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three seasons than the recommended quantities for maintenance and the relevant level of milk production. Therefore those feeds should be emphasised which contained higher DCP percentages to reach a balanced ration for these animals. Most of the concentrates contain higher DCP and TDN content than the roughages. Therefore it is advisable to include guar grain, *til* cake, groundnut cake and guar meal to supply balanced ration in addition to gram grain and sarson cake which have been mostly fed in the area. In the area studied, wheat *bhusa* has been fed widely to milch animals. This feed contains no DCP, thus the quantity of wheat *bhusa* should be reduced and replaced by either jowar *kadbi* or bajra *kadbi*, which are also cheaper sources of nutrients than wheat *bhusa*. Leguminous fodders are rich in protein. Farmers should, therefore, be encouraged to grow more of these with possibilities of growing berseem, gram and cow peas in *rabi* and cow peas and guar in *kharif* season in this area, which calls for a slight adjustment in the cropping pattern. However, these leguminous *rabi* crops are relatively high risk crops as they are susceptible to frost and low temperatures and to some diseases.

The analysis of seasonal net returns has suggested better possibilities in the summer and rainy seasons for expanding milk production. This is mainly a function of seasonal price differences for milk. This, however, would require a more adequate feed supply in those seasons.

On the basis of the analysis of the cost of production of milk, the major conclusion which could be drawn is that if the dairy cows and buffaloes are charged with the maintenance costs of the dry animals, then serious losses are involved in the dairy enterprise at the price levels used. The possible explanation for the persistence of dairy production under these conditions could be the willingness to produce milk when a large part of the milk produced is consumed in the household, and when the maintenance of dry cattle is governed by considerations other than economic.

ECONOMICS OF LIVESTOCK ENTERPRISE IN UTTAR PRADESH

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The livestock enterprise in U.P., as elsewhere in India, has up to the present been auxiliary to crop enterprise on almost every farm. The chief reason is that

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it fits in admirably with the cropping pattern for the supply of draught power for cultivation and rural transports as well as protective foods like milk and milk products, besides providing organic matter. It is only near the cities that dairying is combined with pig and poultry farming to yield from a small acreage.

STUDY AREA

The present study is a part of the continuing research project of the Agro-Economic Section of the Government Agricultural College, Kanpur in the eastern districts of U.P., namely, Azamgarh and Ghazipur. The data are used to explain the economics of livestock enterprise in the region in different size-groups of holdings. The districts are economically depressed areas where the density of the population per square mile is as high as 844 as against 251 for the country as a whole (1951 Census). The combination of a disproportionately large number of workers in agriculture with low productivity per acre stands at the heart of the central agricultural problem. The large decrease in the area under meadows and pastures resulting in a sharp shrinkage in the fodder base of the animal husbandry does not augur well for the proper maintenance of livestock.

Objects of the Study

This study seeks to (1) work out the economy of the two sub-aggregates "livestock and crops" of the aggregate economy of the farm output ; and (2) develop suitable information in the livestock enterprise for future planning in the region.

Method of Study

Two districts representing eastern U.P., namely, Azamgarh and Ghazipur were purposively selected in 1962-63 for investigation on the basis of soil, climate and cropping pattern. From each district, two blocks were selected on the suggestions of the District Planning Officers concerned. Five villages from each block and 16 cultivators from each village were randomly selected according to the probability proportional to the cultivated area. Thus, the sampling scheme was multi-stage random sampling. In all there were 320 cultivators, but 3 were dropped for non-response. The holdings were further sub-divided into seven size-groups, varying from 0—2.5 acres to 20—25 acres. The survey method was used. The field work was divided between two teams of investigators, who systematically interviewed the cultivators. They carried with them standardised schedules to be filled in for each cultivator.

EMPIRICAL ANALYSIS

(1) The input and output data of all the three types of milch animals, *i.e.*, buffaloes, cows and goats were worked out according to the size-groups. In calculating the input values, the total expenditure not only on milch animals but also on dry animals and calves were taken into account. The input values include : (i) value of feeds (dry and green fodder and concentrates), (ii) value of labour (family and hired), and (iii) other expenses (interest and depreciation on livestock and cattle shed, cost of ropes and veterinary services, etc.)

In working out the value of the output, the income from milk, dung and appreciation in calves were recorded.

(2) The contribution of the livestock enterprise to the total farm output was determined.

(3) The profitability or otherwise of the composite enterprise, namely, crop and livestock production for each size-group was determined on per acre basis.

