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Comparative Study of Investment Opportunities between Milk and Major Crop Production in Haryana

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ABSTRACT: In India, the livestock and farming sectors are inter-dependent and both are crucial for the livelihood security of the rural population. Farm resources are always limited and there is more than one alternative to use them. When resources are used in one product, the benefits from alternative products are always foregone. Since mix farming have both rearing of livestock and growing of crops, it is necessary to identify the investment opportunity in production of milk vis -a -vis other major crops for using the available resources. The investment opportunities have been determined in terms of returns per rupee invested (output-input ratio) and share of costs in the total returns (financial efficiency ratios). The former ratio indicates benefit cost ratio while the later ratios determine the amount of investment (cost) involved in generating a return of rupee one. The study was based on secondary data pertains to seventeen years on unit level cost of production for milk and major crops of Haryana. The study concludes that the returns per rupee invested were higher in case of milk than other major crop sequences in Haryana. On the other hand, milk production required lesser of the working capital in relation to the value of product as shown by the efficiency ratios, this gives a comparative advantage to milk production in addition to regular flow of income and employment. Thus, the dairy production comes out to be a lucrative area for farmer with less capital and the higher expected returns per rupee invested.

KEYWORDS: Investment, Output-input ratio, Efficiency ratio, Terms of Trade, and Milk

I. INTRODUCTION

The Indian economy has undergone structural changes over the time. In India, the livestock and agricultural production are inter-dependent and both are crucial for the livelihood security of the rural population. The second major sub-sector of Indian agriculture is the livestock sector in which milk production is the major activity with 70 per cent share. Even when there is no agriculture, livestock production still exists. Due to unequal distribution of agricultural land, 7.16 per cent of the rural landless households derive their income mainly from dairy activities. The demand for milk is projected to be around 180 MT in 2021-22, in order to meet this demand, the milk production should grow at the rate of 5.5 per cent per year (NDDB, 2014). This sector, acts as a supplementary and complimentary enterprises to agriculture, especially to landless laborer, marginal and small farmers in principal/subsidiary status.

On an average, the foods of animal origin in Indian diet account for about 10-11 per cent of the total consumption expenditure (NSSO, 2010). Milk and milk products are the most preferred items, claiming 70 per cent of the expenditure on livestock-based foods. Although, the milk production in the country has grown at a remarkable rate, much higher than crop production, still the sector continues to operate under several constraints, such as unorganized markets, shortage of feed and fodder, inadequate livestock support services, thus not providing a level playing field. To

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make dairying an instrument of economic empowerment in the country, a more equitable and inclusive approach to dairy development is required.[1]

There could be 10-12 per cent shortfall in production in relation to demand milk. In the next 20 years, if the country wants to meet its domestic demand and also make a moderate place for itself in the world dairy markets, dairying should offer itself as a prospective alternative for investment and diversification with immense commercial potential.

The study was conducted purposively in Haryana state, in view of the fact that, despite recent industrial development, Haryana was primarily an agricultural economy with preponderance of food crops namely Wheat, Rice, Bajra. About 70 per cent of residents are engaged in agriculture. The state is self-reliant in food production and the second largest supplier to India's central pool of food grains. Haryana was the state that fits well with the requirement of established mixed production system, equal production possibilities and comparable infrastructural development both in milk and crops. In Haryana with stagnant growth of agriculture and high cost of land, the farmers have started looking towards for other alternatives like commercial dairying.

In such a scenario, the most significant issue that needs attention is to analyse the opportunities available in dairy sector to allocate more resources at both government and farmer level. So, the present study intends to compare investment opportunity (benefits) between both milk and major food crop, on the basis of their returns to per rupee invested and extent of capital required to operate production.[2]

II. MATERIAL AND METHODS

2.1 The Database

The present study was based on secondary data on unit level cost of production for milk and major food crops of Haryana. The unit level data pertains to seventeen years from the year 1994-95 to 2010-2011 collected under comprehensive cost of cultivation scheme, the Directorate of Economics and Statistics, Department of Agricultural Cooperation and Farmers' Welfare, Ministry of Agriculture GOI, New Delhi. From the unit level data, information on required parameters were compiled for six major crops grown in Haryana, namely wheat, rice, bajra, rapeseed-mustard, cotton and sugarcane, and milk production.

