Dairy farmer's Perception towards Water Used in Dairy Farming in Western Dry Region of India

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ABSTRACT

Perception is subjective. Physical signals and psychological factors such as attitude, past experience, social and cultural background influence perception. We interpret our sensory perception in different ways depending on previous experiences, selective processes, mental sets and cognitive styles. Understanding the processes of human perception is crucial to understanding behaviour. Perception in this study was operationalized as the degree to which information or idea is perceived by the dairy farmers about water used. The majority 61.11 per cent of dairy farmers were strongly agreeing towards the fact that fodder crops required less water as compared to the other crops. While respectively 30.09 per cent Neutral & 8.80 per cent strongly disagree felt that fodder crops required less water as compared to the other cereal crops. Thus the perception of farmers towards the statement that "Fodder crops required less water as compared to the other cereal crops" ranked first with weighted mean score of 90.83 on the perception scale. Likewise, 50.93 per cent of farmers revealed their perception by agreeing strongly that about this aspect, 38.89 and 19.19 per cent farmers expressed their neutral and strongly disagree desire towards the aptness of farmers about dry fodder and concentrate feeding enhance the water consumption for dairy animals.

Key words: *Perception; Water use; Dairy farmers; Weighted mean score;*

In past few years, assessing the global, ecological and environmental sustainability has got wider recognition and attention worldwide. The rising global water scarcity has become a catastrophic issue having a call for action by governments, policy-makers, water managers and water users among private, public and non-governmental organizations in the issues related to environmental and sustainable use of natural resources. From several studies we can infer that four billion population across the world face the huge problem of water scarcity (*Mekonnen and Hoekstra, 2011*). After assessment the indicators of water sustainability across different sectors of economy at global level it was found that, the largest share of freshwater is used in production of food at global level. About 86 per cent of the total freshwater resources are consumed for the food production resources in the world (*IWMI, 2007*). Thus realizing the relative importance of water towards food production as well as human survival cannot be changed very easily, although reduced and balanced. A huge interest of researchers and policy makers in vested in studying the sustainable use of water and ensure its economical utilization in agriculture and food sector. Freshwater extraction in at global level has increased by nearly seven-folds in the previous century (*Gleick, 2000*). Change in diet preferences as per growing population could increase the water withdrawals in the upcoming decades (*Rosegrant and Ringler, 2000*). Consumptive use of water denotes to the amount of water would be longer available after its immediate use. The agriculture consumes about 85 per cent of the global freshwater at present time (*Shiklomanov, 2000; Hoekstra and Chapagain, 2007*). The findings of previous studies about water use focused on water withdrawals for different sectors of the economy. There are very few studies of global water consumption (evaporative use of water). Dictionary meaning of perception is 'act or power of perceiving'. Perception

is the process of receiving information or stimuli from our environment and transforms it into psychological awareness (*Van Den Ban and Hawkins, 1996*). Perception is subjective. Physical signals and psychological factors such as attitude, past experience, social and cultural background influence perception. We interpret our sensory perception in different ways depending on previous experiences, selective processes, mental sets and cognitive styles. Understanding the processes of human perception is crucial to understanding behavior. Perception in this study was operationalized as the degree to which information or idea is perceived by the dairy farmers about water used.

METHODOLOGY

The method of summated rating suggested by *Likert (1932)* was followed in the development of scale. The following steps were considered for measuring perception of dairy farmers towards climate variability.

It is the first step of scale construction and a tentative list of 33 statements pertaining to farmer's perception towards water use in dairy farming were collected through consultation with expert working in the area of dairy and animal husbandry. Both positive and negative statements in the list were taken with care to reduce the effects of social desirability, positive response bias and to maintain the consistency of the respondents in answering the statements.

These statements were edited as per the 14 informal criteria enunciated by *Edwards (1957); Likert (1932)*. Out of 33 statements, 14 statements were retained after editing. These statements were found to be non-ambiguous and non-factual.

The list of 33 statements were mailed by post, e-mail and also handed over personally to 60 judges who have expertise in the area of dairy farming, extension education and veterinary extension to give response on 3-point continuum i.e. Agree (A), Undecided (UD) and Disagree (DA) and as it gives more degree of freedom for their choice (*Edwards, 1957*).

