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ASSESSING THE IMPACT OF TRAINING PROGRAMMES FOR DAIRY FARMERS BY *KRISHI VIGYAN KENDRA*, FARM SCIENCE CENTRE, INDIA

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ABSTRACT

India is spending huge amount of resources on agricultural training in general and animal husbandry training in specific but scanty research findings indicate actual impact of those training programmes and hardly any study accounted for selection bias while assessing impact of those training programmes. This study, therefore proposed to assess the impact of dairy farming trainings imparted during the duration of 2014-2016 by *Krishi Vigyan Kendra* (KVK) (Farm Science Centre) under ICAR- Indian Veterinary Research Institute (IVRI), Izatnagar, Uttar Pradesh, India. Data were collected from 80 trainee farmers and 240 non-trainee farmers on various aspects, i.e. their knowledge on scientific dairy husbandry practices, adoption of various scientific dairy husbandry practices in the field condition, attitude towards dairy farming, yield from dairy and profitability from scientific dairy farming. Logistic regression was applied to estimate the probability of participation in training programme. Propensity Score Matching (PSM) 1:1 was then used to control for the confounding variables which may affect the decision of trainees to participate in the training programme. Total of 76 matches were found and as such, the same number of trainee and non-trainee farmers were finally included in the study. The results revealed that the training programmes had significant impact on knowledge level on scientific dairy husbandry practices, better adoption of scientific animal husbandry practices and higher yield from dairy farming. Similarly, the trainings significantly and positively impacted on profitability from dairy farming. However, no significant impact of training on overall attitude of trainees towards scientific dairy farming was observed.

Keywords: *Krishi Vigyan Kendra*, Impact, Propensity Score Matching, Logistic regression

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INTRODUCTION

Livestock in India has equitable distribution in favour of landless agricultural labourers and marginal & small landholders and thus development of this sector is regarded as one of the most pro-poor policy intervention having significant potential in increasing income and employment for vast rural population in the country (Joshi, 2015). This sector provides livelihood to about 20.5 million and employment to 8.8 percent of Indian population (Dash, 2017). This particular sector contributes 4.11 percent to national gross domestic product (GDP) and 25.6 percent to agricultural GDP (AgGDP). Progress of this sector will be vital for the growth of the Indian agrarian economy. India possesses the largest livestock population in the world (535.78 million) but productivity of Indian livestock is 20-60 percent lower than the global average (GoI, 2012). One estimate suggests that '5 dairy cows' in India produce as much milk as produced by 'one dairy cow' in USA and '10 dairy cows' in India produce as much milk as 'one dairy cow' in New Zealand (Kumar *et al.,* 2011). Though genetic potential of Indian livestock can be a factor influencing the productivity but poor management skill and lack of updated farm practices are crucial contributor towards this huge gap in productivity as compared to that of developed economies like the Unites States of America (USA) or the European Union (EU). The presence of unskilled professionals along value chain with inadequate knowledge in dairying is one of the serious constraints with respect to dairy development (Agricultural Skill Council of India, 2015). India can take pride when it comes to development of new, improved, cost effective and production oriented technologies in livestock sector. However, these technologies need to be transferred to the end users for its validation, refinement and in turn application for improving productivity at the farmers' field. In this regard farm science center or *Krishi Vigyan Kendra* (KVK), established by Indian Council of Agriculture Research (ICAR), have been largely regarded as institutional innovation that effectively link agricultural research and extension to the farmers' field at the district level in India (Chander, 2015). KVKs play multifaceted roles in assessing location specificity of technologies, demonstrating the frontier technologies, validating and refining locale-specific technologies, providing information and inputs, mainly through participatory approaches (Katole *et al*., 2017). As a part of Transfer of Technology (ToT) project of ICAR, KVK plays indispensable role in agricultural technology

transfer and provides need based, skill oriented, vocational training to practicing farmers, farm women and rural youths with the broad objective of increasing productivity and income of farming community. Each KVK trained about 100 persons annually on agri-preneurship (NILERD, 2015). However, the impact assessment of training programmes organized by KVKs is required at periodic intervals for evaluation of their programmes, which will in turn allow suitable and relevant changes to make these trainings more effective in future. The significance of training for development and mobilization of human resources' energies has been recognized long back, but finding out ways for improving effectiveness of training received attention only recently (Kushwaha, 2010). India though still poverty-stricken, spends over Rs. 200 crores on training each year and expenditure of such magnitude calls for a periodic evaluation of training programmes (Lynton and Pareek, 2015).