2.1.1 Brief description of unit level dataset

The unit level data was collected through multistage stratified random sampling technique. At the first stage, whole state was divided into three zones. The total number of tehsils lie in one zone were 10, 28 and 29 in Zone-I, Zone-II and Zone-III, respectively. Out of total number of tehsils, the thirty tehsils were selected in sample through probability proportional allocation. Thus, the tehsils selected in sample were 5, 14 and 11 from Zone-I, Zone-II and Zone-III, respectively. These tehsils were selected by simple random sampling technique. At the third stage, a village called cluster was selected at random from each tehsil. From each cluster, ten holdings were selected by simple random sampling without replacement for final data collection. So, the holdings selected from each zone were 50, 140 and 110, respectively. This makes all together 300-unit level data sets which were used for the analysis.[3]

The investment opportunities in milk and crops were analysed using output-input (O-I) ratios, efficiency ratios and terms of trade (TOT) to identify the areas of investment providing better returns. To make it comparable per annum basis, the first two ratios were calculated for milk and important crop sequences followed in the state (annually). The important crop sequences observed in Haryana which were considered for the study, were rice-wheat, wheat-cotton, pearl millet-wheat, pearl millet-mustard and rice - mustard.

III. RESULTS AND DISCUSSION

3.1 Output-Input (O-I) ratio

Output - Input ratio is an economic indicator, which shows the value of output produced per rupee spent on inputs. It is a simple measure of economic efficiency and mostly used as a basis for comparisons. In order to remove the scale effect, the calculations have been made per hectare basis. It is assumed that farmers will make more

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investment in the production, where the ratio is higher. Output-Input ratios for milk and major crop sequences are given in Table 3.1.

As appear from growth rates, the output-input ratios have reduced over the time under consideration in both milk and crop sequences which show the overall situation in agriculture that the value of input has grown much faster than the value of product. The rate of decrease was second highest in milk after sugarcane. While comparing the absolute values at state level, the O-I ratio of milk were found higher in all the triennium averages than all the other crop sequences i.e. 2.72 in TE 1996-97 (2.72), 2.48 in TE 2003-04 (2.48) and 1.64 in TE 2010-11. It clearly indicated that the value of output produced per hectare from a rupee invested on inputs was higher in dairy than crop sequences. The state level comparative study of output-input ratios among crop sequences revealed that the ratio has remained higher in those crop sequences which has either wheat or rice as one of the sequence crop e.g. it was 1.68 for wheat-cotton in TE 1996-97, 1.52 in wheat-rice in TE 2003-04 and 1.29 in rice-mustard in TE 2010-11. [4]

Table 3.1: Zone wise temporal variations in Output- Input ratios in milk and major crop sequences in Haryana
(₹/ annum)

Particulars	Study Area	TE 1996-97	TE 2003-04	TE 2010-11	CGR (%)
Milk	Zone-I	3.89	2.63	1.76	-4.05
	Zone- II	3.00	2.56	1.84	-3.24
	Zone- III	1.91	2.31	1.39	-2.29
	State Level	2.72	2.48	1.64	-3.10
Major crop sequences					
Wheat-Rice	Zone- II	1.59	1.61	1.31	-1.77
	Zone- III	1.08	1.24	1.27	1.03
	State Level	1.42	1.52	1.28	-1.22
Wheat-Pearl millet	Zone- I	0.96	1.08	1.00	-1.98
	Zone- II	1.47	1.38	1.17	-1.50
	Zone- III	1.32	1.40	1.22	-1.20
	State Level	1.39	1.37	1.16	-1.80
Wheat-Cotton	Zone- I	1.69	1.15	1.31	-3.45
	Zone- II	1.71	1.34	1.29	-1.66
	State Level	1.68	1.39	1.28	-2.13
Rice-	Zone- II	1.50	1.45	1.25	-0.75

