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Thirunavukkarasu D and Jothilakshmi M *

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Article

Modelling the Factors Affecting the Adoption of Compound Feed in Dairy Animal Feeding

D. Thirunavukkarasu [1] and M. Jothilakshmi [2,*]

[1] Associate Professor, Veterinary College and Research Institute, Namakkal-637002, Tamil Nadu Veterinary and Animal Sciences University, India; dthirunavukkarasu@gmail.com

[2] Assistant Professor, Veterinary College and Research Institute, Salem-636112, Tamil Nadu Veterinary and Animal Sciences University, Tamil Nadu, India

* Correspondence: drjothi80@gmail.com; Contact Number: 09585075570

Running head: Factors driving adoption of compound feed

Abstract: Smallholder dairying engages around 70 to 80 million rural households who are mostly landless, small and marginal farmers. These farmers face challenges in terms of adoption of balanced feeding practices including inclusion of compound feed in animal feeding. This necessitates to understand the socio-economic factors that are influencing the adoption of compound feed. The study found that 51% of dairying households adopted compound feed in animal feeding. The adopters and non-adopters of compound feed differed ($P< 0.01$) in terms of land holding, family educational status, breeds owned, membership status in farmer's collectives, fodder adoption, area under fodder, access to grazing resources, availability of crop residues, milk production and milk marketing opportunities. Furthermore, users and non-users of compound feed had significant difference ($P< 0.05$) in extension agency contact, mass media contact, attitude towards dairying and gender participation in farming. The logit regression model explained the variance in adoption to 30%. Further it indicated the role of selective socio-economic characters, farming situations, feeding and marketing practices in adoption of compound feed. In specific membership in farmer's collectives, marketing opportunity, milk production, farm men participation, family education status, grazing resources and attitude towards dairying has greatly influenced the adoption behaviour of compound feed in positive direction. Added, households with high experience, cultivating fodder and having access to crop residues tend to influence the adoption decision negatively. The research observed that farmers tend to use compound feed for increasing productivity in areas of better markets and there exists trade-offs between milk market opportunities, access to cheaper roughages and usage of compound feed.

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Introduction

Smallholder dairying plays an important role in upliftment of rural people through the generation of additional income and employment. It engages around 70 to 80 million rural households. Within the rural section, landless, small and marginal farmers constitute the majority of the dairy farming households. It is an important occupation for women of the rural who are still more vulnerable. Added on to the above nature of dairying, this acts as a cope up mechanism to mitigate the effects of crop failures. This dairying is carried out through integration with crop components in a mixed farming approach. Later supplies much of the feed requirements of animals through crop residues. In mixed farming, 50 to 84 % of the farmers utilise the crop residues in feeding (Valbuena *et al.*, 2011). Thus, this implies the organic relationship between dairy and crop. As like the country, Tamil Nadu state too has similar situations in dairying. It is one among the top milk producing states with estimated households of 2.3 million producing 206 lakh litres per day. At the same moment, the productivity of milk per in-milch bovine is 6.81 kgs per day against state such as Punjab with nearing 10 kgs per day. The main reasons for the low productivity of livestock are due to malnutrition, under-nutrition or both, beside the low genetic potential of the animals. The