In India so far, there are 721 operational KVKs. In this study the training programmes organized by KVK under one of the premiere ICAR institute of the country Indian Veterinary Research Institute (IVRI) was selected for assessing the impact of training programmes imparted using Propensity Score Matching (1:1) to account for selection bias which was not considered in earlier studies on impact of training programmes on agriculture and allied sectors.

MATERIALS AND METHODS

Locale of the study: The study was carried out purposively in Indian Veterinary Research Institute (IVRI) one of the deemed to be universities under Indian Council of Agriculture and Research (ICAR), India and is the premiere institute of veterinary science having the mandate for research, teaching, consultancy and technology transfer activities pertaining to livestock. The campus is situated at Bareilly, Uttar Pradesh which is the highest milk producing state of India. Under the direction of the Joint Directorate of Extension Education (JDEE) of the institute, *Krishi Vigyan Kendra* (KVK) works with one of the major mandate of technology transfer. For the present study, on-campus training programmes organized by KVK-IVRI over a period of 2014 to 2016 were selected purposively.

Sampling method: The institute's official website, annual reports and training registers maintained by KVK-IVRI was accessed for collecting data on trainings organized which were focused towards livestock farming imparted during 2014-16. Data revealed maximum (10) trainings were on dairy management, specifically the most dealt topics of those trainings viz. scientific management of dairy animals, dairy entrepreneurship development and clean milk production practices; majority of trainings (6 of 10 trainings) were imparted on scientific management of dairy animals; so this area of training was included in the study. Considering duration of trainings organized at KVK-IVRI a minimum of 5 days duration trainings were selected for study.

Selection of trainee farmers: Farmers from Bareilly district of Uttar Pradesh were selected purposively considering maximum farmers (135 out of 245 farmers) who participated in these training programmes by KVK-IVRI, were from this district. Among the 15 blocks of Bareilly district, secondary data revealed that trainees from four blocks *viz.,* Faridpur (47), Bithiri chainpur (32) Bhuta (31), and Fatehganj (25) participated in the training. After complete profiling of selected trainees, probability proportional to size (PPS) sampling was used to select proportionate number of farmers from each block to have a representative sample size of 80 farmers for the study. For selecting the farmers in the ultimate sample, the criterion of possessing at least two milch animals by farmers was followed.

Selection of non-trainee farmers: Non-trainee farmers were selected from the near-by two villages (not intervened by any government or private animal husbandry organization) at a minimum distance of 10 kilometers (to reduce the spill over effect) from villages from where the trainees were selected, in all the four blocks. As such 30 farmers (non-trainees) from each of eight villages were selected for study; with the criteria that they had never attended any training programmes organized by any organization but possessed at least two milch animals. Thus, a total of 240 farmers from the four blocks made up the non-trainee sample group for this study.

Analytical framework propensity score matching method (PSM): Propensity score matching (PSM) was used in this study to account for the selection bias by controlling the confounding variables which may in turn affect the impact parameters. PSM which is in essence a model to estimate the probability/propensity that a study unit which has not received the intervention is similar at baseline to another unit from the 'intervention group', based on a set of key characteristics. As such, it reduces the problem of comparison across large numbers of key variables to a 1-dimensional problem; i.e. the minimization of the difference, or distance, between case and control propensity scores.

PSM 1:1 matches between trainees and non-trainees in which pairs of treated and untreated subjects are formed and compared were carried out following three steps:

Covariates were selected which have maximum potential to affect the decision to participate in the training programmes by researcher's understanding and

discussion with experts. Multi-collinearity was found out between the selected variables.

Probability of participating in the training was estimated through a formal logit regression model, logistic regression appears to be the most commonly used method for estimating the propensity score (Austin, 2011).

