



Economic analysis of green fodder crops for enhancing the dairy profitability in Punjab

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Received: 28.09.2020

Revised: 13.12.2020

Accepted: 13.01.2021

Abstract

The present study has been carried out in three agro-climatic regions of Punjab state, i.e. Sub mountainous, Central and South-Western regions for examining the economics of different green fodder crops and importance of green fodder in enhancing the dairy profitability. The study consisted of a total sample size of 120 farmers growing green fodder crops and keeping dairy animals. It was observed from the study that the profitability from important green fodder crops based crop cycle is a little bit higher (bajra + berseem ₹ 51,213) than the traditional wheat-paddy crop rotation (₹ 49,005). It was found that proportion of green fodder in the cost of milk production was lower (12.12 per cent) if green fodder is home-produced compared to the market prices of green fodder (23.13 per cent). In this way, the expenditure on green fodder can be curtailed by about 13-14 per cent, which will curtail the overall cost of production of milk and enhance the productivity and profitability from milk production. A direct link between green fodder quantity and milk yield has been observed. Therefore, farmers need to be motivated for enhancing the green fodder production for properly feeding the animals and further, they should try to increase the herd size so that higher profits from dairy farming can be realized.

Key Words: Market price, milk yield, profitability, variable cost, zone

Introduction

In the agricultural economy of India, the livestock sector play an important role (Bhutiani and Ahamad, 2019). The potential to reduce rural poverty can be higher with growth in the livestock sector than the crop sector (Mellor, 2004). About 28.40 per cent of agricultural GDP in India is presently contributed by livestock sector (Anon, 2019a), and this contribution is 38.77 per cent in Punjab state (Anon, 2019b). The milk yield levels of dairy animals in our country are lower than those in developed nations. There is an acute shortage of green, dry fodder and concentrates in our country. The deficiency of green fodder is 35 per cent (Anon, 2012). Any attempt towards enhancing green fodder availability would result in an increased margin of profits to livestock owners. The profitability of milk production mainly depends on the source of feed and fodder as this cost component constitutes about 70-75 per cent of the total variable cost of dairy farming. Green fodder, which accounts for about 44 per cent of the feed and fodder expenditure, is the essential

component of animal feed which helps to obtain an optimum level of milk productivity (Kaur *et al.*, 2012). Hence, studying the economics of green fodder crops is of utmost importance, but there is a dearth of literature on this topic in the Punjab state. With this backdrop, the present study has been carried out to study costs and returns of production of green fodder and its share in the total cost of milk production in Punjab. The study will provide useful information to policy planners, future researchers and other concerned in the dairy sector.

Material and Methods

Punjab state comprises of three homogeneous agro-climatic regions, i.e. Sub mountainous, Central and South Western regions (Anon, 2014). The present study has been carried out in all these regions. One district from each regions having the highest fodder area was selected for the study purpose. Further, two blocks were selected from each of the selected districts in such a way that one is near to district headquarters and one away from it to represent two different scenarios. Further, a group of two-three villages was selected from each of the selected blocks. A total sample size of 120 fodder growers was selected with 20 farmers from each group of

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villages. Primary data was collected for the agricultural year 2016-17 using personal interview method with the help of a pretested schedule. The schedule included information on working capital (hired and family labour, owned and hired machinery, seed, manure, fertilizer, pesticides, irrigation, and other miscellaneous expenses), production data, price of inputs and outputs, the price paid by purchasers of green fodder. The data on the distribution of dairy animals, milk yield, feed and fodder charges, labour charges, miscellaneous charges etc. was also collected for calculating the economics from milk production.

For achieving the objectives of the study and drawing appropriate inferences, suitable statistical techniques (averages and percentages etc.) were used. The cost and returns of various fodder crops were presented in tabular format. For testing the difference between various regions, the technique of one way analysis of variance was used. The linear correlation coefficient was worked out to see the relationship between milk yield and quantity of green fodder fed. SPSS 20 software was used for carrying out the statistical tests.

