and 4 farms respectively. Changes in average daily milk production, herd size, monthly profit and changes in the behavior of farmers were analyzed.

Impact on farm economics

Change in average milk production: Increased milk production is a key contributor for successful dairy farming. The average change in milk production is an important tool to measure the economics of a farm.

Tables 2, 3 and 4 show daily average animal milk production on the small, medium and large farms respectively, before and after collaboration with PDDC. Data given in Table 2 shows the change in average milk production on the small farms in the study. From the table it is evident that the average milk production of the 30 small Model Farms has significantly increased over the time they had been associated with PDDC. The actual range of the increase in milk production is between 0 - 16 liters/animal/day.

Table 2. Average milk production of small farms before and after collaboration with PDDC

Sr. #	Farmer Identity	Avg. Daily Milk Production (l/animal/day)	
		Before PDDC	After PDDC
1	S1	4.00	10.00
2	S2	5.69	6.00
3	S3	7.00	8.00
4	S4	4.88	5.00
5	S5	10.77	10.83
6	S6	3.00	7.50
7	S7	9.20	12.00
8	S8	4.17	6.00
9	S9	9.10	9.00
10	S10	7.86	14.00
11	S11	5.50	9.09
12	S12	4.00	4.50
13	S13	4.50	11.14
14	S14	5.00	7.50
15	S15	4.29	10.00
16	S16	3.17	5.45
17	S17	7.50	8.18
18	S18	7.00	7.14
19	S19	1.60	8.00
20	S20	4.33	6.25
21	S21	9.00	5.00
22	S22	6.00	13.00
23	S23	6.67	6.50
24	S24	2.50	10.00
25	S25	11.67	16.00
26	S26	2.50	4.83
27	S27	5.00	6.00
28	S28	5.33	8.00
29	S29	4.44	7.00
30	S30	3.75	10.00

Calculated t = 5.41 Tabulated t = 3.659

The t-test analysis supports the positive impact of the Model Farm Program on milk production which has been observed. The calculated value of the t-test (5.41) is greater than the tabulated (3.66) which suggests that PDDC management practices have had significant effects on milk production on the small model farms.

Table 3. Average daily milk production of animals on medium farms before and after collaboration with PDDC

Sr. #	Farmer Identity	Avg. Daily Milk Production (l/animal/day)	
		Before PDDC	After PDDC
1	M1	3.3	6.9
2	M2	5.0	5.6
3	M3	6.5	7.3
4	M4	3.6	4.4
5	M5	6.7	6.8
6	M6	4.4	5.6
7	M7	6.7	8.5
8	M8	4.5	9.1
9	M9	3.8	8.6
10	M10	6.0	8.2
11	M11	4.6	4.6
12	M12	5.0	6.2
13	M13	7.1	7.0
14	M14	5.8	7.3
15	M15	4.0	10.0
16	M16	5.0	8.0

Calculated t = 4.28 Tabulated t = 4.07

Table 4. Average daily milk production of animals from large farms before and after collaboration with PDDC

Sr. #	Farmer Identity	Avg. Daily Milk Production (l/animal/day)	
		Before PDDC	After PDDC
1	L1	6.86	8
2	L2	5.00	5.45
3	L3	6.67	8.00
4	L4	7.14	8.00

Calculated t = 4.94 Tabulated t = 5.84

The practices which have had the most beneficial effects are firstly and most importantly free access to clean water, as compared to the traditional practices of giving water twice daily. Once animals are given *ad libitum* water their potential for milk production increases as a greater percentage of the water intake becomes available for milk production, over and above the maintenance requirement.

Small farmers who have become involved in PDDC have improved the nutritional status of their animals by

providing more green fodder and less wheat straw. On small farms the feeding of animals can be controlled effectively. Green fodder has higher digestibility and nutritional content than wheat straw, thus more nutrients are directed to milk production and body condition of the animal than is the case in traditional farming practices.

Small farms are managed by the family unit. Greater control over milking time, milking routine, and milking techniques can be maintained. Small changes on dairy farms easily can be noticed, and if these changes are negative they can be addressed in a timely way.

PDDC Model Farmers receive continuous technical assistance, intended for three years. Assistance and advice to improve health and hygiene conditions on small farms has a direct effect on milk production. Due to the farm size, PDDC assistance can be more focused and individual variations can be more easily observed and treated.

