



Original Research

Knowledge of Farmers about Organic Dairy Farming Practices: A Comparative Analysis

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Abstract

Interest in organic crop and livestock farming have remerged in recent past given the increasing adverse environmental, social and economical impacts of modern agriculture. But unlike organic crop farming the concept and practice of organic dairy farming is relatively new. Uttarakhand, one of the leading states in organic farming in India, have a predominance of mostly traditional integrated crop livestock farming closed to organic system along with relatively unpolluted ecosystem. The state also has a vast number of certified organic farmers supported by well-developed organizational structure thus also offered good prospect for organic dairy farming. Thus, the study was designed to analyze the extent of knowledge about organic dairy animal rearing among those certified organic farmers as well as non-organic farmers in vicinities. It was found that for most of the standard organic dairy farming practices organic farmers in plain regions exhibited better understanding with an average knowledge score of 48.97 per cent followed by organic farmers in hilly regions (43.46 %) though the difference in knowledge level among them was not significantly different as confirmed by Kruskal-Wallis test. In case of non-organic farmers knowledge level was much lower but not nil in both plain and hill. It was found that education, farming system, extension agency contact, gender, herd size, use of locally available non-technical sources, social participation, management orientation and economic motivation was the major contributory factors which explains the variation in knowledge level of farmers with a contribution of 73.80 per cent of variances ($R^2 = .738$) in knowledge score. Education farming system, extension agency contact; locally available non-technical sources utilization, gender, economic motivation, risk orientation and mass media utilization had substantial direct effect on knowledge level as derived from path analysis.

Key words: Knowledge, Organic Dairy Farming, Organic and Non-Organic Farmers, Path Analysis, Stepwise Regression

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Introduction

Dairying plays a crucial role in Indian rural economy by supplementing the income of farm families and also by providing an important source of employment. Dairying accounts for 66.90 per cent of total value of output from livestock sector (Mishra and Bardhan, 2011). Livestock activity assumes special significance in hilly states like Uttarakhand owing to small landholdings and limited scope of other livelihoods. Uttarakhand characterized by mixed crop-livestock systems in smallholder farming. Over 80 per cent of rural households own livestock and more than 80 per cent of all livestock species are owned by marginal and small holders (Bardhan and Sharma, 2013). Thus, livestock not only play an integral role in agricultural development by providing supplementary livelihood but also provide manure and ploughing of terraced farmlands along with effective resource recycling (Altieri and Toledo, 2011) which is prerequisite for adopting organic farming system (Sati, 2016). According to the National Organic Standards Board of the US Department of Agriculture (USDA) the word 'Organic farming' is an ecological production system which avoids or largely excludes the use of synthetically compounded fertilizers, pesticides, growth regulators and livestock feed additives. To the maximum extent feasible, organic farming systems rely upon crop rotations, crop residues, animal manure, legumes, green manure, off-farm organic wastes, mechanical cultivation, mineral bearing rocks and aspects of biological pest control to maintain soil productivity and tilth, to supply plant nutrients and to control insects, weeds and other pests. Uttarakhand have a predominance of mostly traditional integrated crop livestock farming (Subrahmanyeswari and Chander, 2008) along with small and marginal farmers depending on rainfall.

Organic farming is low external input sustainable agriculture system (LEISA), ideally suited to rain-fed hill agriculture (Hermansen, 2003). But unlike organic crop farming the concept and practice of organic dairy farming is relatively new (Oruganti, 2011). Organic dairy farming means rearing cattle on organic feed (i.e. pastures cultivated without the use of fertilizers or pesticides), have access to pasture or outside, along with the restricted usage of antibiotics and hormones. It deliberately avoids the use of synthetic inputs such as drugs, feed additives and genetically engineered breeding inputs. Welfare of animals is also of prime importance under organic dairy farming system (Chander *et al.*, 2013; Wolde and Tamir, 2016). A considerable numbers of farmer presently practicing organic farming in Uttarakhand and the state also have a well-developed structure for promoting organic farming as well as marketing of organic crop products that ensure premium price received by farmers. These organic farmers are supposed to maintain their dairy unit organically to maintain integrity of their farming system as mandated by organic certification system. Thus, the present study was designed to measure the knowledge of these organic farmers spread across plain and hilly regions about organic dairy farming practices along with how these are affected by socio-economic, psychological and communication characteristics related factors as it will be crucial for future promotion of organized organic dairy farming in the state. Non-organic farmers from vicinity were also

included in the study design to get a comparative and in-depth view.