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Mustard	Zone- III	1.11	1.19	1.26	1.25
	State Level	1.34	1.37	1.29	0.57
Pearl millet- Mustard	Zone- I	0.97	1.10	1.15	0.69
	Zone- II	1.35	1.20	1.04	-0.59
	Zone- III	0.95	0.81	0.73	-1.64
	State Level	1.27	1.17	1.09	-0.45
Sugarcane	Zone- II	1.40	1.08	0.86	-4.42
	Zone- III	1.28	1.31	0.81	-3.04
	State Level	1.31	1.17	0.81	-3.12

Note: Zone I (Arid, Southern region and major crops -pearl-millet, and rapeseed-mustard), Zone-II (Semi-Arid, South western region and major crop – cotton, sugarcane) and Zone-III (Sub Humid, North eastern region and major crops - rice, wheat and sugarcane)

Similar trends in O-I ratio were exhibited at zonal level over the study period. The ratios have decreased in all the zones except in Zone-III for wheat-rice and rice-mustard, and Zone-I for pearl-millet-mustard. Nevertheless, it was only rice-mustard in Zone-III where this growth was significantly higher. This was due to the fact that these were the major crops of Zone-III and continuously lot of improvements have taken place in these crops in terms of varietal improvement and package of practices. A further look into the zonal output-input ratios displayed that in case of Zone-I the best option was wheat-cotton as it was having the highest output-input ratios (1.69, 1.15 and 1.31) over the three-time intervals, respectively. In Zone-II the output-input ratio of wheat-cotton (1.71) was found highest in initial TE 1996-97 while in later two trienniums TE 2003-04 and TE 2010-11, the output-input ratios of wheat-rice (1.61 and 1.31) were highest.[5] In case of Zone-III, the output-input ratios of wheat-pearl millet (1.32 and 1.4) were the highest in TE 1996-97 and TE 2003-04, while in TE 2010-11, the output-input ratio of wheat-rice (1.27) was highest.

3.2 Efficiency Ratios:

At commodity level, these ratios are used to measure the operational efficiency in its production. The efficiency ratios calculated were operating, overhead and gross cost ratios. At individual level, these ratios indicate what percentage of gross revenue is going out to meet operating cost, overhead expenses and the gross costs. [6]

3.2 (i) Operating Cost Ratios

The importance of operating cost (OC) ratio lies in the fact of its being an indicator of the efficiency level of production. A lower operating cost ratio indicates a greater efficiency in production. A farm commodity with lower OC ratio will be preferred by farmers having less capital in hand. Zone wise temporal variation in OC ratios for milk and important crop sequences for Haryana are given in Table 3.2.

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Table 3.2: Zone wise temporal variations in operating ratios for milk and major crop sequences in Haryana (Proportion)

Particulars	Study Area	TE 1996-97	TE 2003-04	TE 2010-11	CGR (%)
Milk	Zone-I	0.247	0.356	0.498	3.58
	Zone-II	0.331	0.370	0.545	3.15
	Zone-III	0.528	0.430	0.693	1.95
	State Level	0.354	0.385	0.572	2.78
Major crop sequences					
Wheat-Rice	Zone-II	0.385	0.393	0.429	1.35
	Zone-III	0.488	0.414	0.403	-0.71
	State Level	0.441	0.401	0.423	0.50
Wheat-Pearl millet	Zone-I	0.720	0.707	0.724	2.31
	Zone-II	0.441	0.553	0.528	1.07
	Zone-III	0.456	0.407	0.420	0.44
	State Level	0.467	0.515	0.517	1.29
Wheat-Cotton	Zone-I	0.358	0.733	0.531	4.53
	Zone-II	0.353	0.662	0.452	1.34
	State Level	0.356	0.517	0.445	1.84
Rice-Mustard	Zone-II	0.335	0.385	0.427	0.94
	Zone-III	0.558	0.473	0.414	-2.28
	State Level	0.423	0.407	0.411	-0.88
Pearl millet-Mustard	Zone-I	0.674	0.630	0.590	-0.05
	Zone-II	0.441	0.567	0.579	0.94
	Zone-III	0.704	0.562	0.809	1.30
	State Level	0.477	0.545	0.571	0.90

