Title: Yield gap in milk production is considerable in Indian Himalayan state of Meghalaya

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Short title: **Milk yield gap in Meghalaya**

SUPPLEMENTARY FILE

Table S1 – supplementary materials. Strata selection of the sample respondents into small, medium and large categories.

Observations	(1) Bins		(2)Frequency	(3)√Frequency	(5)	√Frequency	Sub-total	(6) Strata		Category
	Lower	Upper						Lower	Upper	
1	1.71	6.95	36	6		6	6.31	1.71	7.27	Small
2	6.96	12.2	23	4.8		4.8		7.28	14.04	Medium
3	12.21	17.45	16	4		4	12.63	14.05	41	Large
4	17.46	22.69	3	1.73		1.73				
5	22.7	27.94	2	1.41	(5) C=18.94/3	1.41				
6	27.95	33.19	0	0	~6.31	0				
..	33.2	38.44	0	0		0				
81	38.45	43.69	1	1		1	18.94			
(n=81)				(4) Total =18.94						

Note: (1) Bin size 81, (2) frequencies calculated for bins; (3) calculates square root (4) calculate sum of square root; (5) determine category size c~6.31; (6) find strata boundaries. (Source: Dalenius and Hodges 1959)

Table S2- supplementary materials. Standard animal units for Eastern and North Eastern region

Type of animal	Adult male	Adult female	Young stock male<1	Young stock female<1	Young stock male>1	Young stock female>1	Heifer
CB	1.48	1.71	0.41	0.72	0.71	1.08	1.24
Local	1.11	1.00	0.29	0.63	0.55	0.82	0.98

(Source: Feroze *et al.*, 2016)

Table S3 – supplementary material, provides description and measurement of variable included in ANCOVA model. In this study, it is expected that a farmer with more experience will be in a position to undertake proper dairy management activities leading to increased milk production which in turn will imply reduction in the yield gap. Jafor (2019) in Assam found a positive effect between dairy experience and increase in milk production.

It is assumed that the size of cattle shed might have a negative effect on total milk yield gap. Enough space allowance and good housing condition may play a key role towards welfare of farm animal which in turn may facilitate incremental milk production. Earlier researchers reported that higher milk production tended to be associated with increased free space in Ireland and Norway (Graves, 1989; Naess *et al.*, 2011).

When the price of concentrate increases farmer tend to purchase less of concentrate which will negatively affect milk production. The price determines the quantity of the concentrate farmer will purchase, when the price is low then the farmer can buy large quantity of concentrate which has a direct impact on milk yield. The cattle which are fed higher amount of concentrate may produce higher milk in comparison to the animals which are provided with lesser amount of concentrate. Feroze *et al.* (2017) reported that the amount of concentrate has positive and significant effect on milk productivity in Meghalaya.

 If the research station is nearby, then the farmers can gain more knowledge for taking care of animals easily by participating in the training programs, awareness camps held by the research station while nearby market means easier disposal of milk and more motivation towards enhancing their dairy farming in comparison to the farms where the market is far.

The labour allotted by the farmer in dairying activities like health care, feeding the animals, cleaning the animals as well as cattle shed, positively affect the milk yield. Higher the time engaged with the livestock, narrower may be the yield gap. Paul and Chandel (2010) also reported that human labour has positive effect with milk yield in north eastern states of India.

Education level of the family head is recorded as 1 for literate and 0 for otherwise. It is expected that the farmer with higher education would be interested to adopt improved technology and thus may have better management skill in dairy enterprise. Economic status is coded as 1 for economically sound farmer and 0 otherwise. A farmer is considered economically sound if (possess any three of the following resource/item in their household; Modern house, motorcycle,

four wheeler, power tiller, television and freeze or refrigerator). Non-economically sound farmer means he/she will have lesser amount of resources to spend on cattle feeds/concentrate, animal healthcare etc., thus effecting milk yield.

The farmers can acquire better management skill through frequent contact with extension personnel. It is assumed that contact with extension personnel will have a positive influence on milk production and thus decrease in yield gap. Moreover, cows reared in a scientific cattle shed will likely have a better chance of increased milk productivity. Housing type, accessibility, drainage, exposure to sun and protection from wind was taken into consideration to decide whether the shed is scientific or not. Favourable environment can be provided with scientific cattle shed and the transmission of diseases can be minimized. Vaccinated cattle can escape from different diseases, so they may produce higher milk as the animal suffering from various diseases produces lesser milk.

Table S3 – supplementary material. Description and measurement of variable included in ANCOVA model

Variable	Variable name	Measurement	Expected sign
X_1	Experience in dairy farming	Years	-
X_2	Estimated size of animal shed	Square metre	-
X_3	Price of concentrate	₹	+
X_4	Total quantity of concentrate/animal/day	kg	-
X_5	Distance to research station	km	+
X_6	Market access	km	+
X_7	Human days allocated to dairy	Hours	-
D_1	Educational level of the family-head	Literate=1,otherwise=0	-
D_2	Education of person involved in dairy dairy	Literate=1,otherwise=0	-
D_3	Economic status of dairy farmers	economically sound=1, otherwise=0	-
D_4	Contact with extension personnel	Yes=1, no=0	-
D_5	Scientific cattle shed	Yes=1, no=0	-
D_6	Vaccination	Yes=1, no=0	-

References

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