The Logit used is one of the form: $Ln (Pi / 1-Pi) = \alpha + \sum \beta_i x_i + \sum Di + e_i$

Where the left hand side represents the log of odds of participating in training and X is the vector of continuous independent variables and D is vector of dummy independent variables. A total of 12 baseline covariates or confounders were selected *i.e.,* wealth category (poor, middle, rich where poor acts as constant, which was calculated based on the ranking as per index of assets given by Ahuja *et al.* (2003)), age, age², gender, marital status, respondent category, education of the respondent, experience in dairy farming, distance to nearest veterinary institution, distance to KVK-IVRI, contact with extension professionals from KVK-IVRI and social participation of respondent are the coefficients to be estimated which represent the change in the log of odds of participating in training in the model. A positive estimated coefficient with significant p value implies an increase in the likelihood that a respondent will be a trainee *i.e.,* the covariate affects significantly the decision of trainee to participate in the training programme. Similarly, a negative estimated coefficient with significant p value suggests that covariate affects negatively the decision to participate in the training programme.

iii. A matching method was selected to match treated and untreated group. PS matching 1:1 was performed by using the caliper matching which matched the trainees with non-trainees with a similar propensity score within a caliper distance of 0.15. As such 76 matches were found out on that criterion. Finally, 76 trainees and 76 non-trainees were selected to assess the impact of scientific dairy farming trainings organized by KVK-IVRI on 5 impact parameters, viz. knowledge level, degree of adoption of scientific dairy husbandry practices, attitude towards dairy farming, milk yield and profitability.

For assessing knowledge of farmers on scientific dairy husbandry practices, a knowledge test was developed and validity and reliability were tested. Adoption of scientific dairy farming practices by the respondents was measured with the help of pre-developed scale of Kumar *et al*., 2014 with suitable modifications. Attitude of the respondents towards scientific dairy farming practices was measured using an attitudinal scale developed by Kokate (1980). Milk yield per animal per day was considered to measure the yield parameter. Total variable cost and income analysis was carried out to assess profitability per animal per day basis.

RESULTS AND DISCUSSION

Logistic regression among selected covariates: The results of logistic regression analysis on 320 observations (80 trainees and 240 non-trainees) revealed significant and positive influence of wealth status (middle wealth category), age², gender of respondent category and contact with KVK-IVRI extension professionals on likelihood of participation in KVK-IVRI training programmes (Table 1). On the other hand, factors like age, rich wealth category, marital status (being married) and education of respondents significantly and negatively affected their decision to participate in the training programme.

The above findings imply that as compared to poor wealth category respondents, middle wealth category farmers are more inclined to participate in the training programmes of KVK, while rich farmers have relatively less likelihood of participating in such trainings. The odds ratio (OR given by e^{β}) associated with the variable age indicates that increase in age by one year decreases the likelihood of participation by 24 per cent, thus implying that younger respondents are more inclined to participate. However, the positive sign of the coefficient associated with the variable age^2 indicates that older farmers are more likely to participate in training programmes as compared to their middle-aged counterparts. Similarly, male members of family, unmarried respondents, member involved in dairy management activity in house and farmers who were in contact with KVK personnel were more likely to participate in the training programmes. Education exerted negative effect on likelihood of participation implying their access to other sources of information keep them updated on scientific dairy husbandry practices. Variables like experience in dairy farming, distance to nearest veterinary institution (hospital/polyclinic/dispensary/aid centre), distance to KVK-IVRI and social participation of respondents had no significant influence on their probability of participation in the training programme.

Table 2 elicits the results of logistic regression fitted on 152 observations (76 trainee and 76 non-trainee respondents) after matching. The results revealed that all the variables exerted non-significant influence on probability of participation in the training. This signifies all the covariates are adequately matched or controlled.

Knowledge on Scientific Dairy Husbandry Practice: A comparison analysis of knowledge level of trainees and non-trainees on various aspects of scientific dairy husbandry practices revealed that non-trainees had comparatively lesser knowledge than trainees on every specific aspects *i.e.,* breeding, feeding, housing, health care, general management and calf management (Table 3). Significantly higher knowledge score of trainees than non-trainees on breed and health management aspect of

dairy cows can be attributed to knowledge gained in trainings organized at KVK-IVRI. Similar result was found in the study of Roy (2018) found out the ex-trainee farmers of KVK, Sonamukhi, Bankura and non-trainee farmers of nearby areas differed significantly in knowledge of feeding and health care areas of scientific dairy farming which could be attributed to impact of training programmes organized by KVK. The mean overall knowledge score on scientific dairy farming practices of trainee and non-trainee suggesting trainees had significantly higher ($p < 0.01$) overall knowledge than non-trainees in both before and after situation, which could be related to impact of dairy farming trainings organized at KVK-IVRI. More of trainings on the poor knowledge areas could have a significant effect on dairy husbandry practices of farmers. The result of the study is also in conformity with the findings of Singh *et al.* (2010), Nazir *et al*., (2012), Sai *et al*., (2013), Sharma *et al.,* (2013), Gautam *et al.* (2014), Sharma (2014a), Kumar *et al*., (2014), Aggarwal and Sandhu (2015), Kour (2016), Malabasari and Hiremath (2016) and Monika *et al*. (2016), who observed positive impact of KVK interventions on knowledge level of respondents.