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Sugarcane	Zone-II	0.372	0.385	0.327	-0.48
	Zone-III	0.400	0.201	0.328	-2.07
	State Level	0.415	0.303	0.331	-2.99

Note: Zone I (Arid, Southern region and major crops -pearl-millet, and rapeseed-mustard), Zone-II (Semi-Arid, South western region and major crop – cotton, sugarcane) and Zone-III (Sub Humid, North eastern region and major crops - rice, wheat and sugarcane)

In most of the cases, the OC ratios has increased over the time under consideration which shows the overall situation in agriculture and milk production where operational expenditure has grown much faster than the gross income of the farmer. The same is apparent from the positive compound growth rate (CGR) of operating ratios of milk and other crop sequences. The only exceptions were the crop sequences namely rice-mustard (-0.88%) and sugarcane (-2.99%) which indicates that the production of these crop sequences have become more efficient over the time and there was higher increase in the value of output per hectare as compare to input costs of these crops. Among the commodities which registered highest growth in the ratio was milk. The operating cost ratio of milk increased at the rate of 2.78 per cent per annum during last seventeen years. While comparing the state level values for milk and crop sequences, the OC ratio of milk (0.354) was found lower than all crop sequences in TE 1996-97. In the subsequent triennium average (TE 2003-04), it has become second lowest after sugarcane but was the highest (0.572) in the latest TE 2010-11. The operating ratio for milk which was lowest earlier and highest later on among all crop sequences, clearly revealed that milk production which was considered to be low input- low output production earlier, lot of input intensification has been taken place in the later years. Among zones, the input intensification in milk production was registered more in Zone-I with 3.58 per cent growth rate in operating cost ratio. Nevertheless, in the Zone-III which has favourable production environment, the OC ratios were the highest overtime among zones.[7]

Among crop sequences, the highest growth in operating cost ratios was observed in wheat-cotton (1.84%) followed by wheat-pearl-millet (1.29). The former crop sequence was followed in Zone-I and II only while the later was observed in all the zones. For both the crop sequences, the growth rate in operating ratios were highest in Zone-I. The only crop sequences for which operating cost ratios have decreased were rice-mustard (-0.88% per annum) and sugarcane (-2.99 % per annum). In these crop sequences, the increase in input expenses was lower than the increase in value of output which may be on account of higher increase in productivity or output prices or both. In sugarcane, OC ratio reduced in both the zones i.e. Zone-II and Zone-III while in rice-mustard, it decreased in Zone-III only. The growth rate in operating ratio was lowest in wheat-rice (0.50%) followed by pearl-millet-mustard (0.90%). These crop sequences has registered negative growth rate in Zone-III (-0.71%) for wheat-rice and Zone-I (-0.05%) for pearl-millet-mustard. The reasons for the same are favourable agro-climatic conditions for the crops in these zones accompanied by adoption of improved technology and modern methods of cultivation. [8]

3.2. (ii) Overhead Expenses Ratio

Overhead expenses (OE) ratio is a metric that allows individuals to evaluate expenses as a percentage of income. In general, a farm enterprise strives to achieve the lowest overhead expenses, without sacrificing its resources or competitiveness. Overhead expenses ratios for milk and important crop sequence are given in Table 3.3.

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Table: 3.3: Zone wise temporal variations in overhead expenses ratios for milk and major crop sequences in Haryana (Proportion)