Results and Discussion

Comparative economics of fodder crops

The comparative economics of various fodder crops in various regions of Punjab has been shown in Table 1. A perusal of table revealed that among the *Kharif* fodder crops, bajra fodder was observed to be the most economical fodder crop with the profit of ₹19645/acre followed by sorghum and maize with ₹ 19159/acre and ₹ 13933/acre, respectively. In a regions wise analysis, the highest profit of bajra was found to be in Central region with ₹ 20655/acre due to higher yield, for sorghum in South-Western zone with ₹ 19664/acre on account of higher yield and for maize fodder in Sub Mountainous zone with ₹ 14097/acre which was on account of lower variable cost. Among *rabi* season fodder crops, the profit was observed to be the highest in berseem, i.e. ₹ 31568/acre and the same was maximum in South Western region with ₹ 32819/acre on account of lower variable cost followed by Central zone (₹ 30957/acre). Next to berseem was oats fodder in *rabi* season with an overall profit of ₹ 19756/acre which was maximum in South-Western zone, i.e. ₹ 20925/acre on account of higher yield and gross

returns followed by Sub Mountainous zone (₹ 18574/acre). The total variable cost of sorghum fodder crop was ₹ 11946/ha, and its major component was human labour expenditure (Grover and Kumar, 2013). About two-thirds of the total production was sold directly to forwarding/commission agent.

Comparative profitability of competing crops

The comparative profitability of various competing crops in various regions of Punjab state has been shown in Table 2. A perusal of table showed that among the *Kharif* season crops, the paddy crop was found to be most profitable with ₹ 25971/acre followed by maize with ₹ 19573/acre. The profit of paddy was maximum in the Central region with ₹ 28119/acre followed by South Western region (₹ 26963/acre). The maize crop was cultivated in Sub Mountainous region only. Further, the profit from sugarcane which is an annual crop, was observed to be ₹ 46411/acre and this crop was cultivated only in Sub Mountainous zone. Among *rabi* season competing crops, the profit was maximum in capsicum crop, i.e. ₹ 46343/acre followed by ₹ 23034/acre for the wheat crop. The capsicum was cultivated in South-Western zone only. The profit of wheat crop was the highest in the Central region with ₹ 24966/acre followed closely by ₹ 24729/acre in South-Western zone. According to Grover and Kumar, 2012, the profitability of the paddy crop was about double than that of sorghum fodder crop. Berseem fodder crop had higher profit than sorghum, but it was less profitable than its competing crop wheat in *rabi* season. Kumar and Grover (2014) found that the variable cost of maize fodder crop was found to be ₹ 8948/ha which was less than maize (grain) crop during the season.

Share of green fodder in cost of buffalo milk production

Share of green fodder in cost of buffalo milk production in various regions of Punjab state has been presented in Table 3. A perusal of table revealed that in the summer season, the average quantity of green fodder fed per milch animal per day was 28.40 kg which was the highest in Sub Mountainous region with 33.90 kg followed by Central zone (26.70 kg) and South Western zone (24.20 kg). The quantity of green fodder fed to animals in different zones differed significantly. The cost of homegrown green fodder per milch



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animal per day basis was the highest in Sub and South Western zones with ₹ 15.90 and ₹ 14.13 Mountainous zone, i.e. ₹ 19.85 followed by Central respectively with an overall cost of ₹ 16.76 in

Table 1. Comparative profitability of various fodder crops in various regions of Punjab state (₹/acre)

Particulars	Kharif			Rabi	
	Maize	Sorghum	Bajra	Berseem	Oats
Sub Mountainous zone					
Total Variable Cost	8082	9713	7418	18282	8916
Yield (q/acre)	171	214	209	409	212
Gross Returns	22179	27312	27023	48446	27490
Profit	14097	17599	19605	30164	18574
Central zone					
Total Variable Cost	8440	-	7396	17437	8562
Yield (q/acre)	176		214	410	218
Gross Returns	22454	-	28051	48394	27054
Profit	14014	-	20655	30957	18492
South Western zone					
Total Variable Cost	9005	9407	-	14970	7645
Yield (q/acre)	174	224		413	218
Gross Returns	22144	29071	-	47789	28570
Profit	13139	19664	-	32819	20925
Punjab					
Total Variable Cost	8315	9464	7395	16648	8607
Yield (q/acre)	173	221	211	410	216
Gross Returns	22248	28623	27040	48216	28363
Profit	13933	19159	19645	31568	19756

