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Understanding the farmers' preference for designing weather based agro advisory services

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Abstract
Weather is considered crucial for agriculture as it determines the productivity of the crops. It is evident that farmers incur crop losses for being unaware of the aberrant weather events. Hence provision of weather based agricultural advices to farmer's gains paramount importance in this situation. However, farmer's acceptance of the advice heavily depends upon their preference of varied aspects of the service. In this regard, the present study was undertaken to understand the different aspects of the service which is appropriate to the farmers needs to increase the adoption of advisories. Five key aspects of the service viz., frequency of messages, timing of the message, source of message, mode of feedback and the response time (time taken to respond to farmer's queries) were identified to seek farmers' opinion. Conjoint analysis was performed to estimate the utility and relative importance values for each aspect of the service. The results revealed that the farmers prefer to receive weather based agro advisory services once in a week from agricultural scientists of TNAU during afternoon hours. Regarding the mode of feedback & response time, text message given either instantly or within a day was most preferred by farmers. The high relative importance values for frequency of message and source of information signify the value contained by the farmers for these two aspects.

Keywords: Preferences, weather based agro advisory service, conjoint analysis, paddy farmers

Introduction
Indian agriculture considered as the gamble of monsoon is a well known fact. Climate and weather still remain the major factors determining the agricultural production of the country despite other technological advancements. It is apparent that weather parameters decide the success and failure of a crop due to its influence on each and every stage on crop growth. Variations in climate like late onset and early withdrawal of monsoon, shift in rainfall patterns, drought, floods, etc may create problems on water availability for the crop thereby resulting in crop losses. Every year, a substantial portion of crop loss was due to unpredictable weather events. This is because farmers were not prepared to make decisions on proper crop management practices as they were unaware of the future weather conditions going to prevail in their vicinities. However, these loses could be minimized to a considerable extent through informing farmers on the future weather in advance through weather forecasts. The main objective of the weather forecasting is to provide advice to the farmers on the actual and expected weather and its influence on the various day-to-day farming operations i.e. sowing, weeding, time of pesticides spray, scheduling irrigation, fertilizer application etc. and overall crop management (Vashisth *et al.*, 2013; Ray *et al.*, 2017) [12, 9]. If the information on weather and the appropriate actions to be taken to cope with the future weather events is provided in advance, it could be helpful for the farmers to mobilize their own resources at the right time to reap the benefits. Hence, this situation validates the need for providing weather based agro advisory services to the farmers. However, ensuring farmers' access to timely weather information cannot be made possible through public extension system characterized by the limited availability of experts unless it is supported by information and communication technologies. ICT tools offer several advantages to facilitate technology transfer to the farmers residing even in remote corners of the country. Information and communication technologies encompasses a wide range of tools such as mobile phones, rural information kiosks, computers, tablets, etc., among which mobile phones offer greater advantages such as personalized information sharing, instant delivery of message, mobility of devices and cheaper cost for deployment (Sivabalan, 2016). Further, the percentage of population using mobile phones with internet is increasing at a faster rate which is a positive sign for provision of mobile phone enabled weather based agro advisory services. At the end of Feb 2019, there were 1183.68 million mobile phone subscribers (GSM, CDMA, LTE) with rural wireless subscriptions of 527.11 million in India.

As on 31st December, 2018, the number of people browsing internet via mobile phones and dongles were 499.95 million (TRAI, 2019) [11]. Churi *et al.* (2017) [2] indicated that mobile phones were considered important communication channels for accessing weather information by farmers as they are cheap and easy to use. Hence, the provision of personalized, site specific, relevant and time bound weather information through mobile phones will reach the farmers and makes the innovation and diffusion process easier.