(4) The cost of production of milk per seer (1 seer=0.937 kg.) was worked out separately for buffaloes, cows and goats.

Table I gives the total number of cattle head on the aggregates of the holdings in each size-group and on per acre basis. The number of bullocks on 145 holdings in the size-group 0—2.5 acres was 162, indicating that the holdings were practically one bullock holding. The number of dry cows, buffaloes and goats were 81, 87 and 19 respectively and the corresponding number for the milch animals was 51, 55 and 11. It was further observed that the number of dry animals was higher in every size-group. The proportion of dry to milch animal decreased with the increase in the size of holdings. The goats were generally maintained on small holdings up to 5 acres. Out of a total of 30 goats, 25 were kept on the holdings falling in this size-group.

Table II throws light on the input-output relationship on the maintenance of buffaloes, cows and goats. The percentage distribution of expenditure on an average on feed, labour and other charges (interest, depreciation on animals, buildings, veterinary medicines, etc.,) was 63.32, 13.94 and 22.74 per cent respectively for buffaloes. The corresponding figures for cows were 60.50, 16.71 and 22.79 per cent. Goats are generally kept for milk and for meat. The cost of milk production per seer (0.937 kg.) was, on the whole, Re. 0.50 for buffalo and Re. 0.78 for cow. Buffalo and goat milk was sold in the village at Re. 0.50 per seer and that of cow at Re. 0.66 per seer according to the prevalent custom. The cow is ill-fed and a neglected animal in comparison to the buffalo. The cost of goat milk was Re. 0.38 per seer and therefore, it pays to keep goats. But the management problem stands in raising them on a sizable scale.

REGRESSION ANALYSIS

To work out the contribution of each item of expenditure on maintenance of the gross income the regression study of the gross income on feeds, labour and other items of expenditure has been made. The observations have been taken on every individual item falling in different size-groups.

In the following lines the gross income per acre has been represented by Y and expenditure on feeds, labour and other items by x_1, x_2 and x_3 respectively. The model for the regression analysis is given below :

$$Y = a_0 + a_1x_1 + a_2x_2 + a_3x_3 + E$$

Where, a_0, a_1, a_2 and a_3 are the constants to be evaluated by the method of Least Square and E is the random variation with zero mean and unit variance.

TABLE I—TOTAL NUMBER OF CATTLE HEAD ON HOLDINGS AND THEIR PER ACRE DISTRIBUTION (1962-63)

Size-group (in acres)	No. of holdings	Average size	No. of draught cattle (Bullock)	Buffalo			Cow			Goat		
				Milch	Dry	Calves	Milch	Dry	Calves	Milch	Dry	Kids
0—2.50	145	1.29	162 (0.864)	17 (0.091)	29 (0.155)	17 (0.091)	15 (0.080)	23 (0.123)	14 (0.075)	6 (0.032)	11 (0.059)	11 (0.059)
2.50—5.00	75	3.53	130 (0.508)	15 (0.057)	25 (0.091)	15 (0.057)	13 (0.049)	21 (0.079)	12 (0.045)	3 (0.011)	5 (0.019)	5 (0.019)
5.00—7.50	42	6.09	91 (0.357)	7 (0.027)	10 (0.039)	5 (0.019)	8 (0.031)	12 (0.047)	5 (0.019)	1 (0.004)	1 (0.004)	2 (0.008)
7.50—10.00	25	8.52	69 (0.324)	7 (0.033)	12 (0.056)	7 (0.033)	7 (0.033)	10 (0.047)	5 (0.023)	—	—	—
10.00—15.00	23	12.00	66 (0.239)	5 (0.018)	6 (0.021)	5 (0.018)	5 (0.018)	11 (0.040)	4 (0.014)	—	—	—
15.00—20.00	3	17.54	15 (0.285)	1 (0.019)	—	1 (0.019)	1 (0.019)	2 (0.038)	2 (0.038)	—	—	—
20.00—25.00	4	21.68	22 (0.254)	3 (0.033)	5 (0.055)	2 (0.023)	2 (0.023)	2 (0.023)	2 (0.023)	1 (0.011)	2 (0.023)	2 (0.023)
Overall	317	4.21	555 (0.449)	55 (0.044)	87 (0.070)	52 (0.042)	51 (0.041)	81 (0.065)	44 (0.035)	11 (0.009)	19 (0.015)	20 (0.016)

Note :—Figures given in brackets indicate number of cattle head per acre.

