

INVESTMENT IN COMMERCIAL PRODUCTION OF MILK IN URBAN AREAS

BY K.C. RAUT

Institute of Agricultural Research Statistics

1. INTRODUCTION

In India although milk production is in the hands of millions of producers very few are of commercial type habitually selling milk. In rural areas milk is only a by-product of arable farming. It is only in big cities and that too on a limited scale, that producers take up milk trade on commercial lines. The reasons for the present position appear to be mainly due to the fact that the resources for investment are limited and also the individuals engaged in the trade are hardly aware of its potentialities by way of returns. It is likely that an impetus towards expansion and improvement of the trade can be given if it can be shown that a judicious investment of money in milk production could bring about profitable returns. It is but reasonable to expect that an investor would like to have an idea of the returns he can get from his investment in any particular enterprise. In this context it is necessary to find out the optimum allocation of resources between various components of fixed and working capital to get the maximum return and also to predict with reasonable degree of precision the returns expected. With this end in view a study of the present rate of investment, its distribution between various inputs and the returns realised was made utilizing the data on urban commercial stalls collected in the surveys carried out by the Institute of Agricultural Research Statistics to estimate the cost of production of milk. Further, detailed investigations have been carried out with the available data to find out the relationship of net return with total investment and also separately with various components of investment. Estimates of optimum rate of investment and its distribution between various components for getting maximum net return have also been worked out.

2. MATERIAL FOR STUDY

Large-scale sample surveys were conducted by the I.A.R.S. to estimate the cost of production of milk in Delhi (1953-55), Madras

(1957-59) and Calcutta (1960-62). The details of the sampling design of the enquiries are given by Panse (1956) and Panse et al. (1961, 1963, 1965). Data on various items were collected from randomly selected producer households through weekly visits by trained enumerators. The data on milk yield and feeds fed were collected by direct weighing and the feed composition was recorded. Other data were collected through direct observation and careful enquiry from the producer and price rates checked by enquiries in the local markets.

The number of households maintaining milch stock was 4,163 in the corporation limits of Delhi, and New Delhi, 7,340 in Madras and 6,271 in Calcutta. Out of the total number of households having milch animals a random sample of 54 households in each of the three cities was selected for collecting data to estimate the cost of production of milk. Of these 32 producers in Delhi, 26 in Madras and 30 producers in Calcutta were of commercial type, habitually selling milk. The present study is based on the data from these commercial producers.

3. TOTAL INVESTMENT

Table 1 gives the order of total investment and its distribution between fixed and working capital in Delhi, Madras and Calcutta. About 75 percent of the producers invested less than Rs. 3,000/- and only in 8 to 13 per cent of the cases the order of investment was more than Rs. 5,000/-. More than half the number of producers in Madras, two-fifths in Delhi and one-fourth in Calcutta invested less than Rs. 1,000/-.

The range of investment varied from Rs. 224/- to Rs. 12,525/- in Delhi, Rs. 309/- to Rs. 9,048/- in Madras and Rs. 270/- to Rs. 11,040/- in Calcutta. The total capital invested may be divided into fixed and working capital. Fixed capital comprised the amount spent for purchase of animals and value of assets and equipment. Amount spent on feed, incidence of labour, recurring expenditure etc. for one month was taken as the working capital. The period was fixed in view of the fact that generally monthly payments are received by the producer for the milk supplied.

In all the three cities fixed capital was the major component of investment accounting for about 80 to 92 percent of the total investment. The proportion of fixed capital was comparatively high in the low investment group of producers in Delhi and Madras.