However, from a farmer's perspective, the forecast value increases only if it is capable of influencing their decisions on management practices (Gadgil *et al.,* 2002) [4]. Farmers tend to expose themselves to the weather based agro advisory services that are in accordance with their existing attitude, values, needs and interests. Hence, mobile phone enabled weather information and advisory service should be designed in such a way as preferred by farmers to improve its utility. Hence it becomes important to understand the different aspects of the service which is appropriate to the farmers needs to increase the adoption of advisories. Against this background, the present study was undertaken to identify the farmer's preferences for designing the weather based agro advisory services.

Materials and Methods

An initiative of providing weather based agro advisory services was planned to be given to the paddy cultivating farmers of Gobichettipalayam block of Erode district of Tamil Nadu. For the purpose, a sample of 120 farmers from three villages viz., Pudhukarai Pudhur, Kugalur and Savundapur were selected considering maximum area under paddy cultivation. To effectively design the weather based agro advisory services, conjoint analysis was employed to identify the farmer's preferences on the key aspects of the service.

Conjoint analysis is a multivariate technique used to understand how people develop preferences for objects/services. It gives the measure of utility of each attribute of the object/service where utility refers to the subjective judgment of preference specific to each respondent (Anderson *et al.,* 2010) [1]. The main theoretical foundations of conjoint analysis are in consumer theory and are extensively used in market research to effectively design a product considering the value given to the features of the product by the user. The fundamental assumption is that the utility derived from a good or service is derived from the properties or attributes of the good or service. In other words, overall utility for a good can be decomposed into separate utilities for its constituent attributes (Louviere, 1994) [6]. In conjoint studies, respondents choose between alternative products or scenarios that display varying levels of selected attributes. Appropriately structured and repeated across a sample of respondents, these comparative evaluations can be used to calculate the part-worth utilities of each attribute (Green and Srinivasan 1990) [5]. For example, Claret *et al.* (2012) [3] employed conjoint analysis to determine the relative importance of different attributes of various identified factors for consumers in choosing a sea fish for consumption. Patil *et al.* (2006) [7] who used conjoint analysis to examine farmers' preferences towards public and private sector seeds using seed attributes such as seed price, brand name, timing of seed availability and mode of payment found that farmers assigned maximum importance to price, followed by the timing of seed availability and the brand name in their seed buying decisions. Here, for the present research, a pilot study was conducted among the farmers to identify the key aspects of the advisory service. Based on their responses, five key aspects viz., frequency of messages, timing of the message, source of message, mode of feedback and the response time (time taken to respond to farmer's queries) and their different levels were finalized to seek farmers' opinion. The different levels of the identified key aspects of the advisory service were presented as follows:

Frequency of message= Daily, Once in two days, Twice a week and Once in a week
Timing of the message= Morning, Afternoon and Evening
Source of message= TNAU Scientists, Extension officers from SDA, Subject matter specialist from KVK and Research Scholar
Mode of feedback= Phone call, Text message and Voice message.
Response time = Instantly, within a day and Within two days.

Conjoint analysis is used to determine the best possible combination of the aspects of the advisory service by identifying the utility values for different levels of the selected key aspects and the relative importance that these aspects contain for the farmers. If the farmers were asked to give their preference one by one for each aspect, then they may select aspects which may not be feasible for designing weather based agro advisory service. In this case, combination of different levels of each aspect has been generated to administer to farmers and rate their preference. The number of combinations that could be created for different levels of the identified five aspects was 432, which was complex for farmers to rate. Hence, out of these 432 combinations, 16 combinations which make a good representation across all the aspects were generated using orthogonal design supported by SPSS. Farmers were then asked to rate these 16 combinations in terms of their choice for each aspect. Conjoint analysis was performed with the collected responses to estimate the utility and relative importance value for each aspect.

Results and Discussion

The finding on the utility and relative importance values of each aspect of the service obtained using conjoint analysis is presented in the Table 1.