TABLE II—DETAILS OF INPUTS-OUTPUTS ACCORDING TO THE KINDS OF LIVESTOCK AND COST OF MILK PRODUCTION (1962-63)

Size-group (in acres)	Expenditure (on per acre basis) in Rs.						Income (on per acre basis)						Average expenditure per animal (in Rs.)
	Feeds	Labour			Other	Total Expenditure	Yield of milk in mds.	Income from milk in Rs.	Income from others	Total	Cost of production per seer of milk (Re.) 1 seer =.937 kg.	Input-output ratio	
		Family	Hired	Total									
1	2	3	4	5	6	7	8	9	10	11	12	13	14
						Buffalo							
0—2.5 ..	31.30 (61.54)	7.43	0.39	7.82 (15.38)	11.74 (23.08)	50.86	2.33	46.64	4.01	50.65	0.50	1 : 0.99	174.78
2.5—5 ..	20.92 (62.02)	4.63	0.30	4.93 (14.62)	7.88 (23.36)	33.73	1.48	29.69	2.56	32.25	0.52	1 : 0.96	191.65
5—7.5 ..	9.48 (62.95)	1.95	0.16	2.11 (14.01)	3.47 (23.04)	15.06	0.77	15.41	1.02	16.43	0.45	1 : 1.09	200.80
7.5—10 ..	12.98 (63.78)	2.50	0.27	2.77 (13.61)	4.60 (22.61)	20.35	0.92	18.46	1.63	20.09	0.50	1 : 0.99	239.41
10—15 ..	6.94 (64.50)	1.18	0.21	1.39 (12.92)	2.43 (22.58)	10.76	0.53	10.62	0.86	11.48	0.49	1 : 1.07	224.17
15—20 ..	4.58 (66.28)	0.67	0.16	0.83 (12.01)	1.50 (21.71)	6.91	0.47	9.41	0.77	10.18	0.34	1 : 1.47	246.78
20—25 ..	16.25 (67.34)	2.04	0.68	2.72 (11.27)	5.16 (21.39)	24.13	1.04	20.77	1.47	22.24	0.54	1 : 0.92	273.74
Average	16.31 (63.32)	3.38	0.30	3.68 (13.94)	6.00 (22.74)	25.99	1.20	24.03	1.97	26.00	0.50	1 : 1.0003	211.30

(Contd.)

TABLE II (*Concluded*)

1	2	3	4	5	6	7	8	9	10	11	12	13	14
						Cow							
0—2.5 ..	8.32 (57.18)	2.49	0.28	2.77 (19.04)	3.46 (23.78)	14.55	0.38	10.07	2.98	13.05	0.74	1 : 0.82	60.62
2.5—5 ..	5.66 (58.59)	1.48	0.26	1.74 (18.01)	2.26 (23.40)	9.66	0.25	6.69	1.68	8.37	0.77	1 : 0.86	64.40
5—7.5 ..	3.71 (59.98)	0.84	0.21	1.05 (16.96)	1.43 (23.11)	6.19	0.17	4.28	0.89	5.17	0.75	1 : 0.83	50.32
7.5—10 ..	4.55 (60.91)	0.91	0.30	1.21 (16.20)	1.71 (22.88)	7.47	0.17	4.63	1.31	5.94	0.85	1 : 0.79	82.08
10—15 ..	4.43 (67.22)	0.62	0.26	0.88 (13.35)	1.28 (19.43)	5.59	0.13	3.36	0.77	4.13	0.88	1 : 0.73	86.00
15—20 ..	3.56) (61.59)	0.58	0.30	0.88 (15.33)	1.34 (23.18)	5.78	0.10	2.26	1.73	3.99	0.81	1 : 0.77	76.05
20—25 ..	3.09 (63.97)	0.41	0.26	0.67 (13.87)	1.07 (22.16)	4.83	0.14	3.69	0.64	4.33	0.74	1 : 0.89	84.74
Average ..	5.12 (60.50)	1.22	0.28	1.50 (16.71)	2.05 (22.79)	8.67	0.22	5.77	1.51	7.28	0.78	1 : 0.84	64.22
						Goat							
0—2.5 ..	0.60	0.84	—	0.84	0.15	1.59	0.06	1.16	1.12	2.28	0.34	1 : 1.43	13.25
2.5—5 ..	0.25	0.26	—	0.26	0.08	0.59	0.02	0.40	0.57	0.77	0.38	1 : 1.30	15.12
5—7.5 ..	0.11	0.11	0.01	0.11	0.02	0.25	0.007	0.14	0.17	0.31	0.40	1 : 1.24	20.83
7.5—10 ..	—	—	—	—	—	—	—	—	—	—	—	—	—
10—15 ..	—	—	—	—	—	—	—	—	—	—	—	—	—
15—20 ..	—	—	—	—	—	—	—	—	—	—	—	—	—
20—25 ..	0.51	0.14	0.20	0.35	0.17	1.03	0.03	0.52	0.62	1.14	0.45	1: 1.10	22.89
Average ..	0.21	0.21	0.01	0.22	0.06	0.49	0.016	0.326	0.326	0.652	0.38	1 : 1.33	15.31