The average number of animals maintained in each of the investment groups was of the same order in the three cities and increased

TABLE 1. *Order of investment by producers*

<i>Group</i>	<i>Range of investment (Rs.)</i>	<i>Percentage of producers</i>	<i>Average investment (Rs.)</i>	<i>Fixed capital %</i>	<i>Working capital %</i>	<i>Average number of animals</i>
DELHI						
I	≤1000	40.6	464	89.9	10.1	1.2
II	—3000	34.4	1940	83.8	16.2	3.2
III	—5000	12.5	4178	83.2	16.8	9.2
IV	>5000	12.5	8194	83.2	16.8	15.2
MADRAS						
I	≤1000	53.8	596	91.7	8.3	1.6
II	—3000	19.2	1572	88.0	12.0	3.5
III	—5000	19.2	3892	88.1	11.9	9.8
IV	>5000	7.8	7055	86.1	13.9	17.5
CALCUTTA						
I	≤1000	26.7	565	84.4	15.6	1.1
II	—3000	50.0	2047	79.6	20.4	4.0
III	—5000	10.0	3816	83.6	16.4	8.7
IV	>5000	13.3	8714	80.6	19.4	18.8

with the amount invested. The order of investment was low in Madras as compared to the other two cities mainly due to low price of animals which were mostly of local type and of comparatively lower productivity.

4. RECEIPTS AND EXPENSES

The annual receipts and expenses of a producer under each group in the three areas are presented in Table 2. The largest portion of cash receipts was from the sale of milk. The value of milk which was consumed in the household and income from dung have been included under 'perquisites'. Youngstock was neglected practically by all commercial producers. Cow calves were sold along with their

TABLE 2. Annual receipts (Rs.) and expenses (Rs.) per producer

Components	DELHI				MADRAS				CALCUTTA			
	I	II	III	IV	I	II	III	IV	I	II	III	IV
Receipts												
1. Sale of milk	688	4735	12660	24718	873	2755	9129	16602	1569	7171	10467	29893
2. Perquisites	255	319	331	608	285	417	398	584	259	263	698	1172
3. Total receipts	943	5054	12991	25326	1158	3172	9527	17186	1828	7434	11165	31065
Expenses												
4. Feed	430	2560	5380	10235	585	1831	4158	8728	946	3961	5854	15167
5. Paid labour	33	205	692	901	28	113	478	477	21	256	676	1583
6. Miscellaneous expenses	15	144	176	552	10	19	109	97	32	181	131	316
7. Total cash expenditure	478	2909	6248	11688	623	1963	4745	9302	999	4398	6661	17066
8. Depreciation on animals	75	824	2086	4731	16	416	978	2803	127	753	1281	3727
9. Depreciation on asset and equipment	11	32	79	70	2	6	18	33	11	10	62	80
10. Total expenses including depreciation	564	3765	8413	16489	641	2385	5741	12138	1137	5161	8004	20873
11. Family income (3-10)	379	1289	4578	8837	517	787	3786	5048	691	2273	3161	10192
12. Interest on fixed and working capital	17	68	146	286	22	57	142	252	20	71	134	298
13. Family earnings (11-12)	362	1221	4432	8551	495	730	3644	4796	671	2202	3027	9894
14. Family labour	46	276	460	1207	131	243	333	177	311	426	273	377
15. Producer's net income (13-14)	316	945	3972	7344	364	487	3311	4619	360	1776	2754	9517
Average number of animals per stall	1.2	3.2	9.2	15.2	1.6	3.5	9.8	17.5	1.1	4.0	8.7	18.8

dams before weaning and the buffalo calves were allowed to die in most of the cases. Thus the income from sale of calves was negligible. The amount spent in cash was for cattle feed, hired labour and for other miscellaneous items like rent, medicines, lights etc. Depreciation was calculated towards culling charges of animals and replacement of asset and equipment. Family income was worked out deducting the total expenses from the total receipts. From the family income was deducted the interest at the rate of four per cent per annum on the fixed capital on assets as well as the initial stock of animals and interest for a limited period of one month at the rate of 12 per cent per annum on the working capital and the balance obtained was called family-earnings. In most of the cases a substantial proportion of labour was contributed by the producer himself or his family. The value of labour was worked out on the basis of the existing local wage rates. Producer's net income was obtained by deducting the charge on family labour from family earning.

The figures of net earnings per year by a producer in different groups are given in Table 3.

