



## Effectiveness of cattle and buffalo expert system in knowledge management among the farmers

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Received: 30 August 2015; Accepted: 21 September 2015

### ABSTRACT

Present investigation was conducted to assess the effectiveness of cattle and buffalo expert system which was developed under the network project on 'Development of Expert System for Crop and Animal Enterprises' with Central Institute for Women in Agriculture (CIWA) as the lead centre. The primary aim of the project was to develop an expert system on cattle and buffalo. The study was carried out to test the effectiveness of developed expert system in terms of knowledge gain and skill acquisition among the 140 farmers who were selected from two villages each from Panamarathupatti and Vazhapadi blocks of Salem district. The snow ball sampling method was used to identify four groups of farmers consisting of marginal and small size dairy farmers, medium size dairy farmers, big dairy farmers and women dairy farmers. The test verified pre and post exposure modules were developed for assessing the respondent's knowledge gain and skill acquisition behaviour due to cattle and buffalo expert system in cattle. The study showed that medium and large size farmers gained relatively higher knowledge and skill due to their inclination towards undertaking dairy farming on commercial lines as compared to marginal farmers who took up the same at subsistence level in addition to other socio-economic characteristics. The study also brought out constraints and suggestions in improving the usage of expert system among all categories of farmers.

**Key words:** Cattle and buffalo expert system, Effectiveness, Knowledge gain, Skill acquisition

Dairy farming has been evolving into a complex management system requiring the accumulation and integration of knowledge and information from many diverse sources. In order to remain competitive, the modern farmer often relies on animal specialists and advisors to get information for decision making. Most often, assistance of an animal expert is not always available when the farmer needs it. In order to alleviate this problem, expert systems were identified as a powerful tool with extensive potential in animal husbandry especially cattle and buffalo production.

An expert system (ES), also called a knowledge based system (KBS), is a software that attempts to reproduce the performance of one or more targets, most commonly in a specific problem domain, and is a traditional application and/or subfield of artificial intelligence (Rafea 1998). Expert systems help in selection of animal breeds, diagnosis or

identification of pests, diseases and disorders and taking valuable decisions on its management. The expert systems developed earlier were more of text based and could be utilized only by the extension officials and scientists (Ponnusamy *et al.* 2012). Image based expert system was also developed for the benefit of the farming community.

### MATERIALS AND METHODS

The expert system on cattle and buffalo developed by the team of scientists from Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu Veterinary and Animal Sciences University, Chennai, Zonal Project Directorate, Zone VIII, Bengaluru, Central Institute for Women in Agriculture (CIWA), Bhubaneshwar, was used for this study mainly to test its effectiveness in terms of knowledge gain and skill acquisition among the farmers. The system was developed by using rule and knowledge based artificial intelligence concept to diagnose and to give key information for taking decision in critical period of animal rearing. The Salem district of Tamil Nadu was selected, based on the higher density of cattle and buffalo population and existence of prominent dairy industries. Panamarathupatti and Vazhapadi blocks of Salem district were selected based on the cattle and buffalo population density. Two villages from each block were selected and 35 farmers from each revenue villages were selected as respondents. The snow ball

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sampling method was employed to identify and select farmers for this study. Accordingly, four groups of farmers consisting of marginal and small size dairy farmers, medium size dairy farmers, big dairy farmers and women dairy farmers were selected for this study. Each group of farmers consisting of 35 respondents constituted the sample size of 140 farmers. The test verified pre and post exposure modules were developed for assessing the respondent's knowledge gain and skill acquisition behaviour due to cattle and buffalo expert system. The statistical tools namely percentage analysis, t test, F test, analysis of variance were employed for drawing valid conclusions.

The cattle and buffalo expert system had the following three components.

**Health Advisor:** The expert system was defined into three parts. The system that really addresses the farmers' problem without feeding any single word and it will automatically define and identify the problem. Based on the problem, the advisory report will be generated. This is named as Animal Health Advisory or Doctor. This is the core of the expert system and used Artificial Intelligence concept and used image-mapping concept. This is the first kind of approach in expert system in animal husbandry.

**Decision Support System (DSS):** The decision support system was defined as the decision drawn from the system at each and every stages of dairy farming including marketing, schemes and services. The DSS will give critical information based on the queries, search words and selection to the users for taking best possible decision for dairy farming. DSS is also having image and video library for imparting e-learning domains to the users.

**Information Systems or Animal Informatics:** The large volumes of contents on dairy farming were collected and all the contents could not be used for Doctor as well as for the DSS components since both are queries and code based. Hence, the collected contents were organized and developed as animal informatics which provide details of information about the cattle and buffalo enterprises. This is highly useful for the researchers, extension workers and other stakeholders for getting instant details of information.

