

LIVESTOCK-CROP PRODUCTION SYSTEMS ANALYSIS FOR SUSTAINABLE PRODUCTION (SUB PROJECT IN HIMACHAL PRADESH), 2005 (Mimeograph)

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Abstract: To generate additional and regular cash income throughout the year some subsidiary occupation is needed by the farmers. Commercial livestock rearing is one of the most suitable enterprises, which could be adopted by farmers in hilly areas. With this background the present study would attempt to understand and analyse interactions, between different components of farming systems so as to make recommendations to improve the productivity and efficiency of the livestock- crop production systems in different agro-climatic zones of Himachal. Study reveals that buffalo is the main bovine followed by Crossbred cattle in low hills. In mid hills, crossbred cattle are major bovine, followed by Local cattle and Buffalo. In high hill wet and dry zones crossbred cattle are the major bovines followed by local cattle. The study reveals that AI is more prevalent in case of local and crossbred cow in all the four zones but in case of buffalo, Natural Service is preferred by the farmers. Jersey breed most suitable in agro-climatic conditions prevailing in Himachal Pradesh. Both dry and green fodder is fed to the bovines in all zones except Kinnaur where about 11 percent farmers fed dry fodder, due to inadequate availability of green fodder. Age at first calving in case of crossbred cow ranges between 2.56 to 3.61 years whereas it is 3.92 to 4.21 in buffalo. Age at first calving ranges between 3.8 to 4.7 years in local cow. The calving interval of crossbred cow varies between 315 to 420 days out of which for 205 to 274 days it remains in milk and rest of the days in dry period. Contrary to this, calving interval in local cow varies between 450 to 485 days out of which for 218 to 284 days it remains in milk and rest of the days in dry period. Cost of production per litre of milk in case of crossbred cow ranges between Rs 6.81 to 12.02. Whereas in case of local cow it varies between Rs. 8.17 to 13.66 per litre. In case of buffalo it comes out to be Rs. 9.69 and 8.98 per litre in Hamirpur and Solan. Production and Financial constraints in production faced by farmers are high incidence of insects/ pests in HYVs, high cost of credit and lack of credit availability from institutional sources. Sustainable increase in food grain production through extension of improved crop varieties, particularly in agro-pastoral areas, improving marginal croplands and improving water use and irrigation system – including promotion of water harvesting and efficient use technologies.

Objectives of the study

1. To identify the various livestock-crop production systems in the different agro-climatic regions of Himachal Pradesh.
2. To identify the constraints in practicing various livestock-crop production systems in different agro-climatic regions of the state.
3. To study the resource structure and socio-economic profile of the farmers practicing various livestock-crop production systems in different agro-climatic regions of the state.

4. To study the economic characteristics and productivity level of various livestock maintained and crops grown in different parts of the country in different systems.
5. To study the various breeding, feeding and management practices followed by the farmers.
6. To ascertain the practices involved and the constraints faced in the marketing of crops, livestock and livestock products.
7. To ascertain the input-output relationship for the various livestock-crop production systems in the different agro-climatic regions of the state.
8. To ascertain the potential for increasing the income and employment through adoption of improved technology in various livestock-production systems.

Methodology

In order to achieve above mentioned objectives, four districts were selected purposively from each NARP zone in Himachal Pradesh i.e. district Hamirpur from low hill sub-tropical zone, district Solan from Mid hill sub- humid zone, district Shimla from High hill temperate wet zone and district Kinnaur from high hill temperate dry zone. In each district a typical representative village cluster was selected purposively for the detailed investigation for the project. The sample village clusters were surveyed and information obtained on village schedule. In the low hill zone Bhota block of Hamirpur, in the mid hill zone Solan block of Solan district, in high hill wet zone Tikker block of Shimla district, and in high hill dry zone, Sangla block of Kinnaur district were selected for the study. In each block 150 households were surveyed. Thus, the study based on total sample of 600 households in Himachal Pradesh.

In order to examine the socio-economic structure and livestock crop production analysis, simple tabular analysis consisting of averages, percentages etc. were extensively used. In order to study the cost and returns of various crops, Cost A_1 was used. To obtain input-output relationship for various livestock and crops log-linear form of production function was used.

In order to study the various livestock-crop production systems (LCPS), various combinations of LCPS were identified from each zone and analysis was done accordingly for the two major LCPS in each zone.