TABLE 3. *Producer's net earnings per year*

<i>Investment group</i>	<i>Delhi</i>		<i>Madras</i>		<i>Calcutta</i>	
	<i>Av. net income per year (Rs.)</i>	<i>Net income per Rs. 100 invested</i>	<i>Av. net income per year (Rs.)</i>	<i>Net income per Rs. 100 invested</i>	<i>Av. net income per year (Rs.)</i>	<i>Net income per Rs. 100 invested</i>
I	316	68·1	364	61·1	360	63·7
II	945	48·7	487	31·0	1776	86·8
III	3972	95·1	3311	85·1	2754	72·1
IV	7344	89·6	4619	65·5	9517	109·2

Although the average income increased with the increase in investment in all the three areas the trend was not same for the net income per Rs. 100/- invested. A producer under low investment group (Group I) in each of the three areas got net income of about Rs. 65/- per annum for Rs. 100/- invested. The lower medium group (II) of producers got the minimum net income amounting to about Rs. 49 per annum in Delhi and Rs. 31 in Madras per Rs. 100/- invested; but in Calcutta a producer under this group realised about 87 per cent of

investment. The higher-medium-group (III) got maximum net return in Delhi and Madras amounting to about 95 per cent and 85 per cent of the investment respectively. The percentage of net return for a producer under this group in Calcutta was 72 which was less than that for a producer in the lower medium group. A producer in high investment group realised about Rs. 600 per month in Delhi, Rs. 800 in Calcutta and only Rs. 380 per month in Madras. The main reason for the low income for the low-investment groups of producers was due to relatively higher expenditure on feeding of animals and labour (vide Table 2.) as compared to other groups. In Calcutta the producers of higher-medium group realised less net return due to higher investment on working capital coupled with low production.

It is of interest to know the order of investment per animal and the corresponding net return realised per annum by a producer under different groups in the three areas. These results are given in Table 4.

TABLE 4. *Investment and annual net income per animal*

<i>Investment group</i>	<i>Delhi</i>		<i>Madras</i>		<i>Calcutta</i>	
	<i>Investment (Rs.)</i>	<i>Net income (Rs.)</i>	<i>Investment (Rs.)</i>	<i>Net income (Rs.)</i>	<i>Investment (Rs.)</i>	<i>Net income (Rs.)</i>
I	387	263	372	228	514	327
II	606	295	449	139	512	444
III	454	432	397	338	439	316
IV	539	483	403	264	464	506

The amount of money invested per animal was widely different not only from one area to other but also in various groups in each area. In Delhi it was seen broadly that the order of investment was more where the proportion of buffaloes was more than the cows because a buffalo was comparatively costlier and heavier. Majority of the cows were of Haryana breed and buffaloes Murrahs. In the low investment group (I) there were only cows and in group II there were mostly buffaloes. The proportions of cows and buffaloes in Group III and IV were 1:1 and 3:7 respectively. Comparing the first two groups of producers it could be observed that by investing about

Rs. 220/- more on a buffalo a producer could get only about Rs. 30/- more per annum as compared to keeping a cow. Although the milk production was enhanced by maintaining more number of buffaloes yet it did not compensate the higher amount of investment.

In Madras the buffaloes were purely non-descript and cows either crossbred or Ongole breed. It was observed that the order of investment was more where the proportion of cows particularly crossbred maintained was more than the buffaloes. In each of the groups I and IV the proportion of cows and buffaloes was 1:2 whereas in Groups II and III the ratios were 5:3 and 1:3 respectively. Considering the percentage of net return as well as return per animal it is observed that a producer under group III realised maximum benefit.

In Calcutta about half the number of cows were nondescript and remaining ones either Haryana or Crossbred. The buffaloes were mostly of Murrah breed. The producers under the investment group I had either only cows or only buffaloes whereas in group II they maintained both cows and buffaloes in equal proportions. There were mostly cows in group III and the proportion of cows and buffaloes in group IV was 5:2. The highest investment group (IV) realised maximum percentage of income although the investment per animal was comparatively less than the first two groups. Better utilization of feed and labour coupled with higher production might be the reason for realising maximum net return by a producer under Group IV.