Data given in Table 3 indicates the change in average milk production on the medium farms in the study. It is evident that the average milk production has increased after contact with PDDC, but on average to a lesser extent compared with the small farms. The actual range of the increase in milk production is between 0 - 10 liters/animal/day.

The t-test analysis supports the positive impact of the Model Farm Program which has been observed. The calculated value of the t-test (4.28) is greater than the tabulated (4.07). PDDC Model Farm management practices have had significant effects on average daily milk production of animals on medium sized Model Farms.

As with the small farmers free access to water and improved animal nutrition has had a positive impact on productivity. With larger numbers of animals after becoming involved with PDDC however, but no increase in land holding, it is more difficult for the medium farmers to meet the green fodder requirement of the animals. Wheat straw, available on the farms as a by-product from the agricultural crop, still remains an important component of animal rations, and is utilized first, ie before purchasing additional green fodder.

On the medium farms, labour outside the family unit is employed but the family unit still has direct monitoring over farm operations. Because the farm is dependant on labour, there may be less attention paid to critical elements of the farm (by the employed labour) which affects the extent to which milk production is increased by the Model Farm Program interventions, compared to small farms. However there remains a close interaction between the labor and the family unit so PDDC advice is still followed to a large extent.

It is evident from Table 4 that the change in average milk production of the four large model farms did not match the changes observed of the small & medium farms. The average increase observed was less than 2 liters/animal/day. Statistical analysis indicated no significant increase in milk production.

There are several factors which are likely to contribute to the fact that milk production on the large farms was not increased significantly. It is the opinion of the authors that the largest contributing factor to this result is unavailability of skilled labour. In addition, the farm owner is usually absent from the farm, so effective supervision of labour is not possible.

On large farms, good management practices such as proper feeding, fodder planning, milking techniques, time of milking and animal health practices may not be implemented according to PDDC advice. Unskilled labour is more likely to maintain traditional procedures. Hygienic conditions are difficult to maintain.

On large farms, although record keeping is essential, it is seldom practiced. This results in large numbers of unproductive animals being maintained. Animals lose their individual identity and therefore negative changes in nutritional and health status are often overlooked.

Due to the larger number of animals in the animal compound, heat stress has more impact on milk production than on the small & medium farms. The positive effect of the PDDC cooling system is somewhat diminished by the large amount of heat produced by many animals.

Herd size: Of the small Model Farms included in the survey, two thirds have increased the size of their herds after becoming involved with PDDC. Six small farmers increased animal numbers by between one and five, six farmers increased animal numbers between six and ten head, and nine farmers increased their herd size by more than ten animals. Ten of the small farmers did not increase the size of their herds.

Model Farms of medium size were more consistent in showing increases in herd size, with 13 of the 16 farms in this category increasing their herd numbers by more than ten head. One farm maintained its original animal numbers, whilst two farms reduced the number of animals in their herds.

All four of the large Model Farms in the survey increased the number of animals in their herds by more than ten over the period since being involved with the PDDC Model Farm Program. Data on the changes in herd size are presented in Table 5.

Profitability: It is suggested that increase in herd size is an indicator to satisfaction of the farmers with their dairy businesses, and their confidence of continuing in dairy in the future.

Table 5. Number of farms which show a change in herd size of after joining the PDDC Model Farm Program

	Increased Herd Size by 1 – 5 head	Increased Herd Size by 6–10 head	Increased Herd Size by >10 head	No Increase in Herd Size	Reduction in Herd Size
Small Farms (1 – 49 animals)	6	6	9	10	
Medium Farms (50 – 99 animals)			13	1	2
Large Farms (>100 animals)			4		

Farm profitability is the relationship between the cost of production and the income generated from dairy activities. As profitability increases the socio-economic condition of the farming family improves. Sustainability in the long term is also related to the profitability of the farm. PDDC is committed to increase the profitability of dairy business in Pakistan.

Table 6 indicates the change in profitability on the small farms after involvement with PDDC. In all but three cases the farm profitability was improved (in some cases this is indicated by a reduction in loss). The overall impact of the PDDC Model Farm Program on profitability is positive.