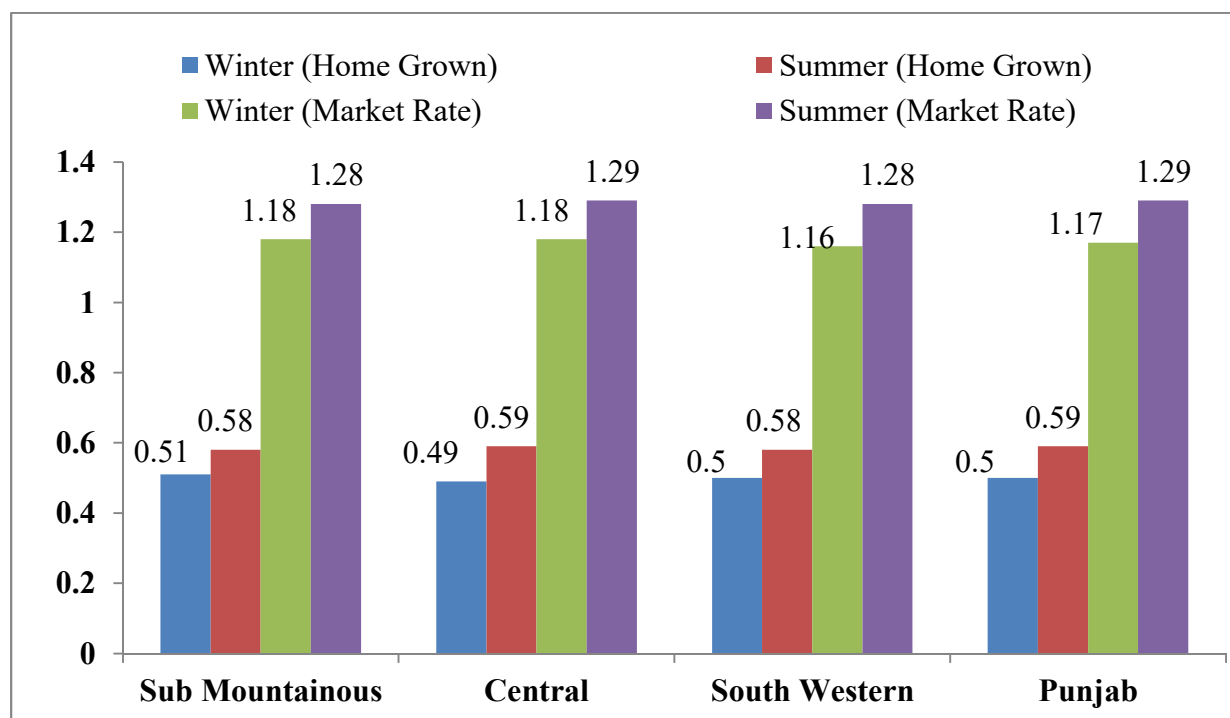


Figure 1. Price of home grown and market price of green fodder (₹ /kg)



Table 2. Comparative profitability of various competing crops in various regions of Punjab state (₹ /acre)

Particulars	Kharif		Rabi		Sugarcane
	Paddy	Maize	Wheat	Capsicum	
Sub Mountainous zone					
Total Variable Cost	19437	12794	11298	-	40239
Gross Returns	39884	32367	30466	-	86650
Profit	20447	19573	19168	-	46411
Central zone					
Total Variable Cost	19971	-	10692	-	-
Gross Returns	48090	-	35658	-	-
Profit	28119	-	24966	-	-
South Western zone					
Total Variable Cost	20132	-	11109	48657	-
Gross Returns	47095	-	35838	95000	-
Profit	26963	-	24729	46343	-
Punjab					
Total Variable Cost	19930	12794	10909	48657	40239
Gross Returns	45901	32367	33943	95000	86650
Profit	25971	19573	23034	46343	46411