Materials and Methods

The knowledge of farmers regarding organic dairy farming practices was operationalised as the amount of information understood, stored in memory came from their exposure to the concept of organic dairy farming either by conscious or unconscious choice. For the purpose of measuring the knowledge level of farmers a knowledge test was developed and administered to the respondents. Items with difficulty index of more than 0.25 and less 0.75 and with discrimination index of above 0.30 were selected for inclusion into knowledge test. Knowledge score for all four separate management practices and standards along with overall knowledge score for each farmer was summed up and converted into percentage for better understanding. Respondents were classified based on their knowledge score in four part of management practices as well as for overall knowledge level by using cumulative square root technique. Test score were later make subjected to one way analysis of variance (ANOVA) for comparing farmers' knowledge across four farming system. Non-parametric equivalence of one way analysis of variance was used as the result of Levin's Test confirmed that the distribution of knowledge score was not homogenous across the different categories of farmers. Thus, Kruskal-Wallis H Test was administered by using SPSS (V-23).

$$H = \frac{12}{n(n+1)} \sum_i \frac{R_i^2}{n_i} - 3(n+1)$$

The study was conducted across four districts of the Uttarakhand namely; Haridwar, Udham Singh Nagar (as plain region) and Tehri and Pithoragarh (as hilly region) purposively based on number of organic farmers and area under organic cultivation. Two blocks from each district, thus, a total eight block was selected randomly for surveying the farmers. 240 farmers having rice-wheat-dairy animals as component of farming system was selected for final data collection among whom half were registered organic farmers and rest were non-organic farmers for comparison.

Result and Discussions

Knowledge Level of Farmers about Organic Dairy Farming Practices

Table 1 depicted the existing understanding of farmers to the concept of organic dairy farming separately for various standards and management practices and also in *toto*. In case of knowledge about general standard of organic dairy farming (not particular to any management practices) in plain regions 45 per cent of organic farmers had shown the sign of higher level of knowledge followed by 38.33 per cent at medium and in hilly regions 31.67 per cent had shown higher level of knowledge followed by 45 per cent in medium

category. Despite of being organic farmer 16.67 percent in plain and 23.33 per cent in hill had little bit lower level of knowledge in general standards of organic dairy farming. In case of non-organic farmers 13.33 per cent in plain regions and 8.33 per cent in hilly regions has expressed higher level of understanding about the concept of organic dairy farming despite of being a non-organic farmer. 31.67 per cent and 25 per cent of non-organic farmers in plain and hilly regions respectively also had shown medium level of knowledge about general requirement of organic dairy farming practices.

Table 1: Distribution of farmers according to knowledge level about organic dairy farming practices

Category	Organic Farmer		Non-organic Farmer	
	Plain n=60	Hilly n=60	Plain n=60	Hilly n=60
General Standard				
Low (<36.36)	16.67	23.33	55	66.67
Medium(36.36-73.28)	38.33	45	31.67	25
High (>73.28)	45	31.67	13.33	8.33
Breeding Management				
Low (<29.49)	50	25	81.67	88.33
Medium(29.49-71.92)	20	45	13.33	11.67
High (>71.92)	30	30	5	0
Hosing and Feeding Management				
Low (<23.37)	11.67	26.67	56.67	75
Medium(23.37-52.34)	41.67	51.66	35	21.67
High (>52.34)	46.66	21.67	8.33	3.33
Health Care and Milking Management				
Low (<26.65)	28.33	31.67	58.33	80
Medium(26.65-56.99)	41.67	40	38.33	20
High (>56.99)	30	28.33	3.34	0
Overall Knowledge Level				
Low (<27.27)	28.33	31.67	71.67	86.67
Medium(27.27-55.03)	31.67	40	16.67	10
High (>55.03)	40	28.33	11.66	3.33
Average Score (in %)	48.97	43.46	31.85	21.15