Main findings

Resource structure and socio-economic profile of sampled farmers

Average family size in Kinnaur is 7.07 persons with the sex ratio of 994, being highest in the districts under study followed by Hamirpur (6.39), Solan (6.20) and Shimla (5.65). Occupational distribution of households reveals that, crop farming is the main occupation of sampled households in all the four zones, followed by dairying. Kinnaur,

though almost every household reared bovine, but the output is generally used for their home consumption. Average operational holding was 1.09, 1.89, 1.75 and 1.25 hectares in district Hamirpur, Solan, Shimla and Kinnaur respectively. Cropping intensity in these districts was 191.65, 128.36, 107.02 and 91.70 percent respectively. Maize and Wheat are the major crops of Hamirpur and Solan districts. In Solan district farmers also grow cash crops like, tomato, peas and capsicum extensively. In Shimla, maize and barley are the major cereals, apple and potato are the major cash crops. In Kinnaur, again apple is the major fruit crop. Peas, potato, maize, wheat, barley, ogla, fafra, rajmash and kidney beans are also grown by the farmers in Kinnaur. Composition of bovine reared by the farmers in different agro-climatic zones reveals that buffalo is the main bovine followed by Crossbred cattle in Hamirpur. In Solan, crossbred cattle are major bovine, followed by Local cattle and Buffalo. In Shimla and Kinnaur Crossbred cattle are the major bovines followed by local cattle. Besides, people in Kinnaur district rear goat, sheep and yak on large scale. Fixed investment in crop farming is Rs. 1033, 2133, 9362 and 9339 per household and in case of bovine fixed investment is Rs. 56232, 64824, 30926 and 47565 per household in district Hamirpur, Solan, Shimla and Kinnaur respectively (Table 1).

Breeding, Feeding and Management practices followed in bovine husbandry on sampled farm households

The study reveals that AI is more prevalent in case of local and crossbred cow in all the four zones but in case of buffalo, Natural Service is preferred by the farmers. Jersey breed is more preferred in case of crossbred cow in all the zones. This breed is most suitable in agro-climatic conditions prevailing in Himachal Pradesh. Pregnancy diagnosis is given after 90 days in Hamirpur and Solan and after 60 days in Shimla and Kinnaur. Feeding system adopted by majority of farmers in Hamirpur and Solan is of individual type whereas in case of Shimla and Kinnaur feeding is done both individually and in group. Both dry and green fodder is fed to the bovines in all zones except Kinnaur where about 11 percent farmers fed dry fodder, due to inadequate availability of green fodder. Method of feeding adopted by majority of farmers is stall-fed as well as grazing in open fields. But in case of buffaloes it is 100 percent stall-fed. This is due to

heavy weight of animal and difficulty to move along hilly terrain. Both home made and compound feed is fed to bovines. Similar is the case of feeding supplementary ration/concentrate during late pregnancy in all zones. Recommended practices are followed in case of milking of animals, animal health and calf rearing except in case of Kinnaur where practice of washing of udders before milking and vaccination against preventive diseases is poor. In all the zones majority of farmers tied diseased animals together with healthy animals and deworming of calves was also not done. In case of marketing of milk consumer is the first choice of farmers in Solan and milk vendors in Hamirpur and Shimla. Milk is not sold in Kinnaur and entirely used for home consumption in one form or another.

Economic Characteristics and Productivity of various Livestock and Crops

Delayed maturity of milch animals is one of the major factors responsible for the uneconomic nature of dairying. Age at first calving in case of crossbred cow ranges between 2.56 to 3.61 years whereas it is 3.92 to 4.21 in buffalo. Age at first calving ranges between 3.8 to 4.7 years in local cow. The calving interval of crossbred cow varies between 315 to 420 days out of which for 205 to 274 days it remains in milk and rest of the days in dry period. Contrary to this, calving interval in local cow varies between 450 to 485 days out of which for 218 to 284 days it remains in milk and rest of the days in dry period. It is observed that crossbred cow has the longest lactation period, shortest dry period, as well as short inter calving period and lowest age at first calving as compared to local cow. The calving interval in case of buffaloes is 310 and 350 days in Hamirpur and Solan respectively out of which for 191 and 208 days it remains in milk and rest of the days in dry period. The milk yield in crossbred cow ranges between 2.89 litres to 5.03 litres per day, which is much higher than that of local cow yield of 2.07 to 2.22 litres per day (see Table1). In case of buffalo, the milk yield is 4.86 and 4.09 lts./day in Hamirpur and Solan respectively. Total lactation yield is much higher in case of crossbred cow followed by buffalo and local cow. Direct sale of milk to the consumers is the best scenario in Solan and Milk vendor in Hamirpur and Shimla. Village Dairy Co-operatives are non-functional in all the zones under study. Per capita

milk consumption is highest in Solan whereas in other zones, it is much lower than State average of 401 gms per capita per day.