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adequate supply of nutritive fodder and feed is a crucial factor influencing the productivity and performance of the animals. One of the major feeding resources for animals is crop residues of paddy, sorghum, groundnut etc. Kannan (2012) reported that the cultivation of Groundnut, Paddy and Sorghum which forms major part of crop residue in animal feeding has negative compounded annual growth rate in terms of acreage under cultivation for the period 1967-68 to 2007-08 in Tamil Nadu. Paddy cultivation has declined from 22.75 to 17.89 lakh hectares during 1998-99 to 2007-08 and in the same period sorghum cultivation have moved down from 36.50 to 28.35 lakh hectares in Tamil Nadu. In case of maize cultivation, the trend was opposite. As per Government of Tamil Nadu -GoTN (2014) area under cultivation of maize has increased from 55,000 to 3.80 lakh hectares. Replacing food-feed (residue of the food crop used as feed) crops namely paddy, groundnut and sorghum with crops like maize, black gram, green gram, coconut, fruits and vegetable has increased over the years (Velavan and Balaji, 2012). Added to the above, there is shortage of 20 million tonnes of dry matter (NDDB 2014) and wide variation in availability of dry and green fodder across districts of Tamil Nadu. To address the above issues, Tamil Nadu state government has been promoting grasses, cereal and leguminous fodder to meet out two-third of dry matter requirements and the remaining through concentrates and compound feed through various programmes across state for last one decade. Furthermore, dairy co-operative system has been promoting compound feed at subsidised costs with a budget outlay of INR 218 million for the period 2014-2019(GoTN, 2017). Added to the above, the organised private dairy players and feed companies have been promoting the usage of compound feed. Furthermore, the feed industry has designed wide range of compound feed products to cater the diversified requirements (lactation stage wise and animal milk yield potential wise) of cattle. The production compound feed across the country has increased from initial production of 50,000 tonnes per annum to 7.5 million metric tonnes during the period 1960's to 2018 against the estimated potential of 30 million metric tonnes in the country. Currently, the cattle feed market size is growing at a rate of 10% per annum and 88% of the compound feed requirement is met out through the informal sector (Motilaloswal, 2019). In southern states of India, 2.31 million MT of feed is produced per annum. This account 31% of total compound feed produced in the country (Yes bank, 2015).

The above changes namely increasing production, supply and promotional activities for compound feed, changing cropping pattern and thrust for fodder development necessitates comprehending on level of adoption and factors driving adoption of "compounded feed" in dairy animal feeding in Tamil Nadu.

Methodology

To understand the above, data on 384 dairying households which was part of author research titled "Transition of smallholder dairy farming in mixed crop livestock farming system of Tamil Nadu" was used. The above 384 households were distributed in three crop-livestock systems of the state on the proportionate basis to share of households. The data was collected from seven districts, covering 21 villages of Tamil Nadu. This data set, had information on selective socio-economic and psychological characters of farmers, farming situations, feeding practices and marketing practices. The variables were reported in various levels of measurements. The adoption of compounded feed was recorded at nominal level. Based on the available nature of data, the researcher used descriptive statistics and logit regression model to understand the role of "compounded feed" in dairy animal feeding and factors driving the adoption.

Results and discussion

The data revealed that one-fifth dairying household was landless and more than half of farmers had less than 5 acres of land. On an average household possessed 2.8 acres of land. Added, three-fourth of households possessed 1 to 2 adult milch animals. The above observations were similar with findings of Jothilakshmi et al(2014). Majority (67%) had Jersey cross-breed animals, and the remaining had Holstein Frisian cross with or without Jersey cross. The primary reason for possession of dairy animals in 58% of the households is for home consumption and followed by additional income. For

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others the primary reason was additional income and followed by home consumption. The average milk production per household was about 9.8 litres / day. In 56% of the households, women carried out the majority of the dairy activities. More than half (53%) of the household's representative were members of farmers collectives (Co-operatives / Farmers producer organisation). About three-fifth (59%) of households had access to sell milk through organised sector (Co-operatives / Private processers) and others do not had any access. The average price received per litre of milk was INR 22. About 63 % of the farmers had moderate contact intensity with extension system. On an average, dairy farmer has mass media contact intensity of 21 mean percentage score and an experience of 29 years in dairying. The education status of households is ranged from 1 to 8.5 with an average score of 4.64. About 43% of households have partial or complete adoption of the promoted fodder innovations. The average cultivated fodder was approximately was 0.1 hectare. About 69% of households have access to own crop-residue materials for feeding for dairy animals. While three-fourth of farmers doesn't have access to community grazing lands and permanent fallow lands for the purpose of grazing. Added to the above available roughages, farmers were supplementing selective concentrates with/without compound feed in the study area. More than half (51% - 196 households) of the households has adopted the practice of feeding compound feed during feeding to animals.