Table 1. Results of Logistic regression before matching (dependent variable = likelihood of participation in training programme).

(n= 320; 80 trainees and 240 non-trainees)

SR #	Variables	B	S.E.	Sig.	Exp(B)
1	Middle wealth category*	.545	.368	.038	1.724
	Rich wealth category*	-2.047	.580	.000	7.744
2	Age of respondent(years)	-.306	.106	.004	.737
3	Age²	.003	.001	.014	1.003
4	Gender of respondent(male=1, female=0)	.909	.460	.048	2.481
5	Marital status of respondent (married=1; unmarried=0)	-2.255	.540	.000	.105
6	Respondent category (member of family engaged in dairy management=1, any member of family=0)	.779	.481	.015	.459
7	Education of respondent (number of years of formal education completed)	-.185	.308	.047	.831
8	Experience in dairy farming (years)	-.322	.307	.294	.725
9	Distance to nearest Veterinary institution** (km)	-.202	.305	.508	.817
10	Distance to KVK-IVRI (km)	.062	.351	.860	1.064
11	Contact with KVK personnel (Yes=1, No=0)	1.024	.460	.026	2.783
12	Social participation (Yes=1, No=0) (if Yes then Member=1, Office bearer=0)	.287	.298	.335	1.333
13	Constant	3.366	2.437	.167	28.965

Classification on the basis of wealth status index computed (appendix 1)

** Veterinary polyclinic / dispensary / hospital or aid centres

Table 2. Results of Logistic regression after matching (dependent variable = likelihood of participation in training programme)

(n= 152; 76 trainees and 76 non-trainees).

SR #	Variables	B	S.E.	Sig.	Exp (B)
1	Middle wealth category*	.194	.434	.655	1.214
	Rich wealth category*	-.855	.812	.293	2.351
2	Age of respondent (years)	-.017	.021	.419	.983
3	Age²	.001	.004	.387	.898
4	Gender of respondent (male=1, female=0)	-.111	.692	.873	.895
5	Marital status of respondent (married=1; unmarried=0)	-.385	.599	.520	.680
7	Respondent category (member of family engaged in dairy management=1, any member of family=0)	.201	.604	.739	1.223
6	Education of respondent (number of years of formal education completed)	.143	.361	.492	1.154
7	Experience in dairy farming (years)	.135	.364	.710	1.145
8	Distance to nearest Veterinary institution** (km)	.115	.357	.748	1.122
9	Distance to KVK-IVRI (km)	1.472	.448	.321	4.357
10	Contact with KVK personnel (Yes=1, No=0)	.375	.578	.516	1.456
11	Social participation (Yes=1, No=0) (if Yes then Member=1, Office bearer=0)	-.101	.353	.775	.904
12	Constant	-1.490	1.939	.442	.225

Impact assessment of training on selected impact parameters (comparison of trainee and non-trainee farmers)

Table 3. ATT (Average treatment effect on treated) on knowledge level of farmers on different aspects of scientific dairy husbandry practices.

SR #	Knowledge	Before matching		z-value	After matching		z-value
		Trainees (n=80)	Non-trainees (n=240)		Trainees (n=76)	Non-trainees (n=76)	
1	Knowledge on breeds	2.050±0.112	1.558±0.069	3.721**	2.080±0.117	1.360±0.120	4.334**
2	Knowledge on feeding practices	4.790±0.224	3.988±0.15	2.995*	4.820±0.231	4.140±0.286	1.576*
3	Knowledge on breeding management	5.113±0.374	4.075±0.221	2.38*	5.080±0.384	4.120±0.392	1.750
4	Knowledge on housing management	0.475±0.104	0.254±0.038	2.002*	0.460±0.103	0.260±0.6	1.649*
5	Knowledge on health management	5.563±0.248	4.508±0.16	3.573**	5.510±0.258	4.460±0.286	2.733*
6	Knowledge on General management	3.250±0.294	2.183±0.162	3.117*	3.24±0.300	2.83±0.326	0.921
7	Knowledge on calf management	2.338±0.174	1.917±0.098	2.105*	2.280±0.179	1.920±0.182	1.989*
Overall Knowledge Score		23.575±0.824 (Mean ± SE)	18.483±0.453	5.412**	23.460±0.854	19.180±0.904	3.438**