Input-output Relationship for various Livestock-Crop Production Systems in Himachal Pradesh

In Hamirpur district of low hill zone, cost of production was Rs 119.67 per quintal in maize, Rs 248.38 in wheat, Rs 361.20 in barley, Rs 67.77 in barseem, Rs 19.41 in chari, Rs 148.66 in paddy, Rs 76.71 in oat. In Solan district of mid hill zone, per quintal cost of cultivation comes out for different crops as; Maize (Rs 102.76), Wheat (Rs 338.53), Barley (Rs 324.20), Chari (Rs 28.17), Pea (Rs 128.81), Tomato (Rs 231.26) and Capsicum (Rs 794.78). In Shimla district of high hill zone, per quintal cost of cultivation comes out for different crops as; Maize (Rs. 113.35), Wheat (Rs. 522.69), Barley (Rs. 229.50), Potato (Rs. 143.80), Rajmash (Rs. 898.59) and Apple (Rs. 605.87). In case of Kinnaur district of high hill dry zone, per quintal cost of cultivation comes out for different crops as; Maize (Rs. 170.40), Wheat (Rs. 292.76), Barley (Rs. 221.86), Oglra (Rs. 123.39), Fafra (Rs. 90.00), Rajmash (Rs. 534.45), Kidney bean (Rs. 419.83), Potato (207.77), Apple (Rs. 199.63) and Pea (Rs. 113.77).

Cost of production per litre of milk in case of crossbred cow ranges between Rs 6.81 to 12.02. Whereas in case of local cow it varies between Rs. 8.17 to 13.66 per litre. In case of buffalo it comes out to be Rs. 9.69 and 8.98 per litre in Hamirpur and Solan. Cost of production of mutton is Rs. 23.75 per Kg. in case of goat and Rs. 18.74 per Kg. in case of sheep. Cost of wool production is Rs. 106.22 per Kg. It is revealed from the analysis that rearing of goat and sheep is very remunerative enterprise for the people of Kinnaur district.

The results of input- output analysis revealed that in Hamirpur in case of cross-bred cow green fodder and concentrate are the major components of cost whereas in case of buffalo, dry fodder and concentrate are the main components of cost. The coefficient of multiple determination (R^2) indicated that all the explanatory variables collectively explained about 97 percent variation in milk production in case of crossbred cow and 88 percent in case of buffalo. In Solan, in case of local cow green fodder is the major cost

component. The elasticity coefficient of dry fodder is negative. All the explanatory variables collectively explained about 50 percent variation in milk production and are statistically non-significant. Similar is the case with crossbred cow and buffalo. In case of Shimla, green fodder and concentrate are the major components of cost whereas the response of output to dry fodder is negative. In case of meat of goat and sheep value of dry fodder and human labour are the major components of cost. R^2 indicated that all the explanatory variables collectively explained about 85 percent variation in meat production in case of sheep and 82 percent in case of goat. In wool production human labour is the major cost component followed by value of dry fodder. R^2 indicated that all the explanatory variables collectively explained about 89 percent variation in wool production in case of sheep.

Input-output relationship in crop production revealed that for maize crop in Hamirpur, labour, seed and fertilizer contributed positively and significantly towards maize production, similar is the case with wheat. But in case of barley and paddy, fertilizers had negative impact. Farmers can increase gross returns by increasing the use of human labour and seed in the production of maize, wheat & paddy. In Solan, value of seed in case of maize, wheat, barley, pea and tomato contributed positively and significantly towards production. In case of pea and capsicum labour and plant protection chemicals are also contributed significantly towards production. Use of fertilizers in maize, wheat, barley and pea had negative impact but it may be due to underutilization of other inputs. In Shimla, human labour and fertilizers has a positive and significant effect on the production of maize, wheat, barley, potato and apple. Use of seed in wheat and barley had negative impact but it may be due to underutilization of other inputs. Plant protection chemicals are contributed significantly towards the production of potato and apple. In Kinnaur, human labour is the major factor of production for all the crops and contributed positively and significantly, followed by seed and fertilizers except in case of pea and kidney bean. Plant protection chemicals are contributed significantly towards the production of pea and apple. Except other crops, in case of ogla and fafra all the explanatory variables collectively explained about less than 50 percent variation in crop production and are statistically non-significant.