The adopters and non-adopters of compound feed differed ($P< 0.01$) in terms of land holding, family educational status, breeds owned, membership status in farmer's collectives, fodder adoption, area under fodder, access to grazing resources, availability of crop residues, milk production and milk marketing opportunities (Tables 1 and 2). Furthermore, users and non-users of compound feed had significant difference ($P< 0.05$) in extension agency contact, mass media contact, attitude towards dairying and gender participation in farming.

Table 1. Selected socio-economic and farm variables (Metric) differentiating adopters and non-adopters of compounded feed n=186+198=384.

Variables	Mean Rank	Sum of Ranks	U value
Land holding			
Adopters	165.61	31134.00	13370.000**
Non-adopters	218.30	42786.00	
Number of adult animals owned			
Adopters	183.05	34413.00	16647.000
Non-adopters	201.57	39507.00	
Sale price of milk			
Adopters	182.21	34255.00	16490.000
Non-adopters	202.37	39665.00	
Mass Media score			
Adopters	179.39	33725.00	15960.000*
Non-adopters	205.08	40195.00	
Experience			
Adopters	202.31	38034.00	16580.000#
Non-adopters	183.09	35886.00	
Milk production			
Adopters	173.56	32628.50	14862.500**

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Non-adopters	210.67	41291.50	
Milk marketing opportunity			
Adopters	164.53	30932.00	13166.000**
Non-adopters	219.33	42988.00	
Family education status			
Adopters	171.69	32278.00	14510.000**
Non-adopters	212.46	41642.00	
Attitude towards dairying			
Adopters	179.37	33722.00	15960.00*
Non-adopters	205.09	40198.00	
Fodder area			
Adopters	175.43	32981.50	15215.500**
Non-adopters	208.87	40938.50	

*Adopters and non-adopters differ at ** P<0.01, * P<0.05 and ᵃ P<0.10.*

Table 2. Selected socio-economic and farm variables (Non-Metric) differentiating adopters and non-adopters of compounded feed n=186+198=384.

Variables	**Non-adopters**	**Adopters**	**Chi square value**
Gender participation			
Women alone	118 (63)	95 (48)	11.938*
Men alone	52 (28)	60(31)	
Both	18 (9)	41(21)	
Total	188 (100)	196(100)	
Membership in farmers collectives			
Non- member	106 (56)	74 (38)	13.371**
Member	82 (47)	122 (62)	
Total	188 (100)	196(100)	
Fodder adoption status			
Non- adopters	122 (65)	98 (50)	8.699*
Adopters	66 (35)	98 (50)	
Total	188 (100)	196(100)	
Types of animal owned			
Local and /or Jersey cross	146 (78)	111(57)	19.167**
Jersey cross + Holstein Frisian cross	42 (32)	85(43)	
Total	188 (100)	196(100)	
Access to grazing resources			
No access	121(64)	161(82)	15.553**
Able to access	67 (36)	35(18)	
Total	188 (100)	196(100)	

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Availability of crop residues			
Not available	77 (41)	42 (21)	
Available	111 (59)	154 (79)	17.112**
Total	188 (100)	196(100)	
Reasons for dairying (Primary)			
Home consumption	105 (56)	113(58)	
Additional income	83 (34)	83 (42)	0.127
Total	188 (100)	196(100)	

*Adopters and non-adopters differ at ** P<0.01 and * P<0.05.*

The binominal logistic regression which tested the joint significance of the predictor variables, found that the model is significant at one per cent level of probability with a Chi-square value of 98.65. This estimated model correctly classified 72.04 per cent of the adopters. The predictor variables used in this study explained about 30.20 % (Pseudo R2 =0.302) of the variance in adoption status of compound feed in feeding. The result is similar to the observation of Rogers (2003), who reported the substantial role of socio-economic, personality and communication characters in influencing the adoption of innovations also in parallel to observations of Thirunavukkarasu and Narmatha (2016) in smallholder dairying. The remaining variance may be due to attributes of compounded feed, which explain 49 to 87 % of variance in adoption (Rogers, 2003). Membership in farmer's collectives and marketing opportunity had significant positive relationship with the dependent variable "adoption of compound feed" (Table 3). This implies that increasing participation in farmer's collectives, improved forward linkages and market through organised sector increases the probability of using compounded feed. Milk production, farm men participation, family education status and limited access to grazing resources have a significant positive relationship with usage of compound feed. In addition, households with better attitude towards dairying (at 10% level of significance) likely to adopt compound feed. While households with high experience, cultivating fodder and having access to crop residues tend to avoid compound feed.