## RESULTS AND DISCUSSION

**Effectiveness of the treatment of cattle and buffalo expert system in terms of knowledge gain:** The effectiveness of the system was studied among different categories of the farmers to find out the knowledge gain after exposure to the expert system Tamil version (Table 1). The medium size farmers (T<sub>2</sub>) gained 15.77 % of knowledge followed by large size farmers (T<sub>3</sub>) who gained 15.17 % due to exposure to the expert system (Table 1). The practising farm women (T<sub>4</sub>) also gained knowledge about 14.94 % followed by the marginal and small farmers (T<sub>1</sub>) who gained only 13.80 %. The medium and large size farmers used to be real entrepreneurs in dairy business and involved in all the activities of rearing of animals and milking as manager of the dairy unit. Moreover, the two groups are always willing to learn new techniques for improving the profit in dairy

Table 1. Effectiveness of the treatment on Animal Husbandry Expert System (cattle and buffalo) in terms of knowledge gain

(n=140)

| Treatments                                   | Mean knowledge gain |                            | Mean knowledge gain | Percentage (%) |
|----------------------------------------------|---------------------|----------------------------|---------------------|----------------|
|                                              | Before exposure     | Immediately after exposure |                     |                |
| Marginal and small farmers (T <sub>1</sub> ) | 5.11                | 9.94                       | 4.83                | 13.80          |
| Medium size farmers (T <sub>2</sub> )        | 4.71                | 10.23                      | 5.52                | 15.77          |
| Large size farmers (T <sub>3</sub> )         | 4.97                | 10.28                      | 5.31                | 15.17          |
| Practising farm women (T <sub>4</sub> )      | 3.97                | 9.20                       | 5.23                | 14.94          |

farming. Hence, the medium and large size farmers gained significant knowledge addition due to exposure to the expert system.

Significant difference existed in the effectiveness of the 4 different treatments in imparting knowledge as indicated by the significant 'F' value at 1 % level of probability. The relative effectiveness of the 4 treatments showed significant difference in terms of knowledge gain.

The mean score of the knowledge gain of the four treatments were found to be in the order of

|                  |                  |                  |                  |
|------------------|------------------|------------------|------------------|
| T <sub>2</sub> K | T <sub>3</sub> K | T <sub>4</sub> K | T <sub>1</sub> K |
| 5.52             | 5.31             | 5.23             | 4.83             |

All the above treatments were effective, but distinctly different in terms of its effectiveness towards imparting knowledge. It could be observed that medium farmers (T<sub>2</sub>K) was the most effective and superior in gaining knowledge. This was followed by large size farmers (T<sub>3</sub>K), and farm women (T<sub>4</sub>K); and marginal and small farmers (T<sub>1</sub>K) were found to be less effective with regard to knowledge gain to the subjects in that order.

A medium farmer (T<sub>2</sub>K) was found to be the most effective compared to other 3 treatments namely T<sub>3</sub>K, T<sub>4</sub>K and T<sub>1</sub>K. This might be due to the fact that, the medium farmers might possess more curiosity and interest to learn about new methods and technologies in dairy farming. The medium farmers were mostly middle level educated and highly experienced on dairy enterprise. Hence, the medium farmers gained significant knowledge after exposure to cattle and buffalo expert system. Similar finding was reported by Karuppusamy and Sriram (2015) who revealed that the paddy expert system was found to be more effective in terms of gain in knowledge than other treatments.

**Effectiveness of the cattle and buffalo expert system in terms of knowledge related skill acquisition among the dairy farmers:** All the 4 selected treatments were effective (Table 2) in gaining knowledge related to skill acquisition on dairy farming management due to exposure to cattle and buffalo expert system. The marginal and small farmers gained more knowledge related skill with 19.34 % followed by the

Table 2. Effectiveness of the treatment on cattle and buffalo expert system in terms of knowledge related to skill acquisition

| Treatments                                   | Mean skill acquisition |                            | Mean skill acquisition | Percentage (%) |
|----------------------------------------------|------------------------|----------------------------|------------------------|----------------|
|                                              | Before exposure        | Immediately after exposure |                        |                |
| Marginal and small farmers (T <sub>1</sub> ) | 3.40                   | 10.17                      | 6.77                   | 19.34          |
| Medium size farmers (T <sub>2</sub> )        | 3.28                   | 9.80                       | 6.52                   | 18.63          |
| Large size farmers (T <sub>3</sub> )         | 3.86                   | 9.46                       | 5.60                   | 16.00          |
| Practising farm women (T <sub>4</sub> )      | 3.08                   | 8.88                       | 5.80                   | 16.57          |

medium size farmers. The marginal and medium size farmers usually involved in all the skill works related to rearing of cattle and buffalo starting from feeding, caring and milking. Due to continuous involvement in the skill aspect, the marginal and small farmers have gained significant knowledge related to skill due to exposure to the expert system.