Particulars	Study Area	TE 1996-97	TE 2003-04	TE 2010-11	CGR (%)
Milk	Zone-I	0.023	0.022	0.030	2.12
	Zone-II	0.022	0.019	0.021	0.18
	Zone-III	0.020	0.017	0.026	2.18
	State Level	0.021	0.019	0.026	1.47
Wheat-Rice	Zone-II	0.306	0.279	0.373	1.55
	Zone-III	0.354	0.346	0.426	1.15
	State Level	0.325	0.303	0.390	1.46
Wheat-Pearl millet	Zone-I	0.419	0.369	0.383	1.05
	Zone-II	0.317	0.310	0.406	1.51
	Zone-III	0.351	0.385	0.446	1.60
	State Level	0.329	0.326	0.415	1.76
Wheat-Cotton	Zone-I	0.293	0.481	0.286	1.06
	Zone-II	0.284	0.322	0.355	1.40
	State Level	0.289	0.313	0.369	1.80
Rice-Mustard	Zone-II	0.344	0.321	0.409	0.59
	Zone-III	0.352	0.375	0.392	0.18
	State Level	0.348	0.340	0.383	-0.09
Pearl millet-Mustard	Zone-I	0.434	0.388	0.387	-0.34
	Zone-II	0.349	0.344	0.455	0.94
	Zone-III	0.421	0.727	0.511	1.39
	State Level	0.357	0.369	0.421	0.56
Sugarcane	Zone-II	0.307	0.342	0.374	2.39

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	Zone-III	0.376	0.359	0.374	0.68
	State Level	0.330	0.350	0.368	1.45

Note: Zone I (Arid, Southern region and major crops -pearl-millet, and rapeseed-mustard), Zone-II (Semi-Arid, South western region and major crop – cotton, sugarcane) and Zone-III (Sub Humid, North eastern region and major crops - rice, wheat and sugarcane)

In most of the cases, the overhead expenses ratios have increased over the time under consideration. The same is apparent from the positive compound growth rate (CGR) of OE ratio of milk and other crop sequences. The only exceptions were the crop sequences namely rice-mustard (-0.09%) which indicates that the production of this sequences has become more efficient over the time and there was higher increase in the value of output per hectare as compare to fixed cost incurred. Among the commodities which registered highest growth in the ratio were wheat-cotton, wheat-pearl millet as compared to the milk. The OE ratio of milk increased at the rate of 1.47 per cent per annum during 1994-95 to 2010-11.

While comparing the state level OE ratios for milk and crop sequences, the OE ratio of milk were found lower than all crop sequences as 0.021, 0.019 and 0.026 in TE 1996-97, TE 2003-04 and TE 2010-11, respectively.[9]

The zone wise OE ratio analysis revealed that the ratio was lowest in case of milk in comparison to all other crop sequences over the three trienniums. The highest growth in OE ratio was registered as 2.39 per cent in sugarcane for Zone-II. The only crop sequences for which OE ratio has decreased was pearl millet-mustard (-0.34 %) in Zone-I.

3.2. (iii) Gross Cost Ratio

Gross cost (GC) ratio is a measure of economic competence of a farm enterprise which calculates the ratio of gross expenditure having both operating as well as fixed expenditure to the gross income. It illustrates the overall efficiency of a farm enterprise with respect to the overall expenditure being incurred. Gross cost ratios for milk and important crop sequences are given in Table 3.4.

Table 3.4.: Zone wise temporal variations in gross cost ratios for milk and major crop sequences in Haryana (Proportion)

Particulars	Study Area	TE 1996-97	TE 2003-04	TE 2010-11	CGR (%)
Milk	Zone-I	0.270	0.378	0.528	3.47
	Zone-II	0.353	0.389	0.566	3.00
	Zone-III	0.548	0.447	0.718	1.97
	State Level	0.375	0.404	0.598	2.73
Wheat-Rice	Zone-II	0.690	0.673	0.802	1.44
	Zone-III	0.842	0.760	0.829	0.16
	State Level	0.766	0.705	0.814	0.93
Wheat-Pearl	Zone-I	1.139	1.076	1.107	1.80