It could be concluded that the knowledge of organic farmers who supposed to be highly aware of concept of how to manage their dairy unit organically was not up to the level as expected. In case of breeding management of organic dairy farming unit it was found that 50 per cent of organic farmers in plain regions and 25 per cent in hill only had low level of knowledge. Apart from this 30 per cent of organic farmer in both plain and hilly regions had shown higher knowledge level about breeding management under organic dairy farming regime. Knowledge about specificity of breeding related requirement was severely low among non-organic farmers with vast majority of farmers in both plain and hill had only low level of knowledge about breeding management (81.67 and 88.33 per cent, respectively). But 13.33 per cent and 11.67 per cent of organic farmers in plain and hilly regions, respectively had also medium level of



knowledge about breeding management under organic dairy farming practices. In case of housing and feeding management practices the level of knowledge was better for organic farmers in plain regions than rest of the management practices. In case of their counterparts in hilly regions majority of them had a medium level of knowledge followed by 26.67 per cent had lower and 21.67 per cent had high level of knowledge about specificities of housing and feeding management of dairy animals under organic dairy farming. Though 56.67 per cent and 75 per cent of non-organic farmers in plain and hilly regions, respectively was found to have little knowledge or ignorant about housing and feeding management required to be followed if they decided to convert into organic dairy farming but some farmers having non-organic farming system was found to have considerable knowledge about feeding and housing management.

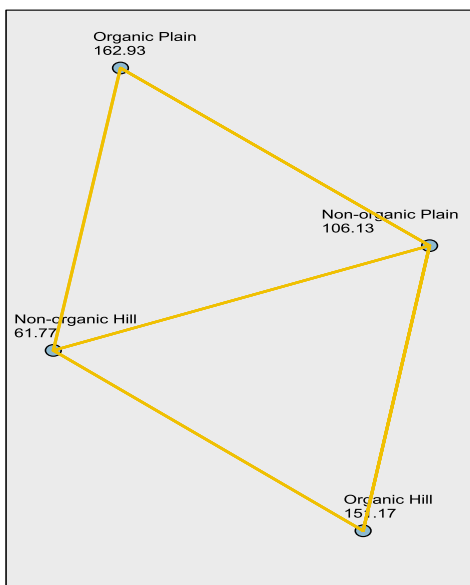
In case of health care and milking management practices permitted or prohibited under organic dairy farming practices almost 30 per cent of organic farmers in plain and hilly regions both was found to have high level of knowledge. Almost same percentage of organic farmers in plain and hill (almost 30 %) were also found to have low level of knowledge in health care and milking management practices. In case of non-organic farmers a substantial proportion of farmers in plain region were found to have considerable knowledge in health care related practices as 38.33 per cent was found to belong medium knowledge category and 3.34 per cent in higher knowledge category. For their counterparts in hilly regions like all other management practices a vast number of farmers were found to be ignorant or have little knowledge about health care and milking related management practices permitted under organic dairy farming regime. But 20 per cent of non-organic farmers also found to have some knowledge about health care practices as they were found to belong in the medium knowledge level category.

Thus, it can be concluded that in all broad categories of management practice related areas of organic dairy farming organic farmers have a higher level of knowledge and more so for organic farmers in plain regions than hilly regions. It was expected as being an organic farmer though not particularly a certified organic dairy farmer, they are supposed to manage their attached dairy unit as organically as possible to maintain the integrity of their organic farming as a whole. The overall picture of existing knowledge will become clearer from the last part of the table which classified the farmers based on their overall knowledge about organic dairy farming. It was found that in *toto* 40 and 31.67 per cent of organic farmers in plain regions had higher and medium level of knowledge in organic dairy farming practices, respectively while the percentage of organic farmers under two before said category were 28.33 and 40 per cent respectively in hilly regions. 28.33 per cent and 31.67 per cent of organic farmers in plain and hilly regions respectively was found to be little ignorant about specifications of managing their dairy unit organically. Despite of being non-organic farmer a few proportion of them had shown considerable understanding about specificities of organic dairy farming as 11.66 per cent and 16.67 per cent in plain regions and 3.33 per cent



and 10 per cent in hilly regions was found to have high and medium level of knowledge, respectively about organic dairy farming practices. Elakkia (2007); Jaganathan *et al.* (2012) in a comparative study among organic and non-organic farmers on extent of knowledge about organic farming practices reported majority of organic (67.50 %) and inorganic farmers (74.16 %) had medium level of knowledge followed by high (11.67 % organic and 10.83 % inorganic) and low (18.33 % organic and 9.17 % inorganic) levels of knowledge. Few farmers both in organic and inorganic group had very low and high levels of knowledge. The Fig. 1 presented the test summary of null hypotheses of no variation in the distribution of mean knowledge score across the regions and farmers which were rejected by Kruskal-Wallis K sample test utilized as an alternative of one way ANOVA.