The data was statistically analyzed and found that t-calculated (4.61) is significantly higher (95% confidence level) than t-tabulated (3.66), indicating a significant increase in profitability on the smaller Model Farms.

In the case of small farms, improved profitability was affected by both reduction in the cost of production and an increase in income due to increased milk production. Decrease in the cost of production was due to changes in feeding practice from wheat straw to cheaper green fodder. In addition, timely health management practices reduced treatment costs. With the installation of fences on the farms the requirement for labour is reduced. A decrease in the cost of labour through reducing or eliminating employed labour units contributed to the reduction in cost of production.

Table 7 indicates the change in profitability of the medium sized farms. The data was statistically analyzed and found that t-calculated (3.92) is lower than t-tabulated (4.07). When the data is analyzed as a group, the large scatter effect was responsible for non-significant results.

However on an individual basis every farm except one showed large positive changes in profitability. The one farm (M16) which did not show a large positive change was in a stable state.

Table 6. Change in small farm profitability

Sr. #	Farmer Identity	Monthly Profit (Rs.)	
		Before PDDC	After PDDC
1	S1	(1,140)	17,080
2	S2	(49,740)	(19,100)
3	S3	57,700	79,390
4	S4	17,070	25,485
5	S5	36,700	22,250
6	S6	(18,725)	(10,003)
7	S7	27,640	73,706
8	S8	(12,365)	(6,310)
9	S9	27,800	13,220
10	S10	(17,136)	46,155
11	S11	3,250	34,751
12	S12	(3,498)	1,900
13	S13	(21,699)	(1,105)
14	S14	(2,600)	(15,460)
15	S15	5,650	16,050
16	S16	(27,473)	10,805
17	S17	1,975	38,650
18	S18	2,550	460
19	S19	(20,480)	10,620
20	S20	(12,207)	2,040
21	S21	(2,525)	9,010
22	S22	(4,650)	13,893
23	S23	10,450	1,743
24	S24	(7,840)	32,000
25	S25	(1,080)	13,968
26	S26	(3,245)	2,645
27	S27	6,700	12,150
28	S28	9,485	14,045
29*	S29	(9,705)	9,840
30	S30	(1,750)	17,000

Calculated t = 4.61 Tabulated t = 3.66

Medium sized farms are still reliant on expensive wheat straw and external labour unit(s), which adds to their cost of production. Despite this, a strong positive trend in increase in profitability is demonstrated. Medium farmers derived the same benefits as the small farmers from participating in PDDC program but their profitability may be limited by land, labour and management restrictions.

Table 7. Changes in medium farm profitability

Sr. #	Farmer Identity	Monthly Profit (Rs.)	
		Before PDDC	After PDDC
1	M1	(27790)	32205
2	M2	(12575)	(8925)
3	M3	56740	197745
4	M4	(21220)	(5500)
5	M5	22850	76760
6	M6	7200	36990
7	M7	40750	116320
8	M8	(1590)	45285
9	M9	(7225)	39116
10	M10	(11700)	(3780)
11	M11	5120	7430
12	M12	20500	32463
13	M13	16610	18400
14	M14	(13320)	33155
15	M15	56800	174740
16	M16	(39320)	(40220)

Calculated t = 3.92 Tabulated t = 4.07

Table 8 indicates the change in profitability of the large farms. In all cases profitability increased markedly. The data was statistically analyzed and found that t-calculated (1.3) is significantly less than t-tabulated (1.6). It showed that data is not statistically significant. It is suggested that the non-significant analysis is due to small sample size and a large scatter within the group.

Table 8. Changes in large farm profitability

Sr. #	Farmer Identity	Monthly Profit (Rs.)	
		Before PDDC	After PDDC
1	L1	(203,760)	1,034,240
2	L2	(64,555)	27,446
3	L3	(51,650)	(31,400)
4	L4	(40,785)	107,050

Calculated t = 1.3 Tabulated t = 1.6

Increasing profitability for the large farmers is related firstly to an increase in milk income through direct marketing, the development of new markets, and eliminating the middle man in the milk handling chain. In addition, the cost of production has decreased through more effective use of labour. This has been made possible after appropriate fencing has been installed on farm. Fencing has reduced the high cost of labour which previously was required to provide feed and water for the animals.