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millet	Zone-II	0.757	0.863	0.933	1.27
	Zone-III	0.807	0.791	0.866	1.02
	State Level	0.796	0.841	0.932	1.50
Wheat-Cotton	Zone-I	0.651	1.214	0.816	3.14
	Zone-II	0.637	0.984	0.807	1.35
	State Level	0.645	0.830	0.814	1.81
Rice-Mustard	Zone-II	0.679	0.706	0.836	0.75
	Zone-III	0.910	0.848	0.806	-1.22
	State Level	0.771	0.748	0.794	-0.52
Pearl millet-Mustard	Zone-I	1.108	1.018	0.977	-0.21
	Zone-II	0.791	0.911	1.034	0.95
	Zone-III	1.125	1.289	1.320	1.20
	State Level	0.835	0.914	0.992	0.77
Sugarcane	Zone-II	0.678	0.726	0.701	0.91
	Zone-III	0.776	0.560	0.702	-0.59
	State Level	0.745	0.653	0.699	-0.63
<p>Note: Zone I (Arid, Southern region and major crops -pearl-millet and rapeseed-mustard), Zone-II (Semi-Arid, South western region and major crop – cotton, sugarcane) and Zone-III (Sub Humid, North eastern region and major crops - rice, wheat and sugarcane)</p>					

In most of the instances, the GC ratios have increased over the time under consideration. The same is apparent from the positive compound growth rate (CGR) in GC ratio for milk and other crop sequences. The only exceptions were the crop sequences namely rice-mustard (-0.52%) and sugarcane (-0.63%) which indicates that the production of this sequences has become more efficient over the time and there was higher increase in the value of output per hectare as compare to gross cost incurred.

The GC ratio of milk increased at the rate of 2.73 per cent per annum during 1994-95 to 2010-11. While comparing the state level GC ratios for milk and crop sequences, the GC ratio of milk were found lower than all crop sequences as 0.375, 0.404 and 0.598 in TE 1996-97, TE 2003-04 and TE 2010-11, respectively.

The zone wise GC ratio analysis revealed that the ratio was lowest in case of milk in comparison to all other crop sequences except for sugarcane (0.702) in TE 2010-11 in Zone-III. The highest growth in GC ratio was registered as 3.14 per cent in wheat-cotton for Zone-I, whereas decreased growth in GC ratios were registered for rice-mustard (-

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1.22%) and sugarcane (-0.59%) in Zone-III, while pearl millet-mustard has registered decreased (-0.21%) growth rate in Zone-I, where these are mostly grown.

3.3. Terms of Trade between milk and crops

It is a measure of the exchange value of one commodity to another. It is an analogous number that represents the ratio of the relative prices. The price relationships have a significant influence on decisions relating to the type and volume of agricultural and dairy production planning by farmer. In this section, we have compared the Terms of Trade (TOT) between prices paid of one kg of crops (₹/kg) and price received for one litre of milk (₹/litre). The prices considered for calculating terms of trade were the farm harvest prices. It signifies the price parity between milk and other major crops.[10]

Terms of Trade between crops (price paid for one kg) and milk (prices received for one litre) is given in following Table 3.5.

Table 3.5: Terms of Trade between crops (price paid for one kg) and milk (prices received for one litre)

Particulars	Study Area	TE 1996-97	TE 2003-04	T E 2010-11	CGR (%)
Wheat v/s Milk	Zone-I	0.430	0.537	0.500	1.24
	Zone-II	0.478	0.568	0.393	-0.53
	Zone-III	0.534	0.577	0.507	0.90
	State Level	0.473	0.559	0.444	0.53
Rice v/s Milk	Zone-II	0.464	0.574	0.699	3.38
	Zone-III	0.589	0.653	0.750	2.64
	State Level	0.499	0.605	0.730	3.28
Pearl millet v/s Milk	Zone-I	0.368	0.373	0.376	0.48
	Zone-II	0.400	0.413	0.346	-0.42
	Zone-III	0.420	0.397	0.394	0.24
	State Level	0.400	0.395	0.365	-0.08
Rapeseed v/s Milk	Zone-I	1.089	1.257	0.944	-0.14
	Zone-II	1.205	1.300	0.896	-1.23
	Zone-III	1.356	1.273	1.161	0.30
	State Level	1.204	1.270	0.983	-0.44
Cotton v/s Milk	Zone-I	2.035	1.685	1.459	-2.55
	Zone-II	2.064	1.696	1.458	-2.82
	State Level	2.051	1.702	1.498	-2.54
Sugarcane v/s Milk	Zone-II	0.078	0.092	0.093	0.03
	Zone-III	0.090	0.082	0.093	0.09
	State Level	0.080	0.086	0.092	0.58