Item analysis : Analysis of item is an important step while constructing valid and reliable scale. The judges were requested to make their degree of response with each statement on a five-point continuum ranging from strongly agree (SA), agree (A), undecided (UD), disagree (DA) and strongly disagree (SD) with scoring of 5, 4, 3, 2, and 1; for positive statements and the scoring pattern was reversed i.e. 1, 2, 3, 4 and 5 for the negative statements. The total individual judge scores were calculated by summing up the score of each statement.

Calculation of t-values : The scores given by judges were arranged in a descending order based on the total individual scores. Two groups, high group and low group were formed to provide criterion groups in terms of evaluating the individual statements. The high group comprised top 25 per cent of judges with their total individual scores and the low group comprised bottom 25 per cent of judges with their total individual. The t-values were worked out in order to discriminate the responses of high and low groups for the individual statements by using the under mentioned formula (*Edwards, 1969*). Thus, out of 44 judges to whom the statements were administered for the item analysis, 11 judges with highest and 11 judges with lowest scores were used as criterion groups to evaluate the individual items.

$$\frac{\bar{X}_H - \bar{X}_L}{\sqrt{\frac{\sum_{t=1}^{n}(X_H - \bar{X}_H)^2 + \sum_{t=1}^{n}(X_L - \bar{X}_L)^2}{n(n-1)}}}$$

$$\sum (X_H - \bar{X}_H)^2 = \sum X_H^2 - \frac{(\sum X_H)^2}{n}$$

$$\sum (X_L - \bar{X}_L)^2 = \sum X_L^2 - \frac{(\sum X_L)^2}{n}$$

Where,

$\bar{X}_H$ = The mean score on a given statement for the high group

$\bar{X}_L$ = The mean score on a given statement for the low group

$\sum X_H^2$ = Sum of squares of the individual score on a given statement for high group

$\sum X_L^2$ = Sum of squares of the individual score on a given statement for low Group

$\sum X_H$ = Summation of scores on given statement for high group

$\sum X_L$ = Summation of scores on given statement for low group

n = Number of subject in low and high group

t = The extent to which a given statement differentiates between the high and low group.

$\sum$ = Summation

The t value is a measure of the extent to which a given statement differentiates between the high score and low score groups. The t value equal to or greater

than 1.76 (n_1+n_2-2 df at 5% level of significance) indicating the average response of high and low groups to a statement differs significantly. Thus 14 statements on dairy farmers' perception towards water use in dairy farming (8 positive and 6 negative) with significant discriminating values were retained in the final scale.

Standardization of the Scale : The validity and reliability was ascertained for standardization of the scale. The reliability and validity was measured by split half method and content validity, respectively.

Reliability of the scale : The reliability of the scale final set of the 20 statements which represent perception of dairy farmers toward water use in dairy farming was administered on a three-point continuum to a fresh group of 30 farmers of non-sample area. Reliability was calculated by using the formula of *Spearman (1910) and Brown (1910)*.

$$r_{SB} = \frac{2r_{hh}}{1+r_{hh}}$$

Where,

r_{hh}= Pearson correlation between odd and even.

But split-half coefficients do not give the same information as the correlation between two forms given at different times (*Cronbach, 1946*). So, that Cronbach's alpha (α) was used for assessing internal consistency of the developed scale to measure awareness of perception of dairy farmers (*Cronbach, 1951*). The formula is :

$$\alpha = \frac{K}{K-1}\left(1 - \frac{\sum_{i=1}^{i=k} \sigma^2 y_i}{\sigma^2 X}\right)$$

Where,

K = Number of items in the scale

$\sigma^2 y_i$ = the variance of item i for the current sample of respondents

$\sigma^2 X$ = the variance of the scale

If the Cronbach's alpha value is: "≥ 0.9 – Excellent, ≥0.8 – Good, ≥0.7 – Acceptable, ≥0.6 – Questionable, ≥ 0.5 – Poor, and less than 0.5 – Unacceptable" to assess awareness. To calculate the Cronbach's alpha value for reliability test, SPSSv21 statistical software was used in this study.

Validity of scale : Validity refers to the credibility or believability of the constructed scale. It is defined asthe accuracy with which a scale measures, which is intended to measure (*Lindquist, 1951*). The content validity of the developed scale was tested which is the representative or sampling adequacy of the content, the substance, the matter and the topics of a measuring instrument. The content validity of the scale was also verified by experts' judgment and it is representative or sampling adequacy of the content. Scientists and scholar be in favour of the use of following approach to specify that ratings of 1 and 2 are considered "content invalid," while ratings of 3 and 4 are considered to be "content valid" in calculating.