Note :—Figures given in brackets indicate percentages.
In calculating the expenditure per animal, account was taken of the existence of milch and dry animals as well as the calves.

The linear model has been preferred to the exponential or other models because of the simplicity of computations involved. The suitability of the model was judged by the analysis of joint regression. Thus the regression equations for buffaloes and cows were found to be :

Buffaloes : $Y = 3.43 - 0.1351x_1 + 2.6396x_2 + 2.5490x_3$ ..... (1)

Cows : $Y = -2.1498 + 1.8329x_1 - 0.3915x_2 + 0.2447x_3$ ..... (2)

Coefficients of Determination and Variance Ratios:

Buffaloes :	$R = 0.9975$	$F = 197.75$	Significant at 1 per cent level.
	$R^2 = 0.9950$		
Cows :	$R = 0.9653$	$F = 13.63$	Significant at 5 per cent level.
	$R^2 = 0.9318$		

Buffaloes

The regression of gross income on the expenditures per acre on feeds, labour and other items from (1) explains the dependence of gross income on the independent variable considered (*viz.*, feeds, labour and others) to the extent of 99.50 per cent. The coefficient of multiple correlation, 0.9975 is highly significant at 0.1 per cent level significance, which indicates that there is a very close correspondence between the observed gross incomes and expected ones for known values of feeds, labour and other items of expenditure.

From the study of partial regression coefficients (marginal value products in the present case), it is observed that the gross income diminishes by Re. 0.1351 for every rupee of expenditure on feeds and increases by Rs. 2.6396 for every rupee of expenditure on labour. From this we may infer that it is not worthwhile to spend much on feeds. On the contrary the expenditure on labour and other item is profitable.

Cows

In case of cows, the gross income per acre has been found to be dependent on feeds, labour and other items of expenditure to the extent of 93.18 per cent. The value of the coefficient of multiple correlation is 0.9653. This is significant at 5 per cent level of significance only. All this indicates that although the observed gross incomes and those expected on the basis of the regression equation (2) are correlated with each other, yet not to that extent as in the case of buffaloes.

The study of partial regression coefficients which are the marginal value products, reveals that the gross income in case of cows increases by Rs. 1.8329 for every rupee of expenditure on feeds and diminishes by Re. 0.3915 for every rupee of expenditure on labour.

Combination of Crop and Milk Enterprises

Table III gives the input and output of crop and livestock and the net income in rupees per acre. It is remarkable that the net income is the highest in the holdings in the size-group below 2.5 acres (Rs. 76.78) while it is the lowest in the holdings within the size-group 20—25 acres (Rs. 23.29). This is a special feature of the region under study, *i.e.*, the districts of Azamgarh and Ghazipur. By and large, the cultivators give scant personal attention to agricultural operations like ploughing, hoeing and other farm operations involving manual labour due to religious and sociological reasons and generally rely on hired labour. Cultivators of the small size-group are, generally, economically and socially very backward and put in more family labour in agriculture.

SUMMARY AND CONCLUSIONS

The districts, Azamgarh and Ghazipur were selected by the Study Team of the Planning Commission with two other districts of eastern U. P. as problem areas for intensive development through the allocation of special funds.

One of the distinguishing characteristics of the districts is the maintenance of a large number of un-productive animals on almost all the farms up to 6 acres, reducing thereby the profit margin of the farm business. The other characteristic of the area focusses attention on the sociological and motivational attitude of the farmers who shun to utilise their personal labour in agricultural operations like ploughing, hoeing, etc. As such, the farmers are between the proverbial 'devil and the deep blue sea' and such a situation can advantageously be faced with the adoption of scientific principles of livestock husbandry.