5. DISTRIBUTION OF PRODUCERS ACCORDING TO THE ORDER OF NET INCOME

It is of interest to know the distribution of producers according to the order of net return they realise per Rs. 100/- investment in their dairy enterprise. Such a distribution in the three areas is given in Table 5 on page 77.

It would be seen from the table that in Delhi and Calcutta nearly three-fifths of the producers realised a net return of more than 60 percent of their investment and in Madras only one-third of the producers got such benefit. A comparatively low income for a major proportion of producers in Madras was observed due to low order of investment by the producers as mentioned earlier and for keeping animals of lower productivity. Secondly the margin of profit in Madras was comparatively less than that in Delhi and Calcutta.

TABLE 5. *Distribution of producers according to their net income*

Net return (Rs.) per Rs. 100/- investment	Percentage of producers		
	Delhi	Madras	Calcutta
≤ 20	18.8	19.1	3.3
— 60	25.0	46.3	26.7
— 100	28.1	19.1	36.6
> 100	28.1	15.5	23.4

6. RELATIONSHIP OF INCOME WITH TOTAL INVESTMENT

As mentioned earlier a producer would like to know the order of net return he would realise by investing a certain amount and the optimum rate of investment for getting maximum profit. In order to obtain a suitable relationship between the net income (Y) and the total investment (X), linear, quadratic and Cobb-Douglas functions were fitted and the results are given in Table 6. In Delhi, linear fit accounted for 72 per cent of variation and the quadratic explained less than one percent additional variation over the linear one. The Cobb-Douglas function was not a good fit as it explained only 55 per cent of the variation. The linear regression coefficient which was highly significant indicated that for every Rs. 100/- investment the producer would get additional income of about Rs. 95/-. Evidently the range of investment observed in Delhi did not reach the optimum for the law of diminishing returns to manifest itself.

In Madras, whereas the linear and quadratic fit accounted for 67 and 68 per cent of variation, Cobb-Douglas explained 78 per cent of the variation. In this case also the elasticity co-efficient as seen from the Cobb-Douglas function was +ve which showed increasing return for increasing amount of investment within the range observed. In this case a producer could get an additional return of Rs. 135/- for every Rs. 100/- investment.

In Calcutta, each of the linear and quadratic functions explained 88 per cent of the variation and Cobb-Douglas only 81 per cent of variation. The linear regression coefficient which was highly significant showed that by investing Rs. 100/- a producer would get additional return of Rs. 107/-. Even in this case the range of investment observed did not cover the optimum.

TABLE 6. *Relationship of net income with total investment*

<i>Nature of curve</i>	<i>Equation</i>	<i>R²</i>
DELHI		
Linear	$Y = -403.6428 + 0.9458^{**} x$	72.0
Quadratic	$Y = -117.9786 + 0.6907^{**} x + 0.00002x^2$	72.8
Cobb-Douglas	$Y = 0.7042 x^{0.9608^{**}}$	55.3
MADRAS		
Linear	$Y = -126.8245 + 0.7357^{**} x$	67.5
Quadratic	$Y = -328.4597 + 0.9651^{**} x - 0.00003 x^2$	68.4
Cobb-Douglas	$Y = 0.0330 x^{1.3550^{**}}$	77.9
CALCUTTA		
Linear	$Y = -383.5739 + 1.0715^{**} x$	88.0
Quadratic	$Y = -503.8433 + 1.1535^{**} x - 0.000006 x^2$	88.0
Cobb-Douglas	$Y = 0.1399 x^{1.2142^{**}}$	80.9

Y: Net income.

X: Total investment.

7. RELATIONSHIP OF INCOME WITH FIXED AND WORKING CAPITAL

In the pervious section it was concluded that the amount of net return increased with the amount of investment in the range studied. In case a producer would be interested to invest more, he would like to know the distribution of his capital towards fixed and working capital. This idea could be obtained by studying the relationship between the net income (y) with fixed (x_1) and working capital (x_2). These results are presented in Table 7.