Adoption of Scientific Dairy Husbandry Practices: Evaluating overall adoption score of scientific dairy husbandry practices like feeding, breeding, general management and health care reveals dairy farming trainings organized at KVK-IVRI having significant impact on adoption behavior of trainees (Table 4). Awareness leads to knowledge which triggers adoption. Exposure in training programmes organized by KVK-IVRI created a great opportunity to know about the relative advantage, complexity and compatibility of practices, which led the farmers for adopting the practices and lack of awareness and knowledge for non-trainees led to either active or passive rejection of the innovation. This suggests that training had enormous role in better adoption of scientific dairy husbandry practices, which are highly needed to improve the productivity of livestock and profitability of farmers in the current scenario. The findings are in line with the findings of Behaghel *et al.,* (2018) who reported that farmers in villages with trained farmer trainers (FTs) reportedly used slightly more technologies (average 13.85 number of technologies) than used by farmers in comparison villages (average 9.15 technologies). The use of technologies enhanced milk production in the area.

Table 4 ATT on adoption of different scientific dairy husbandry practices.

SR #	Adoption parameter	Before matching		z-value	After matching		z-value
		Trainees (n=80)	Non-trainees (n=240)		Trainees (n=76)	Non-trainees (n=76)	
1.	Feeding	6.34 ± 0.19	5.68 ± 0.115	2.983*	6.34 ± 0.2	5.37 ± 0.215	3.318*
2.	Breeding	7.36 ± 0.197	5.65 ± 0.107	7.64**	7.36 ± 0.201	5.55 ± 0.194	6.443**
3.	General management	13.66 ± 0.218	11.40 ± 0.123	9.093**	13.61 ± 0.224	11.43 ± 0.239	6.632**
4	Healthcare	6.59 ± 0.173	3.92 ±0.085	13.824**	6.62 ± 0.179	3.91 ± 0.156	11.435**
5.	Overall adoption score	33.95 ± 0.437	26.65 ± 0.209	15.073**	33.92 ± 0.453	26.26 ±0.413	12.486**

Attitude towards Dairy farming: Analyzing Table 5, overall attitude of farmers towards dairy farming, though significant difference was there between trainees and non-trainees before matching but results after matching shows training did no impacted to a significant extent in terms of overall attitude change of trainees towards scientific dairy husbandry practices. A sustainable attitude change requires plethora of interventions (Chauhan *et al*., 2017), a single training could not impact to an extent for attitude change of dairy farmers towards scientific dairy farming. The finding contradicts the findings of Khode (2018), Sharma (2014b) and Yadav and Mehta (2014) who reported training had a positive impact on attitude of farmers towards dairy farming.

Impact on yield: To assess the parameter yield from scientific dairy husbandry practices; number of animals possessed by the owner, total milk yield and milk yield per animal was calculated. Table 6 illustrates trainees were having better milch animal strength in the herd than non-trainees in both before and after matching scenario resulting significantly higher total milk yield than non-trainees. So considering average milk yield per animal per day (in litre), also significant difference was found between trainees and non-trainees i.e. 2.979 & 2.77 before matching and 2.978 & 2.695 after matching, respectively. Larger herd of milch animals, higher total milk yield and higher average milk yield per animal per day for trainees may be attributed to better scientific husbandry practices followed by them. Application of learned improved managemental practices resulted to higher productivity for trainees from dairy farming. The findings are in agreement with the findings of Sharma *et*

al., (2014) who reported in their study on "Impact evaluation of training programmes on dairy farming in Punjab state" that because of improved management at dairy farms, the average milk production per animal per day increased from 6.76 l to 6.93 l. Mateo (2015) also reported on their study that those who joined ILRI's training program witnessed an increase in their dairy animals' milk yield by 11.7%. Behaghel *et al.,* (2018) reported on their study that both farmers and trained FTs in treatment villages seemed to have produced more milk than those in comparison villages, although the average effects are not statistically significant. Khode *et al.,* (2020) concluded from his study that difference between mean milk yield indices across the dairy trainee (103) and non-trainee (93) was significant implying yield difference might be due to the training intervention which might have enhanced their knowledge level and upgraded their skill in dairying.

Table 6. ATT on yield parameters.