The buffalo is primarily kept for milk production and receives due attention in matter of feed and fodder. The cow and her progeny remain relatively ill-fed and uncared for. On the basis of a comparative study of feed and labour inputs on cows and buffaloes, it was observed that the expenditure on feed was productive in case of cows and a source of loss in case of buffaloes to such an extent that the gross income increased by 183 per cent of the additional expenditure on feed in case of the former and decreased by 14 per cent in case of the latter. On the contrary the expenditure on labour was productive in case of buffaloes and a source of loss in case of cows to such an extent that in case of buffaloes the gross income increased by 264 per cent and in case of cows it decreased by 39 per cent of the additional expenditure on labour.

This brings out the need for the reorganization of the farms in the direction of increasing the productivity of the cows through greater investment in their feed and forage which, in turn, would involve a strict control over their numbers relative to the size of the farm. The reorganization could further be improved through a greater utilization of the family labour, as a fixed cost, on the care of the buffaloes.

Along with the development of a strong extension educational programme for making the farms highly personalised business, it is necessary that the objectives of the livestock enterprise are developed into a set of goals which the farmer

TABLE III—ECONOMICS OF CROPS AND LIVESTOCK COMBINED (PER ACRE BASIS) : 1962-63

(in Rs.)

Size-group (in acres)	Input			Output			Net Profit			Input-Output Ratio
	Crop	Livestock	Total	Crop	Livestock	Total	Crop	Livestock	Total	
0—2.5	173.45 (72.13)	67.00 (27.87)	240.45	251.25 (79.20)	65.98 (20.80)	317.23	77.80	—1.02	76.78	1 : 1.32
2.5—5	138.70 (75.51)	43.98 (24.49)	182.68	208.94 (83.47)	41.39 (16.53)	250.33	70.24	—2.59	67.65	1 : 1.37
5—7.5	129.91 (85.81)	21.50 (14.19)	151.41	197.23 (90.00)	21.91 (10.00)	219.14	67.32	+0.41	67.73	1 : 1.44
7.5—10	117.48 (80.85)	27.82 (19.15)	145.30	168.08 (86.59)	26.03 (13.41)	194.11	50.60	—1.79	48.81	1 : 1.33
10—15	116.82 (87.72)	16.35 (12.28)	133.17	176.15 (91.90)	15.61 (8.10)	191.76	59.33	—0.74	58.59	1 : 1.44
15—20	89.42 (87.57)	12.69 (12.43)	102.11	118.20 (89.29)	14.17 (10.71)	132.37	28.78	+1.48	30.26	1 : 1.30
20—25	112.16 (78.90)	29.99 (21.10)	142.15	137.73 (83.25)	27.71 (16.75)	165.44	25.57	—2.28	23.29	1 : 1.16
Average	130.33 (78.76)	35.15 (21.24)	165.48	191.16 (84.92)	33.93 (15.08)	225.09	60.83	—1.22	59.61	1 : 1.36

Note :—Figures given in brackets indicate percentages.

and his family could achieve. Farm economists and animal husbandry men should evolve a suitable livestock and crop programme for the region based on price-cost relationship and replacement or substitution ratio so as to establish a sound economic relationship between the two enterprises.

ECONOMICS OF DAIRY ENTERPRISE IN JABALPUR WITH SPECIAL REFERENCE TO THE SCALE OF THE ENTERPRISE

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Milk production in big cities is becoming more and more specialised. Although the trend is towards larger units, yet, most of the dairy units in the cities are still small in size. They constitute the backbone of dairy enterprise in Jabalpur.

The present paper outlines the findings of a study of selected cases of dairy units in Jabalpur city. For purposes of this study a dairy unit was defined as a business venture having a minimum of 5 milk buffaloes on the average during the year of survey, *i.e.*, 1963-64. Production units of having less than 5 buffaloes were considered too small to qualify as self-sustaining business units.

Objective

The objective of our study was to determine the input-output relationships and the influence of selected variables on costs and returns as obtained in the selected size-groups of dairy units.

The Dairy Units

The required data were obtained from detailed records of a small group of individual dairy units selected purposively from an estimated number of 200 dairy units stratified by size and located within the corporation limits of Jabalpur city. The qualifying factors for the units selected for this study were (1) availability of data for the calendar year 1963-64 as well as reliable physical and income data on the fluctuation of herd strength ; (2) the operation of herd in the 5—100 size range and (3) production sold out. Only seven cases meeting these qualifications and falling in the following size-groups were selected purposively.