Impact on mind set

The survey attempted to assess the change in mindset of the farmers who had been involved with PDDC for an extended period of time. Three areas were studied– inclination towards positive change, confidence in the dairy industry and decision making regarding the distribution of surplus dairy income.

Questions to illicit farmers' inclination towards positive change included information gathered about changes from traditional to modern farm management practices. Confidence in the dairy industry was indicated by the farmer's vision for his farm in the next 12 months. The survey also gathered data about investing the surplus income generated by the dairy business.

Figure 1 indicates the inclination towards positive change in the management practices adopted by PDDC Model Farmers. Results revealed that the model farmers having small & medium farms have 97 % inclination towards positive change - that is the uptake of modern dairying techniques suggested by PDDC - whilst 75 % of large farmers were positively inclined towards change using these criteria.

Small and medium farmers were more motivated to implement the changes proposed by PDDC because they are aware of the large changes in productivity and profitability that the new management practices can deliver. In addition, they realized the importance of the dairy business and its potential to improve their profitability over and above their previous agricultural outputs. Large farms have already implemented some modern dairy farming techniques, so a lower proportion of large farms showed an inclination towards the basic improvements suggested by PDDC.

Data presented in Figure 2 indicates farmers' confidence in the dairy industry. It is measured by how the farmers foresee their farm status in the coming 12 months time. Of the three groups of farmers, the small farmers showed the greatest confidence in their future within the dairy industry, followed closely by the medium farmers.

Small dairy farmers are mostly dependent on dairy alone as an income source, whereas medium and large farmers may have significant other sources of income to buffer their dairy enterprises. It is pleasing that those farmers who are most dependent on dairy as an income source demonstrate the highest confidence in their industry. Whilst using traditional practices before joining PDDC, small farmers were using the milk for their domestic purposes. Nowadays they have realised that with changes in their management practices they can produce milk surplus to domestic requirements for commercial sales. This will boost their profitability and thus their socio-economic status.

Medium and large farms generally tend to have more diverse income sources (agriculture and/or non-agriculture) which may divert their full attention away from the benefits of dairy farming.

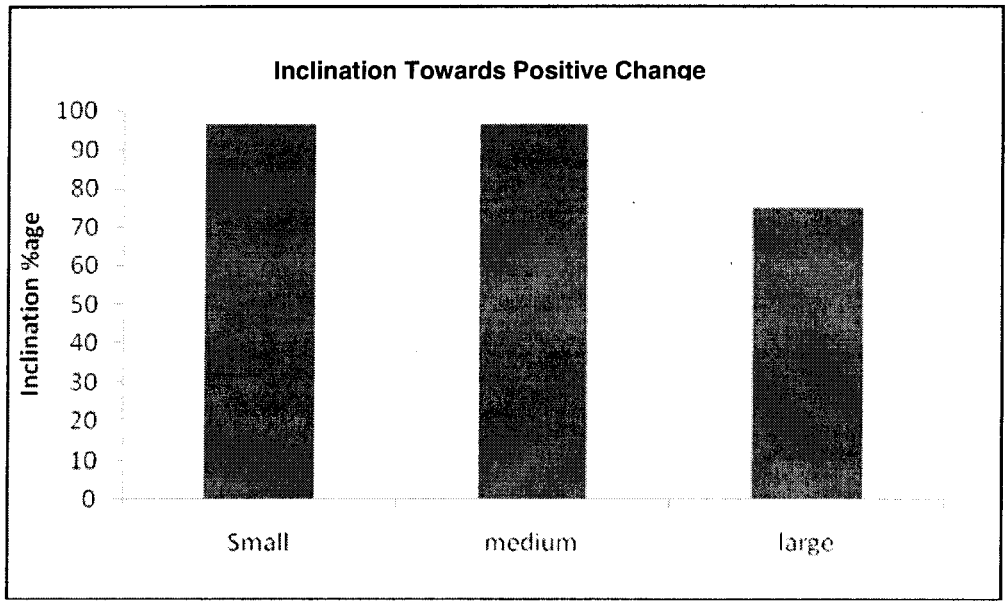

Fig. 1. Inclination towards positive change - percent respondents inclined towards positive change