Administration of scale : The final scale consisting of 14 (Table 3) statements was administered to measure farmer's perception towards water use in dairy farming on a three continuums viz., Strongly Agree (SA), Agree (A) and Strongly Disagree (SDA) with a score of 3, 2 and 1, respectively for positive statements and reverse scoring system for negative statements. The overall possible maximum and minimum scores ranged between70 to 14. Scores were summed up to get the total score for perception of each respondent. Then the respondents were categorized into very low, low, medium, high and very high categories by cumulative square root of frequency method.The present study was conducted in western dry (consisting Rajasthan state) region. In western dry region Rajasthan state were selected purposively and Bikaner district of Rajasthan were selected randomly. The Four blocks were also selected randomly from Bikaner district Each cluster of village consists of 3-4 nearby villages from the selected block in the district of the study area. Thus, 4 clusters of villages one from each blocks were selected, constituting its total number to 4 clusters. From each cluster of villages, 50 respondents were selected in this way a total of 200 respondents were selected from 4 cluster of villages for the study.

RESULTS AND DISCUSSION

In the process of perception scale construction, the reliability and sampling adequacy were calculated. In order to measure internal consistency, Cronbach's alpha, a measure of scale reliability is used to reveal degree of closeness among set of items are in a group. It is considered to be a measure of scale reliability. The value of Cronbach's Alpha >8 falls under Good Category of scale in terms of reliability. The overall value of Cronbach's Alpha is 0.790 and Cronbach's Alpha Based on Standardized Items is 0.784 which proves the good reliability of the scale is reliable (Table 1).

The Kaiser-Meyer-Olkin measure of sampling adequacy (KMO statistic) in this scale was 0.739 which

is "good", this proves that the sample selected was satisfactory for factorial analysis. The Bartlett's test of sphericity was found significant (p<.000) indicating factor analysis to be suitable. A perusal of Table 2 reveals that four factors (Eigen values ≥1) explained 61.809 per cent variance in the dataset.

Table 1. Representation of parameters of reliability test for perception scale

Cronbach's Alpha	0.790
Cronbach's Alpha Based on Standardized Items	0.784
N of Items	14

Table 2. Representation of parameters of sampling adequacy for perception scale:

Kaiser-Meyer-Olkin measure of sampling adequacy		.739
Bartlett's Test of Sphericity	Approx. χ^2	039.036
	df	91
	Sig.	.000

An exclusive perception scale has been devised to measure the farmer's perception towards water use in dairy farming. The scoring pattern follows for positive statements of the scale was 3, 2 and 1 for strongly agree (SA), neutral (N) and strongly disagree (SD) respectively. When the statements were negative, scoring pattern was reversed. A perusal of Table3reveals that 61.11 per cent of dairy farmers were strongly agree towards the fact that fodder crops required less water as compared to the other crops. While respectively 30.09 per cent Neutral& 8.80 per cent strongly disagree felt that fodder crops required less water as compared to the other cereal crops. Thus the perception of farmers towards the statement that "Fodder crops required less water as compared to the other cereal crops" ranked first with weighted mean score of 90.83 on the perception scale (Table 1).

Subsequently 57.41 per cent farmers strongly agreed that crossbred animals required more water footprint. While 30.56 per cent of farmers were neutral and remaining 12.04 per cent of farmers strongly disagreed on their perceptual continuum. This finding was supported by weighted mean score of 88.33 and ranked second on the perception scale.

It was found that 50.93 per cent of farmers revealed their perception by agreeing strongly that about this aspect, 38.89 and 19.19 per cent farmers expressed their neutral and strongly disagree desire towards the aptness of farmers about dry fodder and concentrate feeding enhance the water consumption for dairy animals. It was rank third in order of importance with weighted mean score of 86.67 (Table 3). A study conducted by *Singh (2004)* in North Gujarat, revealed that dairy farming being the most water-inefficient production system, takes a huge share of the precious groundwater resources in the region. Assessing the perception of farmers also reveals that farmers agree about the share of water in animal farming and thus try to understand the practices and measures to utilize water optimally.