Table 3. Share of green fodder in cost of buffalo milk production in various regions of Punjab state (₹ /day/milch animal)

Particulars/Zone	Sub-mountainous	Central	South -Western	Punjab
Summer				
Quantity of green fodder (Kg)	33.90 ^a	26.70 ^b	24.20 ^c	28.40
Home grown fodder				
Cost of green fodder	19.85 ^a	15.90 ^b	14.13 ^c	16.76
Total variable cost	128.28 ^a	125.87 ^a	105.26 ^b	119.39
Proportion of green fodder cost	15.47	12.63	13.42	14.04
If green fodder is purchased from market				
Cost of green fodder	43.42 ^a	34.44 ^b	31.45 ^b	36.64
Total variable cost	151.85 ^a	144.41 ^a	122.58 ^b	139.27
Proportion of green fodder cost	28.59	23.85	25.66	26.31
Winter				
Quantity of green fodder (Kg)	35.40 ^a	33.90 ^a	26.00 ^b	31.80
Home grown fodder				
Cost of green fodder	18.06 ^a	16.82 ^a	12.75 ^b	15.90
Total variable cost	133.41 ^a	138.31 ^a	107.29 ^b	125.87
Proportion of green fodder cost	13.54	12.16	11.88	12.63
If green fodder is purchased from market				
Cost of green fodder	41.72 ^a	40.05 ^a	29.37 ^b	37.21
Total variable cost	157.07 ^a	161.54 ^a	123.91 ^b	147.18
Proportion of green fodder cost	26.56	24.79	23.70	25.28

Note: Figures followed with different superscripts are significantly different (p<0.05)

Punjab. There was a significant difference in the cost of green fodder in all three zones. The share of green fodder in total variable cost of milk production was the highest in Sub Mountainous region, i.e. 15.47 per cent followed by South Western and Central regions with 13.42 per cent and 12.63 per cent, respectively with an overall value of 14.04 per cent in the state. Further, if market price of green fodder prevailing in the respective zones is considered instead of the actual



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cost of production, then the proportion of green fodder in variable cost of producing milk was found out to be 26.31 per cent in the state which was the maximum in Sub Mountainous region (28.59 per cent) followed by 25.66 per cent in South Western region. Similarly in the winter season, the cost of homegrown green fodder on per milch animal per day basis was the maximum in Sub Mountainous region, i.e. ₹ 18.06 followed by Central and South Western region with ₹ 16.82 and ₹ 12.75 respectively with an overall cost of ₹ 15.90 in Punjab. The proportion of green fodder to the total variable cost of milk production was the highest in Sub Mountainous zone, i.e. 13.54 per cent followed by Central and South Western regions with respective figures of 12.16 per cent and 11.88 per cent with an overall value of 12.63 per cent in the state. Further, if the market price of green fodder prevailing in the respective zones is considered instead of the actual cost of production, then the proportion of green fodder in variable cost of producing milk was found out to be 25.28 per cent in the state which was the highest in Sub Mountainous zone (26.56 per cent) followed by

24.79 per cent in Central zone. Hence, the farmers should focus on self-sustenance in green fodder so as to avoid the high cost of purchased green fodder.

Share of green fodder in the cost of cow milk production.

Share of green fodder in the cost of cow milk production in various regions of Punjab state has been shown in Table 4. A perusal of the table revealed that in the summer season, the average quantity of green fodder fed per milch animal per day was 27.70 kg which was the highest in Sub Mountainous region with 35.20 kg followed by Central zone (25.30 kg) and South Western regions (22.60 kg).

The green fodder quantity fed to animals differed significantly in different zones. The cost of homegrown green fodder on per milch animal per day was the highest in Sub Mountainous zone, i.e. ₹ 20.73 followed by Central and South Western zones with ₹ 15.59 and ₹ 13.35 respectively with an overall cost of ₹ 16.37 in Punjab. There was a significant difference in the cost of green fodder crops in all three regions.