Pairwise Comparisons of Farming System



Each node shows the sample average rank of Farming System.

Sample1-Sample2	Test Statistic	Std. Error	Std. Test Statistic	Sig.	Adj.Sig.
Non-organic Hill-Non-organic Plain	44.367	12.650	3.507	.000	.003
Non-organic Hill-Organic Hill	89.400	12.650	7.067	.000	.000
Non-organic Hill-Organic Plain	101.167	12.650	7.997	.000	.000
Non-organic Plain-Organic Hill	45.033	12.650	3.560	.000	.002
Non-organic Plain-Organic Plain	56.800	12.650	4.490	.000	.000
Organic Hill-Organic Plain	11.767	12.650	.930	.352	1.000

Each row tests the null hypothesis that the Sample 1 and Sample 2 distributions are the same. Asymptotic significances (2-sided tests) are displayed. The significance level is .05.

Fig. 1: Pair-wise comparison between farmers of various farming systems based on knowledge level of farmers about organic dairy farming

Fig. 1 depicted that there was no significant difference in overall knowledge level about organic dairy farming practices between the farmers practicing organic farming in plain and hilly regions. Apart from this the rest of the two categories of farmers had difference in mean knowledge score not only with other two farming system (organic-plain and organic-hill) but also among themselves with significantly higher mean knowledge in non-organic plain group than non-organic hill group of farmers.

Influence of Independent Variables on Knowledge Level of Farmers

The affecting factors of depicted differences in knowledge level of farmers across the farming systems may be because of difference in farming system and consequent training, information support or mere exposure they received from the organized support system concerned with particular farming system. But the socio-personal, psychological and situational variables may also have significant influence on the outcome of existing knowledge level. Jaganathan *et al.* (2012) in a study found that knowledge level of organic and inorganic farmers was significantly different at one per cent level and the reason may be attributed to the fact that organic farmers had better education, extension orientation, mass media exposure, environmental orientation and belief in organic farming. In present study co-relational analysis and subsequently stepwise regression analysis was carried out to determine the strength of association and underlying relation between knowledge score and independent variables. The variables having significant correlation with the knowledge level of farmers has been presented in Table 2.

Table 2: Relationship between independent variables and knowledge about organic dairy farming practice

S. No.	Profile Characteristics of the Farmers	Correlation Coefficient	Correlation Coefficient	Correlation Coefficient
		(Organic Farmers)	(Non-organic Farmers)	(r value)
1	Age	-0.622**	-0.413**	-.560**
2	Education	0.848**	-0.688**	.724**
3	Farming experience	-0.640**	-0.402**	-.580**
4	Dairy farming experience	-0.633**	-0.435**	-.577**
5	Social participation	0.451**	0.283**	.340**
6	Economic motivation	0.289**	0.425**	.343**
7	Scientific orientation	-	0.253**	.180**
8	Risk orientation	0.338**	-	.320**
9	Management orientation	0.772**	0.629**	.637**
10	Mass media utilization	0.623**	0.546**	.600**
11	Extension agency contact	0.814**	0.582**	.601**
12	Use of locally available non-technical sources	-0.691**	-0.274**	-.198**
13	Land holding	.328**	0.344**	.254**
14	Herd Size	-	0.204*	-

**Correlation significant at 0.01 level (2-tailed); * Correlation significant at 0.05 level (2-tailed)

It was found that social participation, economic motivation, scientific orientation, risk orientation, management orientation, mass media utilization, extension agency contact and land holding had significant positive correlation with knowledge level while rest of the variables had a negative significant correlation. Biswas *et al.* (2012) found that higher knowledge in improved dairy farming practices were positively associated with increase occupational standard, caste, farm power, economic motivation, information sources utilization, urban contact, attitude in dairy farming and income generation for SHG dairy farmers. Goswami (2010) found significant relationship between income generation, occupation and knowledge in animal husbandry practices. Rahman and Gupta (2004) and Mande *et al.* (2008) revealed positive significant association of occupation and knowledge level in improved dairy farming practices. Jaganathan *et al.* (2012) found that innovativeness, education, mass media exposure, risk orientation, economic motivation, market orientation, extension orientation, livestock possession, level of aspiration, social participation, decision making behaviour, self-confidence and experience in organic farming had a significant and positive relationship with knowledge level at 1 per cent level, but environmental orientation showed a significant and positive relationship with knowledge at 5 per cent level.