Income and Employment Generation from Livestock

Analyses of income and employment generation from various livestock activities revealed that crossbred cow and buffalo are contributed significantly towards the net income and employment in all zones. Net income from local cow is relatively more in case of Solan and less in Shimla. Similarly, in case of crop production, cultivation of maize, paddy, pea, tomato, capsicum, potato, rajmash, ogla, fafra, kidney bean and apple offered remunerative returns and employment to the farmers.

Potential income and employment generation from different LCPS

The analysis of potential income and employment generation in different agro- climatic zones reveals in district Hamirpur, LCPS 1 has vast potential for increasing income and employment for the farmers. The gaps in potential and existing level of gross income, net income, family labour income and employment are 32.29, 46.13, 13.19 and 9.35 percent respectively. The gaps in LCPS 2 are relatively lesser than that of LCPS 1. In case of Solan district, there is a potential to increase income and employment in LCPS 2 as compared to LCPS 1. In district Shimla and Kinnaur, LCPS 1 has greater potential for increasing the income and employment of the farmers as gaps are higher than that of LCPS 2.

Constraints in Marketing of Crops and Livestock Products

Production and Financial constraints in case of crop production faced by farmers in Hamirpur are high incidence of insects/ pests in HYVs, high cost of credit and lack of credit availability from institutional sources. Lack of knowledge about recommended package of practices also affect the productivity of various crops and increase the cost of production. In Solan, inadequate irrigation facilities, high cost of credit and lack of agricultural labour in peak seasons are the major constraints. High cost of credit, inadequate irrigation facilities, lack of knowledge about recommended package of practices and poor communication and extension facilities are the major constraints in crop production in Shimla and Kinnaur district. Lack of marketing facilities at village level is the major constraint followed by low price of farm produce in Hamirpur and

Solan. Whereas, high prices of plant protection chemicals is the major constraint in the crop production in Solan and Shimla. Low price of farm produce and lack of storage facilities are the major marketing constraints in Kinnaur district.

In case of livestock farming, low productivity of animals is the major constraint in Hamirpur, Shimla and Kinnaur followed by lack of availability of green fodder round the year and high costs of feeds and fodders. Low rate of conception through AI followed by lack of availability of green fodder round the year and high costs of feeds and fodders are the major production and financial constraint in Solan. Lack of organized market and low price for crossbred milk are the major constraints in all the four zones in the State.

Policy Issues

For promotion of livestock- crop production system following approach is suggested: Sustainable increase in food grain production through extension of improved crop varieties, particularly in agro- pastoral areas, improving marginal croplands and improving water use and irrigation system – including promotion of water harvesting and efficient use technologies. The croplands should also provide more opportunities for livestock development through processing of feed from agricultural by- products and production of more forage and hay. The crop- livestock production system cannot progress unless a productive crop farming system is established. Ensuring sufficient food grain means developing a potential supply of concentrated feed with a high quality grain base. Increasing the productivity of major cropland also means that more marginal areas can be devoted to developing artificial grassland and cultivating perennial forage integrated with crops.

Table-1: Main findings of the study

Particulars	Agro-climatic zones			
	Low hills	Mid hills	High hill wet	High hill dry

Per household No. of Livestock	Cross bred cows	1.00	1.40	1.33	1.00
	Local cows	-	1.10	1.16	1.00
	Buffaloes	1.35	1.06	-	-
Age at first calving (years)	Cross bred cows	2.56	3.35	3.61	2.85
	Local cows	-	4.70	4.70	3.80
	Buffaloes	3.92	4.21	-	-
Lactation length (days)	Cross bred cows	205	224	213	274
	Local cows	-	284	236	218
	Buffaloes	191	208	-	-
Milk yield (liters/day)	Cross bred cows	4.71	5.03	5.00	2.89
	Local cows	-	2.09	2.22	2.07
	Buffaloes	4.86	4.09	-	-
Milk sold (%)		62.51	22.66	39.39	-
Per capita milk consumption (grams/day)		318	713	375	223
Cost of production of milk (Rs/liters)	Crossbred cows	8.77	6.81	8.36	12.02
	Local cows	-	8.17	9.11	13.66
	Buffaloes	9.69	8.98	-	-
Net income (Rs)*	LCPS 1	11813 (46.13)	23857 (13.42)	8745 (10.40)	8827 (2.46)
	LCPS 2	10073 (42.44)	68060 (37.49)	7907 (9.35)	2890 (0.81)
Employment (man days)*	LCPS 1	63 (9.35)	54 (6.01)	12 (1.72)	45 (4.23)
	LCPS 2	16 (2.58)	3 (0.30)	11 (1.48)	34 (3.04)

*** Gaps in potential and existing income and employment**

Figures in parenthesis are the percentages of potential over the existing for the LCPS in the zone