Table 4. Share of green fodder in cost of cow milk production in various zones of Punjab state (₹/day/milch animal)

Particulars/Zone	Sub mountainous	Central	South Western	Punjab
Summer				
Quantity of green fodder (Kg)	35.20 ^a	25.30 ^b	23.60 ^c	27.70
Home grown fodder				
Cost of green fodder	20.73 ^a	15.59 ^b	13.35 ^c	16.37
Total variable cost	151.0 ^a	138.3 ^a	117.0 ^b	135.1
Proportion of green fodder cost	13.73	11.27	11.41	12.12
If green fodder is purchased from market				
Cost of green fodder	43.57 ^a	32.61 ^b	29.64 ^b	35.73
Total variable cost	173.84 ^a	155.32 ^b	133.29 ^c	154.46
Proportion of green fodder cost	25.06	20.99	22.23	23.13
Winter				
Quantity of green fodder (Kg)	36.80 ^a	30.50 ^b	24.70 ^c	30.60
Home grown fodder				
Cost of green fodder	18.73 ^a	15.11 ^b	12.49 ^c	15.30
Total variable cost	152.0 ^a	144.5 ^{ab}	115.0 ^b	137.0
Proportion of green fodder cost	12.32	10.46	10.86	11.17
If green fodder is purchased from market				
Cost of green fodder	41.99 ^a	35.97 ^b	28.38 ^c	35.80
Total variable cost	175.26 ^a	165.36 ^a	130.89 ^b	157.50
Proportion of green fodder cost	23.96	21.75	21.68	22.73

Note: Figures followed with different superscripts are significantly different (p<0.05)



Table 5. Effect of quantity of green fodder fed on milk yield

Green fodder fed (kg)		Group 1 (<30 kg)	Group 2 (30-35 kg)	Group 3 (35 kg and above)
Buffalo	Milk yield (lt/day)	6.51 ^a	7.04 ^{ab}	7.59 ^b
Cow	Milk yield (lt/day)	10.69 ^a	11.53 ^{ab}	12.44 ^b
Correlation coefficient between milk yield and green fodder fed				
Buffalo		0.33*		
Cow		0.37*		

Note: Figures followed with different superscripts are significantly different ($p < 0.05$)

* indicates statistical significant at 5 % level of significance.

The proportion of green fodder to the total variable cost of milk production was the maximum in Sub Mountainous region, i.e. 13.73 per cent followed by South Western and Central regions with 11.41 per cent and 11.27 per cent, respectively with an overall value of 12.12 per cent in the state. Further, if the market price of green fodder prevailing in the respective zones is considered instead of the actual cost of production, then the proportion of green fodder in variable cost of producing milk was found out to be 23.13 per cent in the state which was the maximum in Sub Mountainous region (25.06 per cent) followed by 22.23 per cent in South Western region.

Similarly in the winter season, the cost of homegrown green fodder on per milch animal per day basis was the maximum in Sub Mountainous region, i.e. ₹ 18.73 followed by Central and South Western regions with ₹ 15.11 and ₹ 12.49 respectively with an overall cost of ₹ 15.30 in Punjab state. The proportion of green fodder to the total variable cost of milk production was the highest in Sub Mountainous region, i.e. 12.32 per cent followed by South Western and Central regions with 10.86 per cent and 10.46 per cent, respectively with an overall value of 11.17 per cent in the state. Further, if the market price of green fodder prevailing in the respective zones is considered instead of the actual cost of production, then the proportion of green fodder in variable cost of producing milk was observed to be 22.73 per cent in the state which was the highest in Sub Mountainous region (23.96 per cent) followed by 21.75 per cent in Central region. Since the feed cost accounted for more than sixty per cent of the total cost, providing good quality feeds and fodder in sufficient amounts will take a long way to the farming community in increasing the milk