On the perceptual continuum, for statements such as use of dairy farm wastage in fodder crop to reduce the water requirement of fodder crop and providing more drinking water can overcome heat stress in dairy animal which leads more use of water accounted medium level with weighted mean score of 81.50 and 80.83 locating it to six and seventh rank respectively in former and later viewpoints.

Among few perceptual statements which less farmers strongly agreed were use of water sprinkler in farm and field minimize the water wastage, insufficient water quantity in dairy farming and its effect on milk production which reduces the quantity of produce and, water requirement which is same and not varies for Lactating and dry animals. We can infer that the per cent age of farmers expressing strongly agree viewpoint in these three statements were 16.67, 19.44 and 17.59 respectively. Accordingly, the per cent age of farmers in disagree viewpoint were 37.04, 52.78 and 68.57 respectively. Thus, weighted mean score was also among the lowest in the perception scale 64.67, 60.00 and 56.17 respectively, which assigned them the 12th, 13th and 14th ranks respectively (Table 3). We can infer that, these statements which recorded least weighted mean and ranks were technical aspects which doesn't have significant contribution in resource scarce settings. For example, adoption of sprinkler irrigation is low in India and majority of farmers don't adopt it. Understanding the water requirement stages of growth of animal leading to lactating and dry stage and its linkage with footprint is tedious and technical, thus it accorded them among least ranked statement in terms of perceptual understanding towards water footprint. The findings of the study are in contrast with the study of *Kasuloet al. (2013)* who reported a strong relationship exists between milk production on one hand and water availability, and pasture production on the other hand.

Table. 3 Distribution of respondents on the continuum of perception scale towards water use in dairy farming according to their weighted mean score

Items	SA		N		SD		WM	Rank
	No.	%	No.	%	No.	%		
Giving more drinking water can overcome heat stress in dairy animal which leads more use of water.	92	42.59	85	39.35	39	18.06	80.83	VII
Animals on Grazing required more drinking water	77	35.65	113	52.31	26	12.04	80.50	VIII
Crossbred animals required more water footprint	124	57.41	66	30.56	26	12.04	88.33	II
Use of water sprinkler in farm and field minimize the wastage	36	16.67	100	46.30	80	37.04	64.67	XII
Water foot print can reduce by changing feeding patterns	30	13.89	108	50.00	105	48.61	68.50	IX
Fodder crops required less water as compared to the others	132	61.11	65	30.09	19	8.80	90.83	I
Buffalo required more water as compared to cattle.	107	49.54	66	30.56	43	19.91	82.67	V
Maxi. portion of water used by animal comes from feed	65	30.09	62	28.70	89	41.20	68.00	X
Use of dairy farm wastage in fodder crops	80	37.04	113	52.31	23	10.65	81.50	VI
Dry fodder and concentrate enhance the water consumption	110	50.93	84	38.89	22	10.19	86.67	III
Crossbred animals required more water than indigenous	101	46.76	79	36.57	36	16.67	82.83	IV
Insufficient water quantity can reduce the milk production	42	19.44	60	27.78	114	52.78	60.00	XIII
Import/Export of dairy product means virtual water trading	36	16.67	110	50.93	70	32.41	66.33	XI
Water requirement is same for Lactating and dry animals	38	17.59	45	20.83	133	61.57	56.17	XIV

CONCLUSION

The majority 61.11 per cent of dairy farmers were strongly agreeing towards the fact that fodder crops required less water as compared to the other crops. While respectively 30.09 per cent Neutral & 8.80 per cent strongly disagree felt that fodder crops required less water as compared to the other cereal crops. Thus the perception of farmers towards the statement that "Fodder crops required less water as compared to the other cereal crops" ranked first with weighted mean score of 90.83 on the perception scale. Likewise,50.93 per cent of farmers revealed their perception by agreeing strongly that about this aspect, 38.89 and 19.19 per cent farmers expressed their neutral and strongly disagree desire towards the aptness of farmers about dry fodder and concentrate feeding enhance the water consumption for dairy animals.It would be helpful in to enhancing crop productivity, low water consuming high nutrition value feed crops, suitable feeding patterns, water saving techniques and increasing milk productivity by shifting to greater-volume producing cows may allow the production of milk in a more water sustainable way, reducing its water use.

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