In Delhi, quadratic curve, explained 74 to 76 per cent of variation as compared to linear and Cobb-Douglas which explained about 74 and 57 per cent of variation respectively. Although quadratic (x_1, x_2, x_1^2, x_2^2) explained 2 per cent more variation over the linear yet none of the regression coefficients was found significant. Accepting the linear one to be the appropriate fit it is observed that more

TABLE 7. Relationship of net income with fixed and working capital

Nature of curve	Fitted equation	R ²
DELHI		
Linear	$Y = -428.7433 + 1.7278^{**} x_1 - 3.0702 x_2$	74.0
Quadratic	(i) $Y = -296.8983 + 1.4933 x_1 - 2.5565 x_2 + 0.000016 x_1^2$	74.1
	(ii) $Y = -457.3116 + 1.7501^{**} x_1 - 3.0095 x_2 - 0.000113 x_2^2$	74.0
	(iii) $Y = -257.7434 + 0.2899 x_1 + 4.4208 x_2 + 0.0002 x_1^2 - 0.0045 x_2^2$	75.6
Cobb-Douglas	$Y = 2.7038 x_1^{0.5312} x_2^{0.3585}$	56.8
MADRAS		
Linear	$Y = -474.8600 + 1.8112^{**} x_1 - 5.6238^* x_2$	73.8
Quadratic	(i) $Y = -343.4347 + 1.7228^{**} x_1 - 7.1453^* x_2 + 0.000042 x_1^2$	74.4
	(ii) $Y = -457.2527 + 1.8506^{**} x_1 - 6.2330 x_2 + 0.000274 x_2^2$	73.9
	(iii) $Y = -233.0612 - 0.1644 x_1 + 1.280 x_2 + 0.0005^* x_1^2 - 0.0116 x_2^2$	78.6
Cobb-Douglas	$Y = 0.0856 x_1^{1.1546^{**}} x_2^{0.1349}$	80.5

TABLE 7 (Contd.)

Nature of curve	Fitted equation	R ²
CALCUTTA		
Linear	$Y = -398.9944 + 1.4495^{**} x_1 - 0.6527 x_2$	89.8
Quadratic	(i) $Y = -201.4288 + 1.3530^{**} x_1 - 0.9756 x_2 + 0.000017 x_1^2$	89.9
	(ii) $Y = -302.1642 + 1.4709^{**} x_1 - 1.0965 x_2 + 0.000143 x_2^2$	89.8
	(iii) $Y = -21.8111 + 0.5559 x_1 + 0.0168 x_2 + 0.0001 x_1^2 - 0.0015 x_2^2$	90.2
Cobb-Douglas	$Y = 0.08334 x_1^{1.6013^{**}} x_2^{-0.3581}$	83.6

Y : Net return

x_1 : Fixed capital

x_2 : Working capital.

investment on fixed capital will give significant net return to the producer. The negative sign in the coefficient of x_2 indicates that more investment on working capital will give diminishing net return. A unit input on fixed capital will realise 1.73 units of net return for any fixed level of working capital.

In Madras, Cobb-Douglas curve which explained 80.5 per cent of the variation may be accepted to be the appropriate one for explaining the relationship of the net return with the fixed and working capital. From the fitted curve the marginal or incremental net returns were worked out.

$$\frac{dy}{dx_1} = 0.0988 x_1^{0.1546} x_2^{0.1349}$$

$$\frac{dy}{dx_2} = 0.0115 x_1^{1.1546} x_2^{-0.8651}$$

The first equation indicates that for fixed x_2 (*i.e.* working capital) there is scope of investing more on fixed capital in order to get additional net return. The second equation indicates that higher level of expenditure on working capital for fixed x_1 will yield diminishing net return. Although higher investment on fixed capital will give increasing return yet there is an optimum investment on working capital for any level of fixed capital. This part will be dealt with later on while studying the relation $Y = F(x_2/x_1)$.