*Analysis of variance for effectiveness of treatment in terms of knowledge related to skill acquisition:* The relative effectiveness of 4 different treatments in terms of knowledge related to skill acquisition was analyzed with the help of analysis of variance technique and it is observed that there existed significant difference among the 4 selected treatments in imparting the knowledge related to skill acquisition as indicated by the significant 'F' value at 1 % of probability.

The mean scores of the four treatments were found to be in the order of

|                  |                  |                  |                  |
|------------------|------------------|------------------|------------------|
| T <sub>1</sub> S | T <sub>2</sub> S | T <sub>4</sub> S | T <sub>3</sub> S |
| 6.77             | 6.52             | 5.80             | 5.60             |

Among the four treatments, marginal and small farmers (T<sub>1</sub>S) were the most effective and superior to impart knowledge related skills about cattle and buffalo rearing technologies, followed by medium farmers (T<sub>2</sub>S), farm women (T<sub>4</sub>S) and large farmers (T<sub>3</sub>S) in that order of succession.

This may be due to the fact that the marginal and small farmers were having high level of practical experience in rearing of cattle and buffalo and hence acquired more skills about cattle and buffalo rearing techniques. The marginal and small farmers also had very good experience with the methods and techniques of feeding, maintaining and management on the cattle and buffalo related to skill aspects compared to other category farmers. This finding is in accordance with Natarajan (1997) who revealed that the combination of all the methods video + slide show + method demonstration were found to have brought about the highest knowledge gain related to skill among the subjects.

*Constraints and suggestions for better usage of cattle and buffalo expert system:* The reason for lack of training

Table 3. Constraints of farmers while using the cattle and buffalo expert system

| Constraints                                                                                            | No. of respondents | (%)   |
|--------------------------------------------------------------------------------------------------------|--------------------|-------|
| Lack of training on use of cattle and buffalo expert system                                            | 127                | 90.71 |
| Non-availability of online expert system module                                                        | 110                | 78.57 |
| Interactive voice based guiding system is missing                                                      | 97                 | 69.28 |
| Missing of automatic updation of new farm problems with solution in the expert system installed system | 88                 | 62.86 |
| Unable to operate the computer system                                                                  | 65                 | 46.42 |
| Unaware about all operations in cattle and buffalo expert system                                       | 59                 | 42.14 |
| Lack of supporting software for all type of computer                                                   | 48                 | 34.28 |

on use of cattle and buffalo expert system might be due to non exposure of majority of the respondents to similar type of expert system before this intervention (Table 3). Moreover, the farmers did not attend any computer training programmes previously. Similar finding was revealed by Balasubramani (2004) who stated that the farmers needed computer training to use RUBEX-04 expert system in rubber cultivation.

Farmers preferred to use this expert system module through online version as the online version has the advantage of operating the programme anywhere with the farmers' convenience and scope to continuously update the latest information on cattle and buffalo. Now the cattle and buffalo expert system used an offline mode which is normally accessed by small number of farmers, the usage would be on higher side if it is put online. Thompson and Ian (2004) reported the non-availability of the web based or online version of expert system in agriculture as a constraint.

Interactive voice based guiding system is very important for ordinary farmers to use expert system in an effective manner. Hence, it would be useful to develop the user friendly expert system for wider use in agriculture (Gandhi *et al.* 2014). Since, expert system is the computer based module, this needs minimum computer literacy for effective usage and interpretation of expert system. The farmers who have not touched the computer system yet, faced this constraint while operating the expert system in animal husbandry. Similar finding was reported by Manimekalai (2011) in her hub and spoke model. Since cattle and buffalo expert system comprising of information system, decision support system and health advisor with a lot of sub components accommodated all possible diagnosis and issues related to cattle and buffalo rearing. Hence, significant number of farmers would not be aware of all the operations. This could be solved through proper training. cattle and buffalo expert system would run only in Windows 7 and above system. Hence the above constraints were felt

Table 4. Dairy farmers' suggestions for further effective use of cattle and buffalo expert system

| Constraints                                                                                               | No. of respondents | (%)   |
|-----------------------------------------------------------------------------------------------------------|--------------------|-------|
| Needs working knowledge of computer system                                                                | 135                | 96.42 |
| Cattle and buffalo expert system for all major Indian languages may be developed                          | 121                | 86.42 |
| Provision may be made for automatic updation of new cattle problems with solution at all installed system | 112                | 80.00 |
| Interactive voice based guiding system may be developed for all stages                                    | 99                 | 70.71 |
| Expert system may be put into online for easy access                                                      | 95                 | 67.85 |
| Expert system DVD may be given to all departments, schools and Panchayat for wider use                    | 87                 | 62.14 |
| Mass awareness programme on animal expert system may be organized for wider publicity                     | 75                 | 53.57 |

by significant number of farmers (34.28%). Hence, it is important to develop the expert system with advanced software and server for sustainability and longevity of expert system (Thompson and Ian 2004).

