Evaluation of a mobile phone based agro-advisory programme on sunflower (*Helianthus annuus* L.)

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ABSTRACT

The increasing penetration of mobile phone networks and handsets in India presents an opportunity to make useful information on agriculture more widely available to farmers. The present study was conducted with 240 farmers growing sunflower (*Helianthus annuus* L.) in two districts in Andhra Pradesh State, India during 2011-12. The taluks and villages were selected based on highest area under sunflower and the presence of farmers with IKSL (IFFCO Kisan Sanchar Limited) sim cards. The farmers were selected by random sampling method. The study used ex-post facto and pre- and post- experimental research designs. An improvised Bennett's hierarchy, a logic model was used for evaluation. The results indicated significant differences in knowledge and adoption scores of pre- and post-dissemination groups indicating the impact of the system. Mobile phones based advisories can create awareness and make knowledge accessible to farmers and to some extent mobilize communities to adopt best practices. To further improve knowledge, adoption of improved practices and impart required skills to farmers training sessions and demonstrations need to be organized after the broadcast of advisories.

Keywords: Adoption, Audio messages, Impact, Listening behaviour, Sunflower

Farmers need information on a variety of topics, at a variety of stages, before adopting a new technology (De Silva and Ratnadiwakara, 2008; Mittal *et al.*, 2010). Farmers have different types of information needs during each stage of the process, ranging from weather forecasts, pest attacks, inputs, cultivation practices, pest and disease management and prices and they need to access a wide range of information related to production technologies, post harvest processes, remunerative markets, credit and weather (Glendenning *et al.*, 2010). Despite a wide range of reform initiatives in agricultural extension in the past decades, the coverage of, access to and quality of information provided to small holder farmers is uneven and the main sources of information to farmers till today are neighbours, input dealers, radio, TV, news paper and extension worker. Considering this poor reach of extension, the information and communication technologies (ICTs) can play an important role in their endeavour of reaching the unreached farmers. Among the various ICT tools, the increasing penetration of mobile phone networks and handsets in India presents an opportunity to make useful information more widely available and offers several advantages over other alternatives in terms of cost, geographic coverage and ease of use (Aker and Mbiti, 2010). Mobile phone networks with a subscriber base of more than 920 million and overall tele-density of 61.38 can play a significant role in technology transfer. Mobile telephony has been widely accepted mode of delivering information not only in India but also in other South Asian and African countries (Mittal, 2011).

In spite of several mobile based initiatives for providing access to timely and quality information to farmers, the rigorous impact evaluation of these initiatives were very few. In order to measure the impact of mobile phone-based applications and services in the agricultural sector on farmers' knowledge, adoption and welfare, rigorous impact evaluations are needed (Aker, 2011). To bridge this gap, Directorate of Oilseeds Research (DOR) has initiated mobile phone based agro-advisories to oilseed farmers with the collaboration of IFFCO Kisan Sanchar Limited. IFFCO Kisan Sanchar Limited (IKSL) is a tri-lateral joint venture between the Indian Farmers Fertilizer Cooperative Limited (IFFCO), Airtel and Star Global Resources Limited. IKSL provides voice-based agricultural information to empower rural farmers and reinforce the cooperative through the mobile network. IKSL distributes airtel SIM cards branded 'Green SIM' to its IFFCO members and other farmers. DOR has developed the content for agro-advisories on sunflower and in collaboration with IKSL disseminated them to the farmers of Andhra Pradesh, India. The present study was undertaken to evaluate the impact of mobile phone based agro-advisory programme on sunflower with the following specific objectives to assess the information needs of sunflower farmers, evaluate the listening behavior of farmers and determine the impact of the advisories in terms of knowledge, opinions, adoption behavior and economic welfare of farmers.

MATERIALS AND METHODS

Sampling: Two districts *viz.*, Mahabubnagar and Prakasham from Andhra Pradesh State, India were selected for the study. Three taluks from each district and three villages from each taluk were selected based on the highest area under sunflower crop. Two hundred and forty registered farmers with 'green sim cards' were selected by random sampling

method from 18 villages. The study used an expost facto and experimental designs for survey and evaluation of impact of mobile phone advisory system, respectively. Before the start of the season (July-September, 2011), interviews were conducted with farmers to assess their information needs, level of knowledge, adoption and economics of sunflower cultivation. During *rabi,* 2011-12 and *kharif* 2012, knowledge on sunflower production technologies was disseminated through audio messages. At least two messages were disseminated in a week during the season. After the end of the each season during March-April and October-November, 2012, data were collected on farmers listening behavior, their opinions on messages, their knowledge, adoption and economics. The details of messages disseminated are as follows:

Category of message	Audio messages (no.)		Farmers interviewed (no.)
	rabi	*kharif*	
Pre-sowing	6	6	240
Sowing and production	12	12	240
Plant protection	6	6	240
Harvest and post harvest management	4	4	240
Total	28	28	-

Measurement of variables: The information needs of farmers on sunflower cultivation were assessed on a three point continuum ranging from high, medium to low. Listening behavior was measured by three sub-components: listening frequency, listening pattern and listening response. Opinions of farmers were obtained on six sub-components: timeliness of the messages, relevance, audio quality, message treatment, content adequacy and usefulness. Knowledge was characterized by the information gained by the farmers on various aspects of sunflower cultivation hearing through the mobile phone messages and measured by asking 25 questions. Adoption refers to use of an idea/practice on sunflower cultivation after listening to audio messages from mobile phones and measured by recording the practices adopted by the farmers after listening to messages. The economics of sunflower cultivation were worked out by recording the cost of cultivation (COC), gross monetary returns (GMR) and benefit cost ratio (BCR).