SR #	Impact variables	Before matching		Z-value	After matching		Z-value
		Trainees (n=80)	Non-trainees (n=240)		Trainees (n=76)	Non-trainees (n=76)	
1.	No of milch animal	4.840 ± 0.750	3.130 ± 0.670	0.677*	4.860 ±0.440	3.090 ± 0.670	0.634*
2.	Milk yield/day (in litre)	14.423 ±1.180	8.670 ± 1.090	1.096**	14.463±0.890	8.330 ± 0.970	1.648**
3.	milk yield/animal/ (in litre)	2.979 ± 0.940	2.770 ± 0.980	1.197**	2. 976 ±0.880	2.695 ± 0.890	1.168**

*Significant at 0.05 level of probability, **Significant at 0.01 level of probability

Profitability of dairy farming (Per animal per day)

*Significant at 0.05 level of probability ** Significant at 0.01 level of probability

It can be inferred from Table 7 that the quantity of green fodder, dry fodder, concentrate fed to dairy animals by trainees was significantly (P<0.01) higher than non-trainees, whereas there was no significant difference between trainees and non-trainees in terms of use of mineral mixture in cattle feed before and after matching. Behaghel *et al.,* (2018) also reported that trained FTs increased their expenditure on feeding practices than comparison group FTs who did not receive any training. Trainees and non-trainees expressed there was no variation found in the unit cost of green fodder and dry fodder for both trainees and non-trainees. There was significant (p<0.05) difference in the unit cost of concentrates between trainees and non-trainees, whereas no significant difference in the unit cost of mineral mixture. Trainees spent significantly (p<0.05) more on the medicines including cost of vaccines and breeding expenses than non-trainees both before and after PS matching. The cost incurred on medication was less by non-trainees which could be due to less practice of vaccination and A.I as less awareness and knowledge on importance of these practices. There was no significant difference in the labor cost incurred for farm management by both trainees and non-trainees. The amount spent by trainees on other variable expenditures including electricity, water, insurance, transportation of animals and other miscellaneous costs were significantly (p<0.01) higher than non-trainees. The total variable cost for trainees and non-trainees was Rs. 54.12 and Rs. 40.29 before matching and Rs. 54.29 and Rs. 41.97 after matching. Trainees had significantly higher (p<0.01) variable cost of scientific dairy husbandry than non-trainees both before and after matching.

In terms of quantity of milk sold after domestic consumption, there was high significant (p<0.01) difference found between trainees and non-trainees both before and after matching whereas, there was no significant difference in terms of price per unit of milk sold. Total income from sale of milk was found out for both trainee and non-trainee which was Rs. 90.53 and Rs. 70.44 before matching and Rs. 89.43 and Rs. 66.92 after matching; respectively suggesting trainees had significantly higher income from milk selling than non-trainees.

Profit from dairy farming (per animal per day) was calculated by subtracting total variable cost involved in dairy farming from total income and found out to be Rs. 36.41 and Rs. 30.15 before matching and Rs. 35.13 and Rs. 24.94 after matching for trainees and non-trainees, respectively, concluding trainees had a significantly higher net profit than non-trainees.

The cost involved in dairy farming per animal per day in rupees by non-trainees was comparatively lesser than trainees and the quantity of milk produced and income from sell of milk was also lower, resulting in reduced profit for non-trainees from dairy farming. The non-trainees were found to use lesser quantity of feed ingredients on daily basis for dairy animal rearing shows that they were not aware of balanced feeding to animals according to body weight and physiological status, whereas trainees were found to be comparatively more aware of balanced feeding practices in dairy farming. The reason could be on-farm production of green fodder and dry fodder which could have increased the availability to use it as animal feed. The lesser amount spent on concentrate and mineral mixture by non-trainees could be an indication of compromise with the quality of

ingredients. Due to small size of milch herd, self-management was adopted by both trainees and non-trainees, which reduces the labor cost and no disparity in the same parameter between trainees and non-trainees. Income from dairy farming was lower for non-trainees due to lower milk production (per animal per day). Though the average cost of milk sold did not vary significantly between trainee and non-trainee farmers, dairy farming was comparatively less profitable to non-trainees than trainees. The findings are in partial agreement with the findings of Khode (2018) who suggested average daily milk yield per farm, net return per animal, net return per farm, expenditure on feeding, labor and overall input cost per animal except dry fodder feeding and health cost was found significantly higher in trainees compared to non-trainees. However, trainees had slightly higher daily net return per litre of milk as compared to non-trainees but the difference was non-significant. Sharma *et al.,* (2014) reported that due to training intervention, increase in net profit per animal per year was Rs. 2607.82, which can be concluded that specialized training courses in dairy farming proved to be beneficial to dairy farmers by enhancing their profit and thereby their socioeconomic status.