Note: Zone I (Arid, Southern region and major crops -pearl-millet, and rapeseed-mustard), Zone-II (Semi-Arid, South western region and major crop – cotton, sugarcane) and Zone-III (Sub Humid, North eastern region and major crops - rice, wheat and sugarcane)

State level analysis revealed that TOT ratios has moved in the favour to rice, and sugarcane as shown by the increase in the value of TOT over time in these crops. In case of other crops namely, pearl-millet and cotton, it has

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moved in favour of milk due to decrease in the value of TOT over the time. Since, pearl-millet and cotton were the major crops of Zone- I and Zone- II. The farmers were more likely to invest in milk production in these Zones. In wheat and rapeseed-mustard the value of TOT ratios, first increase and then decrease, which shows in these crops the TOT ratios were moved in the favour of milk after TE 2003-04. If the situation continues to be the same, the farmer may drift away from these crops and spent more in milk. The pattern of change in terms of trade among zones was not much different from the State.[9,10]

IV. SUMMARY AND CONCLUSION

The results of output- input ratios can be summarised that the output-input ratios of milk and the major crop sequences in the state as a whole have reduced over the time indicating rise in value of inputs much faster than the value of output. In few of the crop sequences e.g., wheat-rice and rice-mustard, it increased in the beginning and then, subsequently reduced. Nevertheless, the output-input ratio of milk for the zones and the state as a whole was considerably higher than all the crop sequences. While comparing the state level figures for TE 2010-11, one rupee invested in milk generated an output of Rs 1.64 while it was in the range of Rs 1.16 to Rs 1.29 for crop sequences wheat-pearl millet, wheat-rice, wheat-cotton and rice-mustard in the increasing order. The output-input ratio was minimum (Rs 0.81) for sugarcane. For milk, the value of output per rupee invested on inputs was the highest in Zone-I till TE 2003-04 which shift to Zone-II in TE 2010-11.

The results of efficiency ratios can be summarised that GC ratio has increased over time for both milk and major crop sequences revealing that the costs have increased more than the returns. The GC ratio was the lowest for milk; which was about 37 per cent in TE 1996-97 and has gradually increased to about 60 per cent in TE 2010-11. That means, total costs (operating and fixed) account for about sixty per cent of the total value of output per hectare. Among crop sequences, it ranges from about 70 per cent in sugarcane to 99 per cent in pearl-millet-mustard. In major sequence of wheat-rice, the total costs account for about 80 per cent of the value of output per hectare. Between OC and OE ratios, the operating cost ratio was comparatively higher but overhead expense ratio was lower in milk production as compare to crop sequences. The overhead expenses in milk were less than three per cent of the value of output per hectare while in case of crops the overhead expenses was lowest in sugarcane and wheat-cotton as 37 per cent.

The results of the study illustrate that milk production has higher output-input ratios and lower gross cost ratios which provide better opportunities for the farmers with lower resources to make investment in this sector leading to further increase in milk production. While comparing the terms of trade of milk with crops, it has move against milk in comparison to wheat, rice and sugarcane and in favour of milk as comparison to pearl-millet, rapeseed-mustard and cotton. Though the output-input and efficiency ratios were favouring investment in milk production, it needs to be supported by favourable terms of trade for milk. In zones, where wheat, rice and sugarcane (mostly Zone-II & III) are cultivated extensively, milk production will not be the first preference of the farmer to make investment.

The overall picture reveals that the returns per rupee invested were higher in case of milk than other major crop sequences in Haryana. As discussed in the later portion of current section, the proportion of fixed costs in milk production were the lowest among all crop sequences, this gives a comparative advantage to milk production in addition to regular flow income and employment. Hence, study concluded that the dairy production comes out to be a lucrative area for farmer with less capital and the higher expected returns per rupee invested. Adequate infrastructural support and extension services would encourage farmers to invest further in this sector.[9,10]

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