*Farmers' suggestions for effective use of cattle and buffalo expert system:* Majority of the respondents (96.42%) suggested to organize more computer literacy training programme at Krishi Vigyan Kendra and Farmers Training Centre especially for farming community in order to utilise the expert system effectively (Balasubramani 2004). More than 86.42% farmers expressed that Cattle and buffalo expert system should be developed for all type of major Indian languages for further improvement of existing extension services system (Table 4). Presently, expert system for cattle and buffaloes, sheep and goat and poultry were developed in Tamil, Malayalam, Kannada and English languages. Still, there exists scope to develop in other Indian languages for wider use and circulation for further strengthening of extension service in India.

Provision may be made for automatic updation of new cattle and buffalo problems with solution at all the installed systems suggested by majority of the farmers. This might be due to the fact that the new issues and problems related to cattle and buffalo needs to be updated periodically otherwise the developed system would become out dated. Hence, whenever any issues or problems recognized in cattle and buffalo farming come up, the same should be updated automatically in the available expert system. The results also get support from Mahajan and Rajesh (2013) who have suggested to develop the expert system with the option to continuously update the contents and rules for effective use of expert system all the time among the stakeholders.

Interactive voice based guiding system will facilitate the users to narrow down their problems and issues with the help of expert system diagnosis and decision support system without any struggle and taking a longer time. Nearly 68% dairy farmers felt that cattle and buffalo expert system may be put in online mode for wider access. This may be due to the fact that the present animal expert system would run only in offline mode and needs further refinement for uploading into online system for easy access and wider use among the farmers.

Cattle and buffalo expert system DVD may be given to all departments, Schools and Panchayats for wider use and effective rendering of cattle and buffalo based advisory services, as suggested by 62.14 % of the farmers which would help popularize the offline expert system through CD and DVD for wider use (Balasubramani 2004). Awareness programme on cattle and buffalo expert system may be organized extensively in collaboration with KVK, FTC and development department for wider use (Ganesan 2002).

The study concluded that effective adoption cattle and buffalo expert system has demonstrated its potential to acquire significant knowledge and skill gain. The benefits were not uniform across all categories of farmers including farm women. Farmers need intensive training on using the expert system. The future is likely to be virtual agricultural extension services where the owner of the farm may be sitting at a distant location from their farm and would like to practise agriculture by appointing contract labour and through mechanization. Hence, effectiveness can be increased only by educating the farmers on handling the various components at KVK, panchayat and line departments in agriculture which would go in long way in providing farm specific advisory services in time and self diagnosis of farm problems.

## REFERENCES

- Balasubramani N. 2004. 'Designing and testing the effectiveness of computer-based expert system on cognitive and conative domains of rubber growers.' Ph.D Thesis, TNAU, Coimbatore.
- Gandhi N, Wankhede S S and Armstrong L J. 2014. Application of expert system in agriculture. *International Journal of Pure and Applied Research in Engineering and Technology* 3 (1): 86–94.
- Ganesan V. 2002. *Development and field testing of expert system as an aid to agricultural extension work*. Leaflet from Kerala Agricultural University, Vellanikkara, Thrissur.
- Karuppusamy A and Sriram N. 2015. Effectiveness of paddy expert system in terms of knowledge gain, skill acquisition and symbolic adoption behaviour among the paddy growers of Thoothukudi District in South TN. *International Journal for Innovative Research in Science and Technology* 1 (10): 129–32.
- Mahajan S and Rajesh V. 2013. A study on expert system, its types and their role in management. *Journal of Management* 1:1–5.
- Manimekalai V. 2011. 'Establishment of hub and spoke model for innovative farming technology dissemination in

- Tiruvanamalai district- An Action Research.' M.Sc Thesis (Ag. Extn), Department of Agriculture Extension and Rural Sociology, TNAU, Coimbatore.
- Natarajan K. 1997. 'Comparative field experiments on effectiveness and economic efficiency of selected extension training methods.' M.Sc (Ag) Thesis, TNAU, Coimbatore.
- Ponnusamy K, Jyoti Nayak and Sabita Mishra. 2012. Development of women friendly expert system in crop and animal enterprises. *Journal of Extension Education* **17** (1): 90–97.
- Rafea A. 1998. *Expert System Application in Agriculture*. Central Laboratory for Agricultural Expert System, PO Box 100. Dokki Giza, Egypt.
- Thompson Alan J and Ian Willoughby. 2004. A web based expert system on herbicide use in Great Britain. *Computers and Electronics in Agriculture* **42**: 43–49.