Table 3. Relationship between selected Predictor variables and adoption status of compounded feed n=186+198=384.

Variables	B	S.E.	Wald	df	Exp(B)
Land holding	0.038	0.057	0.443	1	1.039
Number of adult animals	-0.268	0.208	1.655	1	0.765
Sale price of milk	-0.005	0.018	0.076	1	0.995
Mass media contact intensity	-0.004	0.012	0.092	1	0.996
Experience in dairying	-0.015	0.008	3.334	1	0.985#
Dairying for additional income	0.314	0.290	1.178	1	1.369
Milk production	0.000	0.000	3.899	1	1.000*
Membership in farmers collectives	0.695	0.262	7.033	1	2.004*
Market opportunity	0.454	0.161	7.951	1	1.575*

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Adoption of fodder innovation	-0.603	0.347	3.013	1	0.547#
Family education status	0.198	0.088	5.017	1	1.219*
Gender participation			8.123	2	
Both	1.008	0.358	7.936	1	2.739*
Only men	0.103	0.273	0.143	1	1.109
Contact with Livestock extension system	0.100	0.252	0.158	1	1.105
Attitude towards dairying	0.065	0.039	2.820	1	1.068#
Access to grazing resources – No	0.627	0.285	4.839	1	1.873*
Access to crop residue	-0.850	0.314	7.314	1	0.427*
Fodder area	0.004	0.004	0.967	1	1.004
Possession of high yield animals	0.316	0.296	1.140	1	1.372
Distance to town	0.019	0.015	1.536	1	1.019
Constant	-3.085	0.864	12.757	1	0.046

*Adopters and non-adopters differ at * P<0.05 and # P<0.10.*

The assured market opportunities through organised processors for milk, supply and short term credit arrangement for compounded feed at milk collection centres may be reasons for driving adoption. This study found that out of the total adopters, 78% was pouring/selling milk to organised dairy. Added, assured market opportunities to farmers and changing cropping pattern may be driving intensification within smallholder production (Duncan *et al.,* 2013) and making farms more of moderate intensive nature (Thirunavukkarasu *et al.*, 2014). The membership in farmer's collectives increase the network among which facilitates knowledge / experience sharing and market linkages may be promoting adoption of innovation (Bandiera and Rasul 2002 and Rousan, 2007) which may be reason for promoting compound feed adoption. More than three-fifth (62%) of adopters are members in farmer's collectives. Added, the education is aiding in accessing knowledge and technological resources and prompting for adoption of feed innovations (Rathod *et al.,* 2016). Further, men centric farms tend to use more of compound feed on comparing to farms that are women centric. The social restrictions for farm women in rural sides may limit the access to compound feed or any other external inputs. Added, the households with high production potential and better feelings with dairying likely to utilise more external resources such as compound feed to improve scale of production and monetise the opportunities. While households with high experience, cultivating fodder and having access to crop residues tend to avoid compound feed in order to minimise the cost of milk production. Overall the findings of the study deviates from the past studies which reported that land holdings, dairy income, animal holdings and net return had positive association with adoption of improved feeding practices (Chauhan *et al.,* 2006 and Kumar *et al.,* 2012).

Conclusion

To sum up, this research reveals the households with better education, men centric farms, producing high quantities of milk with limited access to grazing resources in the areas of assured market are more likely to adopt compound feed. In these situations, farmers try to maximise the productivity thorough using compound feed in animal feeding. While in situations with access to

crop residue and fodder, the farmers likely reduce the adoption of compound feed to minimise the cost of production. Thus there is a trade-offs between milk market opportunities, cheaper dry matter resources and compound feed.