Stepwise regression was carried out by using SPSS-23 to single out best predictor combination of influencing independent variables on knowledge level of farmers (Table 3). It was found that education, farming system, extension agency contact, gender, herd size, use of locally available non-technical sources, social participation, management orientation and economic motivation was the major contributory factors which explains the variation in knowledge level of farmers with a contribution of 73.80 per cent of variances ($R^2 = .738$). The nonexistence of auto-correlation was confirmed by Durbin-Watson test with a test score within the range of 1.5 to 2.5.

Table 3: Impact of independent variables on knowledge about organic dairy farming practices (Stepwise regression analysis) (n=240)

S. No.	Variables entered	Multiple		Change in R ²	F change	Durbin-Watson
		R	R ²			
1	Education	0.724	0.524	0.524	262.483	1.811
2	Farming system	0.824	0.678	0.154	113.451	
3	Extension agency contact	0.835	0.697	0.018	14.074	
4	Gender	0.842	0.709	0.012	9.675	
5	Herd size	0.848	0.718	0.01	8.222	
6	Use of locally available non-technical sources	0.85	0.723	0.005	4.015	
7	Social participation	0.854	0.728	0.005	4.542	
8	Management orientation	0.856	0.733	0.005	4.249	
9	Economic motivation	0.859	0.738	0.005	4.059	

To get the clearer picture of direct and indirect effects of independent variables on the dependent variable (knowledge) path analysis was carried out using SPSS AMOS 22. In Table 4 the variables has been arranged

from high to low direct effect. It was found that education farming system, extension agency contact; locally available non-technical sources utilization, gender, economic motivation, risk orientation and mass media utilization had substantial direct effect on knowledge level. The other independent variables in the model and extension agency contact; locally available non-technical sources utilization, economic motivation and risk orientation from the abovementioned variables had substantial indirect effect on knowledge level of farmers flowing through the type of farming system they had.

Table 4: Direct and indirect effect of independent variables on knowledge level of farmers about organic dairy farming

S. No.	Variables	Total effect	Direct effect	Indirect effect
1	Education	0.533	0.533	0
2	Farming System	0.346	0.346	0
3	Extension agency contact	0.124	0.207	-0.083
4	Locally available non-technical sources utilization	0.234	0.129	0.105
5	Gender	-0.109	-0.109	0
6	Economic motivation	0.106	0.07	0.036
7	Risk orientation	0.196	0.053	0.142
8	Mass media utilization	0.009	0.009	0
9	Farming Experience	-0.371	0	-0.371
10	Age	-0.21	0	-0.21
11	Male member engagement	0.083	0	0.083
12	Land holding	0.062	0	0.062
13	Management orientation	0.062	0	0.062

Conclusion

Organic dairy farming has a strong potential in Uttarakhand given the prominent role of dairy farming in economic development of the farmers in the state. The practicing organic farmers should be the first one to take up organic dairy farming given their already existent organic farming system and relevant experiences. But, the very initial step to develop a vibrant and compliant organic dairy farming community across the state is to greatly improve the knowledge level of farmers.

At present, as presented in the present paper, knowledge level of organic farmers, leave alone non-organic farmers, are not very high for most of the broad dairy cattle management areas. For improving it, as a first step of promoting organic dairy farming, there is a need of extensive mass media based campaign supported with relevant training intervention targeted to some selected potential adopters' area-wise. Knowledge of practicing farmers about organic dairy farming will not only ensure quality output but also organized support requirement by farmers for proper adoption of organic dairy farming in future. With rich indigenous knowledge of livestock farming, rich biodiversity, lower cost of production of organic dairy farming and with still unexplored vast domestic market conversion to organic dairy production looks like a lucrative

option for certified organic and other traditional farmers of Uttarakhand. If supported by successive capacity and knowledge building of farmers and suitable mechanism for certification along with promotion of organic dairy products it will motivate farmers to engage in organic production and will contribute to the wellbeing of the environment, the livestock species, the human being in general.

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