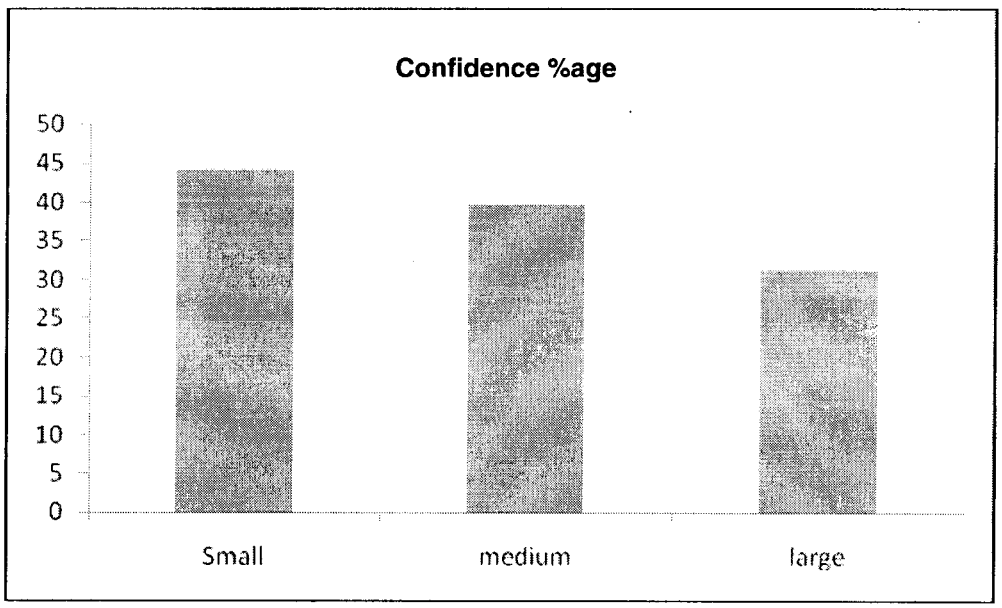

Fig. 2. Confidence in dairy industry – percentage of respondents confident

Data presented in Figure 3 indicates the propensity of the farmers to allocate surplus profit generated from the dairy business towards dairy and non-dairy pursuits. Among small dairy farm holders, 29 % showed interest in expanding their dairy farms, 19% showed interest in diverting surplus into non-dairy areas and 52% showed interest in spending surplus income towards both dairy and non-dairy activities.

Among medium dairy farm holders, 37% showed an interest in expanding their dairy farms, 25% showed interest in diverting surplus into non-dairy areas and 38% showed interest in spending surplus income towards both dairy and non-dairy activities.

Among large dairy farm holders 25% showed interest in expanding their dairy farms, and 50% showed interest in spending surplus income in both categories. Twenty five percent said that no farm surplus was generated.

This data suggests that small and medium farmers recognize that to improve their lifestyles they need to