The linear relationship of net income with the fixed and working capital in Calcutta explained 90 per cent of the variation. The quadratic expression explained only one per cent additional variation over the linear one but none of the Coefficients was significant. The Cobb-Douglas explained 84 per cent of the variation. The linear relationship indicates that every unit increase in fixed capital will give an additional net return of 1.4495 units when the working capital is kept constant. There is an indication of negative net return by spending more on working capital of which major proportion is expenditure on feed. This shows that the animals are overfed and spending more on feed will go waste instead of giving any additional net return. This observation is in consonance with the results obtained in the studies undertaken with the same data in regard to the nutritional requirements and the actual amounts of feed fed to the animals.

As explained earlier there was diminishing net return of the working capital (x_2) at any level of fixed capital (x_1) in Madras. This

TABLE 8. Total, marginal and average net return for various combinations of input

x_2 (Rs)	$x_1=Rs. 1,000$			$x_1=Rs. 2000$			$x_1=Rs. 3000$			$x_1=Rs. 4000$			$x_1=Rs. 5000$		
	Y_p (Rs)	M_p	A_p	Y_p	M_p	A_p	Y_p	M_p	A_p	Y_p	M_p	A_p	Y_p	M_p	A_p
100	463	0.623	42.1	1031	1.386	49.1	1648	2.214	53.2	2297	3.086	56.0	2972	3.993	58.3
200	509	0.342	42.4	1132	0.761	51.4	1810	1.216	56.6	2523	1.695	60.1	3264	2.192	62.8
300	538	0.241	41.4	1197	0.536	52.0	1911	0.856	57.9	2664	1.193	62.0	3447	1.544	65.0
400	559	0.188	39.9	1244	0.418	51.8	1987	0.667	58.4	2770	0.930	63.0	3584	1.204	66.4
500	576	0.154	38.4	1282	0.344	51.3	2048	0.550	58.5	2855	0.767	63.4	3693	0.992	67.1
600	590	0.132	36.9	1314	0.294	50.5	2099	0.470	58.3	2925	0.655	63.6	3785	0.848	67.6
700	603	0.116	35.5	1342	0.258	49.7	2143	0.412	57.9	2987	0.573	63.5	3865	0.742	67.80
800										3047	0.511	63.5	3935	0.661	67.84
900										3090		63.1	3998	0.597	67.8

x_1 : Fixed capital

x_2 : Working capital

Y_p : Total net return at a particular level of fixed and working capital

M_p : Marginal net return for each added Re. 1/- of working capital = $\frac{dy_p}{dx_2}$

A_p : Average net return per Rs. 100 investment *i.e.* $(Y_p \times 100) / (x_1 + x_2)$.

meant that each additional unit of input (working capital) added less to total net return than the previous unit. In other words, total net return increased at a decreasing rate. Table 8 gives the total net return (Y_p), marginal return (M_p) and average net return (A_p) for different input of working capital for any particular amount of fixed capital. As an example, consider the different levels of working capital keeping fixed capital at Rs. 2000/-. Increasing working capital by Rs. 100/- in the first step there was an increase of Rs. 101/- in the total net return. The additional net returns for each added Rs. 100/- investment on working capital in subsequent stages were worked out to be Rs. 65, Rs. 47, Rs. 38, Rs. 32, etc.

The production function representing this type of diminishing returns can be identified by its curvature towards the horizontal axis in a graph. The average net return (A_p) was worked out by dividing the total net return by the total factor input *i.e.* $A_p = \frac{Y_p}{x_1 + x_2}$. It is observed that the average net return per Rs. 100/- total investment first increased, then reached a maximum and finally declined. As long as the marginal return is greater than the average net return, the average productivity of the variable resource (working capital) increases and if the marginal net return is less than the average net return, the average productivity of the resources decreases. Considering these facts it is observed that for a fixed capital of Rs. 2,000/- the optimum working capital should be Rs. 300/-. In other words out of the total investment of Rs. 2,300/- the proportion of fixed and working capital should be Rs. 2,000/- and Rs. 300/- respectively in order to obtain optimum net return of 52 per cent of the investment. Similar cases have been worked out for different order of fixed capital. Broadly it could be seen that the ratio of fixed and working capital should be 6:1 in order to realise maximum return.