production. The green fodder and concentrate quantities were different for different her size category, whereas dry fodder quantity was the same for all size categories (Anbukani, 2016). Brar *et al.* 2017 observed that small-sized dairy farmers had losses in both the seasons while the medium-sized dairy farmers were having profits indicating dairy farming not profitable in small category dairy farms. Hence, the number of milch animals should be increased to six or more for earning reasonable profits. Hence, green fodder should be adequately produced by the dairy farmers themselves as per requirement, and there should be no dependence on the purchase of fodder from the market. In this way, the expenditure on green fodder can be curtailed, which will bring down the overall cost of production of milk and enhance the productivity on account of the feeding of the proper quantity of green fodder. Singh *et al.*, 2018 concluded from their study that if the yield levels of fodder crops remain same, then the area under fodder crops will have to be increased from 8.95 lakh ha to 12.53 lakh ha to meet the fodder requirement. On the other hand, if the area is to be kept constant, then the yield level of fodder crops has to be increased to 899.08 q/ha instead of existing 642.22 q /ha to meet the fodder requirement. However, more emphasis should be on improving the yield levels as there is no scope of the increasing area under green fodder crops because the area available for cultivation has almost stagnated in the state.

Price of homegrown green fodder and market price of green fodder

Figure 1 shows the green fodder price of homegrown fodder and market rate of green fodder in both summer and winter seasons. For homegrown green fodder, in the summer season, the overall price was ₹ 0.59/kg which was higher



than winter price, and it was the maximum in Central region (₹ 0.59/kg) followed closely by Sub Mountainous region and South-Western region with ₹ 0.58/kg in each zone. Similarly, the green fodder price in Punjab in the winter season of homegrown fodder was ₹ 0.50/kg out of which maximum was in Sub Mountainous zone (₹ 0.51/kg) and minimum in Central zone (₹ 0.49/kg). Further, regarding the prevailing market prices of green fodder, in the summer season, the overall price was ₹ 1.29/kg which was higher than winter price, and it was maximum in Central region (₹ 1.29/kg) followed closely by Sub Mountainous region and South-Western region with ₹ 1.28/kg in each zone. In the summer season, the overall market price of green fodder was ₹ 1.17/kg, and it was maximum in Sub Mountainous and Central zones with ₹ 1.18/kg in each zone and minimum in South Western region (₹ 1.16/kg). Hence, the dairy farmers should give due consideration to green fodder production in their annual cropping plan.

Effect of quantity of green fodder fed on milk yield

The effect of the quantity of green fodder fed on milk yield is shown in table 5. The farmers were divided into three groups based on the green fodder quantities fed to the animals and first group having quantity less than 30 kgs; the second group includes quantity between 30 and 35 kgs and group third 35 kgs and above. For testing the difference in yield of three groups, the technique of one-way analysis of variance was used. There was a significant difference in milk yield of the first and third group. Further, the correlation coefficient between milk yield and quantity of green fodder fed was observed to be positive, and it was statistically significant. Hence, it may be inferred that higher quantities of green fodder should be fed to the milch animals for higher productivity, and there is a need for enhancing the production of green fodder by the farmers.

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Conclusion

From the foregoing discussion, it may be inferred that the profit from important green fodder crops based rotation (₹ 51,213) was a little bit higher than the traditional wheat-paddy crop cycle (₹ 49,005). The expenditure on green fodder can be curtailed by about 13-14 per cent by homegrown fodder which will curtail the overall cost of producing milk and enhance the productivity and profitability from milk production. Further, the quantity of green fodder fed to the milch animals had a direct bearing on the milk productivity level. The milk yield was significantly higher for the animals which are fed higher quantities of green fodder as compared to underfed milch animals. Therefore, farmers should try to concentrate more on enhancing green fodder production to minimize the shortage of green fodder requirement and enhance dairy profitability. The surplus green fodder if any, can be sold in the market to earn income which is a little bit more compared to the competing crops. Hence, with proper management of green fodder production at own fields, the overall farm profitability can be improved.

Acknowledgement

The paper has been culled from the thesis entitled "Examining the profitability and marketing pattern of green fodder for sustainable dairy development in Punjab" submitted by second author Harparteet Singh to Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana-141004 during 2017 under the guidance of first author Dr Varinder Pal Singh. The authors are thankful to the Vice-Chancellor, GADVAU, Ludhiana and Dean, College of Dairy Science and Technology, GADVASU, Ludhiana for providing necessary infrastructure and other support required for completion of the study.

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