Table 1: Utility and relative importance of aspects of the weather based agro advisory service

S. No.	Key aspects of the service	Levels of the aspects	Utility Value	Importance Value
1.	Frequency of message	Daily	-2.252	38.603
		Once in two days	-2.990	
		Twice a week	1.169	
		Once in a week	4.073	
2.	Timing of the message	Morning	-0.447	11.735
		Afternoon	0.509	
		Evening	-0.062	
3.	Source of message	TNAU Scientists	2.321	24.826
		SMS from KVK	-0.729	
		Extension agents from State Department of Agriculture	-1.283	
		Research Scholar	-0.308	
4.	Mode of feedback	Phone call	-0.469	12.292
		Text message	0.876	
		Voice message	-0.407	
5.	Response time	Instantly	0.211	12.544
		Within a day	0.211	
		Within two days	-0.422	

From the Table 1, it could be seen that among the different levels of frequency of message, the level 'once in a week' was found to have the highest utility value of 4.073 followed by the levels 'twice a week' (1.169), 'daily' (-2.252) and 'once in two days' (-2.990) respectively. Regarding timing of the message delivered to the farmers, 'afternoon hours' had the highest utility value (0.509) followed by 'evening' (-0.062) and 'morning hours' (-0.447). For the source of message, TNAU scientists had obtained the highest utility value of 2.321 followed by research scholar (-0.308), subject matter specialists from KVK (-0.729) and extension agents from State Department of Agriculture (-1.283) respectively in that order. With regard to mode of feedback, text message had highest utility value (0.876) followed by voice message (-0.407) and phone call (-0.469). Regarding response time, instant response and within a day response were found to have the equal utility value of 0.211 whereas within two days response had obtained the utility score of -0.422. Hence, it could be concluded from the findings that weather based agro advisories provided once in a week by scientists during afternoon hours was considered to be more desirable by farmers. This is in contrary with the findings of Prabha and Arunachalam (2017) [8] who reported that majority of the respondents preferred to receive the messages on daily basis (53.50%) during morning hours (55.00%) and only small proportion of the respondents preferred to receive messages on weekly basis (9.50%) during afternoon hours (12.50%). The probable reason for farmers in the study area preferring weekly once advisories during evening hours was that farmers were annoyed of more number of unwanted messages flooding their inbox. This in turn may obstruct the farmers to overlook the useful information being delivered. Further, farmers mostly remained busy in their fields during morning hours looking after the adoption of cultivation practices. Farmers may rest for a while, in the afternoon hours during which they could allocate sometime to view the messages and could also enable farmers to discuss with the fellow farmers in the evening hours to make decision on the adoption of information. This finding derive support from Mittal *et al.* (2010) who reported that IFFCO Kisan Sanchar Limited's voice messages were sent at unpredictable times during the day and if the farmer did not access the voice call immediately, the information was lost. Hence, sending messages to farmers at times that are of convenient for them to access will increase the receptivity of messages which in turn may enable adoption of information by farmers.

Regarding the source of information, scientists from Tamil Nadu Agricultural University were preferred more as they were continuously involved in research activities. Regarding the mode of feedback & response time, text message given either instantly or within a day was most preferred by farmers. Responding to farmers queries instantly or within a day will enhance the utility of the information. This is because it enables the farmers to quickly take needed actions to cope up with the risks or adverse situations.

From the Table 1, it could also be found that the frequency of message had obtained the highest importance value of 38.603 followed by the source of information (24.826), response time (12.544), mode of feedback (12.292) and timing of the message (11.735) respectively in that order. This shows that the aspects viz., frequency of message and source of information were considered to be most important aspects for the farmers than the other identified key aspects.

Conclusion

From the findings on the utility and relative importance values of each aspect of the service obtained using conjoint analysis, it could be concluded that the farmer's preferred to receive the weather based agro advisory services once in a week from agricultural scientists of TNAU during afternoon hours. Regarding the mode of feedback & response time, text message given either instantly or within a day was most preferred by farmers. The relative importance of the aspects such as frequency of message and source of information were found to be high compared to response time, mode of feedback and message timing. Based on these results, weather based agro advisory service can be appropriately designed for effective dissemination to farmers.

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