8. RELATIONSHIP OF INCOME WITH NUMBER OF ANIMALS

As explained earlier more than 80 per cent of the investment was accounted for fixed capital which was mainly responsible for obtaining higher rate of return. A further study of data revealed that in all the areas the cost of animals constituted more than 97 per cent of the fixed capital. It is reasonable to think that if a producer is to invest more money on fixed capital he is likely to spend more on purchase of animals. His order of net income will therefore depend on the number of animals he is to maintain. The relationship of net income

(y) with the number of animals (x) was studied and presented in Table 9.

TABLE 9. *Relationship of net income with number of milch animals*

<i>Nature of curve</i>	<i>Equation</i>	<i>R²</i>
DELHI		
Linear	$Y = -457.9566 + 504.1912^{**} x$	78.7
Quadratic	$Y = 199.9428 + 175.7586 x + 17.3727 x^2$	80.8
Cobb-Douglas	$Y = 199.5991 x^{1.2120^{**}}$	58.6
MADRAS		
Linear	$Y = -176.1241 + 307.6642^{**} x$	73.3
Quadratic	$Y = -381.4002 + 400.6966^{**} x - 4.8588 x^2$	74.3
Cobb-Douglas	$Y = 105.2161 x^{1.3911^{**}}$	75.7
CALCUTTA		
Linear	$Y = 10.8633 + 443.5121^{**} x$	84.0
Quadratic	$Y = -588.8195 + 633.5565^{**} x - 6.1396 x^2$	85.9
Cobb-Douglas	$Y = 280.9966 x^{1.1737^{**}}$	80.7

Y = Net income

x : Number of milch animals.

In all the three areas linear fit was the best one explaining about 74 to 84 per cent of the variation. As the production function was linear the average product of input was constant. This indicates that the order of net return increases with the number of milch stock. The range of studies evidently did not cover the optimum number.

9. CONCLUSIONS

- (i) Fixed capital was the major component of investment accounting for about 80 to 92 per cent of the total investment and remaining portion formed the working capital.
- (ii) The relationship between the total investment and net return was linear in the case of Delhi and Calcutta and

logarithmic in Madras. The range of investment observed did not cover the optimum.

- (iii) A unit input on fixed capital would realise 1.73 units of net return in Delhi and 1.45 units in Calcutta when working capital was kept constant. There was indication that more investment on working capital would give diminishing net return. In Madras although higher investment on fixed capital would give increasing return yet there was an optimum investment on working capital for any level of fixed capital.
- (iv) The order of net return increased with the number of milch animals. It is profitable to maintain both cows and buffaloes.

ACKNOWLEDGEMENT

The author is grateful to Dr. G.R. Seth, Statistical Adviser, and to Shri V.N. Amble, Deputy Statistical Adviser, Institute of Agricultural Research Statistics for their constant encouragement, general guidance and keen interest in the preparation of this paper. He likes to express his thanks to Shri Shivtar Singh who assisted in the analysis of data.

REFERENCES

1. Panse, V.G. (1956)— A pilot survey for the estimation of the cost of milk production under Indian conditions—Proc. XIV Int. Dairy Congress, Vol. I.
2. Panse, V.G., Amble, V.N. and Puri, T.R. (1961)—Cost of milk production—I.C.A.R. Report series No. 6.
3. Panse, V.G., Amble V.N. and Raut, K.C. (1963)—Cost of milk production in Madras State—I.C.A.R. Report series No. 10.
4. Panse V.G., Amble V.N. and Raut, K.C. (1964)—Cost of production and price of milk—Gosamvardhana Vol. XII, June.
5. Panse V.G., Amble V.N. and Raut, K.C. (1965)—Cost of milk production in West Bengal—I.C.A.R. Report series (In press).
6. Heady, E.O. (1952)— Economics of Agricultural production and resource use. Prentice-Hall Inc., New York.