Conclusion: The training programs organized by KVK-IVRI on scientific dairy management for dairy farmers during the duration of 2014-2016 was found to have high significant impact on their knowledge on scientific dairy husbandry practices, better adoption of scientific dairy husbandry practices in their field conditions and yield from dairy. Similarly, significant impact was seen on profitability of trainee farmers from scientific management of dairy animals, whereas, dairy farmer's attitude towards scientific dairy farming did not change significantly due to training intervention. Hence organizing substantial number of trainings on specific and emerging areas of dairy management with wider coverage of farming population extending all the KVKs throughout India will definitely play crucial in strengthening the dairy sector of our country.

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Appendix-1

Table 5 ATT on attitude of farmers towards dairy farming.

Sl. No.	Attitude	Before matching		z-value	After matching		z-value
		Trainees (n=80)	Non-trainees (n=240)		Trainees (n=76)	Non-trainees (n=76)	
1.	Absolute gain in terms of economic return from dairy farming is very low.	2.250 ± 0.079	2.113 ± 0.043	1.539	2.240 ± 0.081	2.120 ± 0.077	1.056
2.	Dairy farming should be undertaken extensively by all the farmers.	±0.098	1.438 ± 0.051	1.816	1.670 ± 0.102	1.240 ± 0.700	3.524*
3	Dairy farming is not the solution to remove poverty.	0.980 ± 0.018	0.804 ± 0.033	4.532**	0.970 ± 0.018	0.830 ± 0.062	2.637*
4	Dairy farming is an instrument for social and economic change.	1.050 ± 0.030	0.913 ± 0.036	-3.484*	1.070 ± 0.051	0.921 ± 0.068	-2.094*
5	Natural service is better than A.I.	2.860 ± 0.029	2.280 ± 0.018	3.417**	2.880 ± 0.018	2.320 ± 0.046	1.866**
6	I feel that I am as much involved personally in the crops that I grow as with dairy animals that I have.	1.125 ± 0.048	1.196 ± 0.034	-1.201	1.130 ± 0.051	1.210 ± 0.063	-0.976
7	If given a choice, I would rather grow crops than raise animals.	0.863 ± 0.056	0.675 ± 0.440	2.648*	0.860 ± 0.058	0.510 ± 0.093	3.123*
8	Expenditure of feeding of dairy animals is compensated by more milk.	1.642 ± 0.884	1.413 ± 0.590	-2.157*	1.710 ± 0.088	1.380 ± 0.107	-2.373*
9	Dairying should not be encouraged as most of the farmers are small and marginal farmers.	0.532 ± 0.092	0.479 ± 0.055	0.492	0.510 ± 0.096	0.450 ± 0.098	0.433
10	Dairy farming should be covered through insurance scheme.	3.000 ± 0	2.992 ± 0.006	1.417	3.000± 0	3.000 ± 0	0
11	Dairying is less profitable than agriculture.	2.088 ± 0.100	1.563 ± 0.064	-4.42**	2.180 ± 0.103	1.570 ± 0.112	-4.062**
12	Dairy development can bring self-sufficiency in our country.	2.988 ± 0.013	2.663 ± 0.048	6.611**	2.990 ± 0.013	2.660 ± 0.085	3.828**
13	Money spent on dairying is a waste.	1.209 ± 0.027	0.938 ± 0.041	6.558**	1.197 ± 0.029	0.930 ± 0.068	3.227*
14	Input subsidy should be given to enhance dairying among the poor families.	3.000 ± 0	3.000 ± 0	0	3.000 ± 0	3.000 ± 0	0
15	Dairy farming has more limitations than advantages	1.889 ± 0.069	1.138 ± 0.046	0.951	1.887 ± 0.069	1.137 ± 0.071	-0.399
16	Dairying can create more employment in our area.	2.950 ± 0.035	2.825 ± 0.036	2.5*	2.950 ± 0.037	2.720 ± 0.076	2.638*
	Overall attitude score	34.860 ± 0.256	34.150 ± 0.172	2.298*	34.830 ±0.266	34.080 ± 0.325	1.787

**Significant at 0.01 level of probability, *Significant at 0.05 level of probability,

Appendix-2

Table 7 ATT on profitability.