References

Bandiera, O. and Rasul, I. 2002. Social networks and technology adoption in Northern Mozambique. *CEPR Discussion paper no 3341*. Center for Economic Policy Research, London.

Chauhan, D.S, Kamble, V.J, Padghan, P.V, Khandare, N.O, and Kamble, R.R. 2006. Dairy farming practices adopted in tribal area of Kinwatthesil (district – Nanded). *Indian Journal of Animal Research*, 40(1): 64-66

Duncan, A.J., Teufel, N, Mekonnen, K, Singh, V.K, Bitew, A. and Gberemedhin, B. 2013. Dairy intensification in developing countries: Effects of market quality on farm level feeding and breeding practices. *Animal*, 7(12):2054-2062.

GoTN. 2014. Season and Crop Report of Tamil Nadu, Commissioner of Statistics, 2014. Department of Economics and Statistics, Government of Tamil Nadu.

GoTN. 2017. Policy note on Dairy Development. Animal husbandry, Dairying and Fisheries department, Government of Tamil Nadu.

Jothilakshmi M, Thirunavukkarasu D Sudeepkumar NK (2014) Exit of youths and feminization of smallholder livestock production–A field study in India. Renew Agric Food Syst 29(2):146-150. doi:10.1017/S174217051300001X.

Kumar, B.R., Baskaran, D. and Pandian, A.S.S. 2012. Factors influencing the adoption of new feeding technology by the farmer interest groups (FIGs) of Vellore district in Tamil Nadu. *Indian Journal of Animal Research* 46(4):389 - 392

Kannan, E and Sujata, S. 2012. Analysis of Trends in India's Agricultural Growth. *Asian Journal of Agriculture and Development*, 8(2):79-99

Motilaloswal. 2019. Agriculture- Godrej Agrovet. https://www.motilaloswal.com/site/rreports/636897082517710416.pdf.

NDDB. 2014. Dairying in Tamil Nadu - A Statistical Profile 2014.

Rathod, P, Chander, M and Bardhan, D. 2016. Concentrate feeding to dairy cattle: Adoption status and factors affecting its adoption in India. *Indian Journal of Animal Research* 50(5):788-793

Rogers, E.M. 2003. Diffusion of innovations 5th edn. Simon & Schuster, New York. Free press.

Rousan, L.M. 2007. Factors Influencing Adoption of Improved Farm Practices among Women Farmers in Northern Jordan. *American-Eurasian Journal of Agricultural & Environmental Sciences*, 2 (3): 220-226.

Thirunavukkarasu, D, Jothilakshmi,M, Murugesan,S and Doraisamy, K.A. 2014. Transition of smallholder dairy farming system - a micro study in Tamil Nadu, India. Livestock Research for Rural Development. Volume 26, Article #88. http://www.lrrd.org/lrrd26/5/thir26088.html

Thirunavukkarasu, D and Narmatha N. Lab to land – factors driving adoption of dairy farming innovations among Indian farmers. Current science, 111(7), 1231-1234. Doi: 10.18 520/ cs/v111/i7 /1231 -1234

Yes bank, 2015. Indian Feed industry. https://www.yesbank.in/pdf/indian_feed_industry-_revitalizing_nutritional_security.pdf

Valbuena, D, Gerard, B Duncan, A, Teufel, N, Homann, S, Bhatia, M. 2011. Trade-offs of crop residue use in smallholder *mixed farming systems in Sub-Saharan Africa and South Asia. Proceedings of 5th World Congress on Conservation Agriculture and 3rd Farming Systems Design Conference, Sep 26-29, 2011, Brisbane, Australia.*

Velavan, C. and Balaji, P. 2012. Crop diversification in Tamil Nadu-A Temporal Analysis. *Agricultural Situation in India* 78(12): 655-658.

 doi:10.20944/preprints202307.0592.v1