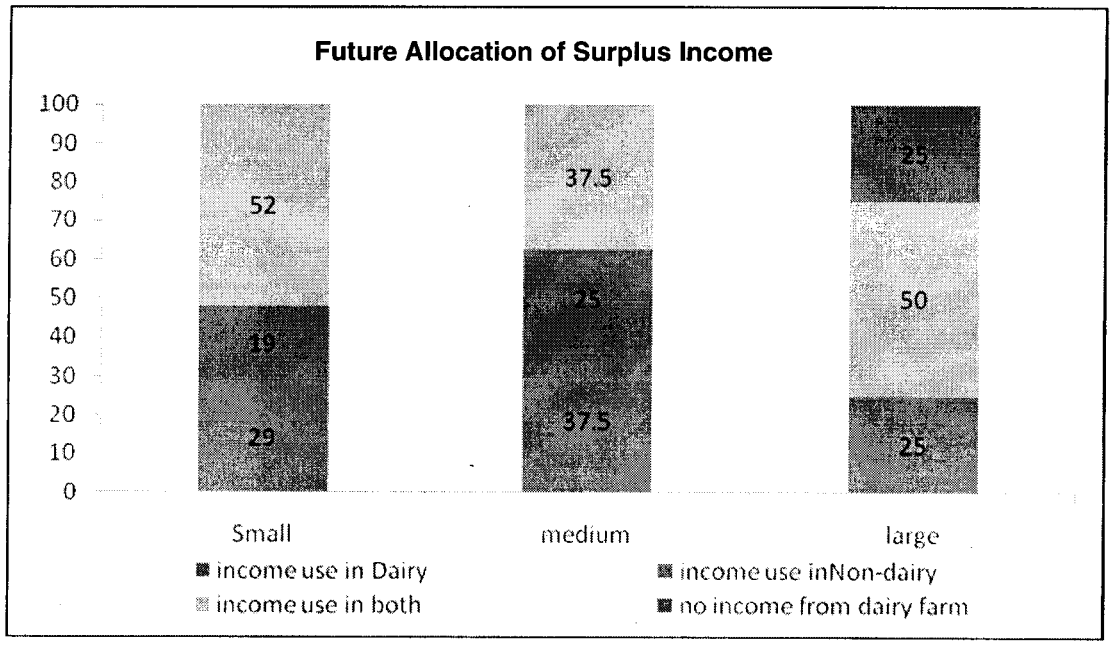

Fig. 3. Future allocation of surplus income

invest in their dairy businesses. Further these two groups appear to be investing the surplus in a balanced manner for improvement in both the dairy and non-dairy aspects of their lives.

One of the large farmers indicated that no surplus was generated from his dairy business. Non-dairy investment appears to be a lower priority in this group. This may be because their lifestyle needs have already been satisfied and are not solely dependent on the dairy business.

SUMMARY

In order to meet the requirement of its rapidly growing population, dairy production in Pakistan needs to be increased. This can be done by adopting modern techniques of dairy farming. New technologies developed by researchers and routinely used in dairy farming overseas are disseminated among the farmers by Pakistan Dairy Development Company. In addition, the PDDC dairy extension program provides PDDC farmers with management, decision making and technical skills through its advisory services.

The present study was conducted on the first 50 Model Farms installed by Pakistan Dairy Development Company throughout Pakistan, which were categorized as small (1-49 animals), medium (50-99 animals) and large (>100 animals). The respondents were interviewed about milk production, changes in herd size, monthly profit, and change in mind set.

- Significant increases were seen in milk production in small & medium sized farms. Large farms also showed an increase in milk production but not a statistically significant increase. On an individual farm basis the majority of farmers in all categories showed an increase in milk production after joining PDDC.
- Most of the farmers in the study increased their herd sizes during the time they had been associated with PDDC. In general this reflects the farmers' confidence in his future in dairy, through the adoption of modern farming practices.
- A significant increase in profitability was observed in small scale dairy farms after joining PDDC. Non-significant increases in profitability were observed in medium and large farms but non-significance of data in these groups was due to the large variation in farm income and expenditure in these two groups. In addition, sample size was a contributing factor to the non-significant result. Individually most farms showed an increase in profitability or a decrease in loss after joining PDDC.
- All farmers in this survey had a positive attitude towards adopting the new technologies proposed by PDDC. In particular the small and medium farmers showed a strong tendency to embrace modern management practices.
- In this survey small farmers indicated that they were the most confident in their dairy farms into the future, followed by medium and then large farmers.

- The spending of surplus income in dairy and non-dairy sectors is commonly observed in all the three groups. However the small & medium farmers gave a higher priority to investing the surplus income in dairy expansion.

CONCLUSION

The impact of the PDDC Model Farm Program on milk production and profitability was obvious in all the three categories of farms in the sample. However greatest impact has been achieved in collaboration with small and medium sized farms.

As the Model Farms continue their collaboration with PDDC and their new practices become more established, it is expected that the rate of positive change will accelerate on these farms. This is due to the flow-on effects of the initial basic management changes implemented on farms (free access to water, improved nutrition and animal health and welfare), brought about by improved nutrition and animal health.

Positive flow-on benefits to be expected in relation to animal production include a reduction in inter-calving intervals, a reduction in calf mortality and increased calf growth rates, and a reduction of the age of first calving. Positive benefits are also expected to be observed in fodder production, with fodder planning practices being implemented on farms which will reduce or remove feed shortages and the reliance on wheat straw as a supplement.

As more dairy farmers in Pakistan implement the modern farming practices espoused by PDDC, national milk flow can be expected to increase, with an associated improvement of the socio-economic condition of dairy farmers. Subsequently the reliance on importation of milk to satisfy the national requirement is expected to decrease.

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