Sl. No.	Parameters		Before matching			After matching		
			Trainee (n=80)	Non-trainee (n=240)	Z-value	Trainee (n=76)	Non-trainee (n=76)	Z-value
	Variable cost per animal per day							
1	Green fodder	Quantity (in Kg)	14.76 ± 0.304	12.37 ± 0.181	6.769**	14.83 ± 0.310	12.62 ± 0.323	4.937**
		Cost/unit (Rs/Kg)	1 ± 0	1 ± 0		1 ± 0	1 ± 0	
2	Dry fodder	Quantity(in Kg)	4.244 ± 0.127	3.783 ± 0.071	3.152*	4.276 ± 0.131	3.618 ± 0.128	3.588**
		Cost/unit (Rs/Kg)	2 ± 0	2 ± 0		2 ± 0	2 ± 0	
3	Concentrate	Quantity(in Kg)	1.193 ± 0.034	0.805 ± 0.032	8.322**	1.198 ± 0.035	0.927 ± 0.058	3.997**
		Cost/unit (Rs/Kg)	12.79 ± 0.16	11.99 ± 0.19	3.178*	12.86 ± 0.17	12.34 ± 0.24	1.775*
4	Mineral mixture	Quantity(in gm)	33.5 ± 2.34	33.38± 1.272	-0.047	35.16 ± 2.43	33.66 ± 2.09	-0.778
		Cost/unit (Rs/Kg)	105.25 ± 1.46	103.75 ± 0.83	0.875	105.26 ± 1.52	105.13 ± 1.48	0.062
5	Medicines (including vaccines) and breeding expenses		3.30 ± 0.04	3.13 ± 0.03	2.042*	3.29 ± 0.04	3.14 ± 0.04	2.517*
6	Labor (In Rs.)		2.61 ± 0.29	2.49 ± 0.14	3.527	2.54 ± 0.30	2.48 ± 0.19	3.775
7	Electricity + water (In Rs.)		0.80 ± 0.03	0.45 ± 0.02	10.139**	0.79 ± 0.03	0.45 ± 0.04	7.599**
8	Insurance + transportation + miscellaneous (In Rs.)		1.23 ± 0.05	0.45 ± 0.29	10.912**	1.22 ± 0.05	0.66 ± 0.04	8.946**
	Total variable cost (In Rs.)		54.12 ± 0.78	40.29 ± 0.53	14.682**	54.29 ± 0.81	41.97 ± 0.95	9.903**
	Income per animal per day							
	Milk sale	Quantity (In Litre)	2.594 ± 0.071	2.044 ± 0.029	7.179**	2.566 ± 0.069	1.954 ± 0.045	7.42**
		Cost/unit (Rs/Litre)	34.89 ± 0.32	34.50 ± 0.19	1.026	34.86 ± 0.33	34.39 ± 0.38	0.925
	Total income from milk (In Rs.)		90.53 ± 2.63	70.44 ± 1.09	7.065**	89.43 ± 2.54	66.91±1.62	7.466**
	Profit (In Rs.)		36.41 ± 2.66	30.15 ± 1.17	2.153*	35.13 ± 2.57	24.94 ± 1.88	3.2*

Appendix-3

The wealth index used a 19 asset variables divided into three categories, viz. ownership of farm assets, household assets and farm-specific characteristics. Appendix 1 presents the specific assets under each of these categories. The index was a weighted linear wealth index where the weights were obtained using principal component analysis. The index is of the following form:

$Ai = \Sigma fk\ (aik - ak) / sk$

Where,

Ai = Value of Index of the ith household

fk = Factor score coefficient for the kth asset by the principal component method

aik = Value of the kth asset for the ith household

ak = Mean of the kth asset over all households

sk = Standard deviation of the kth asset over all households.

Once, the Asset index was obtained for each sample household, the cumulative square root of frequency method was used to categorize each household into one of the three wealth categories, viz. Poor, Medium and Rich on the basis of its Wealth Index.

Table 8. Asset variables used in the composite wealth index.

Ownership of farm assets with Nos	Ownership of household assets with Nos	Farm specific characteristics
Tractor	Radio	Size of land holding
Milking machine	Television	Herd size
Chaff cutter	Mobile phone	
Water pump	Computer	
Sprinkler set	Refrigerator	
Drip irrigation set	LPG	
Plough	Washing machine	
	Water-purifier	
	Air Conditioner	
	Motor cycle	