Evaluation process: An improvised Bennett's hierarchy, a logic model (Taylor and Sara, 1996; Taylor, 1999; McCawley Paul, 2013) was used for evaluation. The model consists of situations/priorities at level 1, inputs, outputs-activities, outputs-participation at level 2, 3 and 4, respectively and outcomes: short-term, medium-term and long-term at level 5, 6 and 7, respectively. Suitable indicators were identified for each level (Fig. 1) and measured. An interview schedule was developed in local language and validated by field data. The data were collected by personal and telephone interviews of farmers. SAS software was used to analyze descriptive statistics such as frequency, mean, per cent and the differences in knowledge, adoption and economics of pre- and post-dissemination groups were tested by paired 't' test.

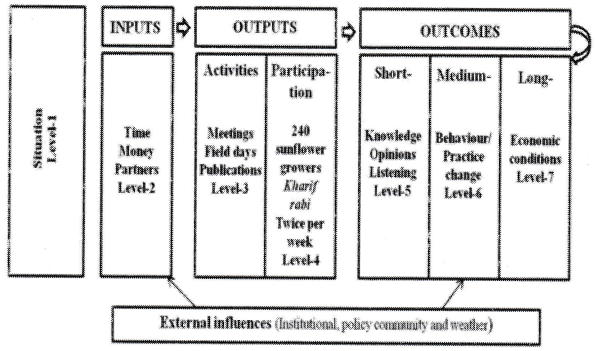

Fig. 1. Logic model applied to evaluation of mobile advisory system

RESULTS AND DISCUSSION

Situation-level 1: The existing situation of the farmers was assessed by understanding the information needs in sunflower cultivation. Among 240 farmers interviewed, 160 farmers (66.67%) felt high information need on improved sunflower cultivars followed by market prices (60.42%), management of tobacco caterpillar (*Spodoptera litura*) and borer (*Helicoverpa armigera*) (54.17), information on weather (53.33%) and information on biological control agents (50.00%). Farmers had low information need on harvesting (43.75%), chemical seed treatment (42.50%) and method of sowing (41.67%) (Table 1). The results are in congruence with that of Mittal *et al.* (2010), who reported that information regarding seeds is the most frequently accessed information by farmers followed by mandi prices, plant protection and fertilizer application.

Inputs-level 2: The total money spent on the programme was ₹ 3.75 lakhs and there were 1,511 people involved, which includes seven scientists from DOR, two technical persons each from IKSL and DOR and 2000 sunflower farmers, five organizations: DOR, IKSL, Airtel (service provider) and two NGOs *viz.*, Research in Environment Education and Development Society (REEDS) and Rythu Mitra Sangam (RMS) (Table 2).

Outputs-level 3 & 4 (Activities and Participation): The activities allotted to and completed by seven scientists were screening of content/scripts for messages, organizing meetings/farmers' days and discussion with farmers on sunflower production technologies. The activities of technical persons of DOR were identifying the farmers, registrations, providing green sim cards and explaining about the broadcast of the messages. Further, the technical persons were also involved in evaluation of responses, record keeping, tabulation of scores, arranging for meetings and

distribution of pamphlets. The NGOs (REEDS and RMS) were involved in facilitating the identification of farmers, building rapport, distribution of sim cards, arrangements for meetings and creating awareness about the dissemination of messages. The activities of technical persons of IKSL were recording of the OBD messages and disseminating through service provider. Among 1500 registered participants, 240 farmers were selected for the survey. The activities of these farmers were registration with DOR, listening to the messages, attending the meetings/farmers days and providing responses during the interviews for data collection.

Table 1 Situation analysis for assessing the information needs of sunflower farmers in the region (n = 240)

Information need	High	Medium	Low
Suitable cropping system	98 (40.83)*	82 (34.17)	60 (25.00)
Suitable intercropping systems	110 (45.83)	95 (39.58)	35 (14.58)
Recommended improved cultivars	160 (66.67)	60 (25.00)	20 (08.33)
Seed treatment with biological control agents	120 (50.00)	68 (28.33)	52 (21.67)
Seed treatment with chemicals	60 (25.00)	78 (32.50)	102 (42.50)
Method of sowing	80 (33.33)	60(25.00)	100 (41.67)
Thinning in sunflower	95 (39.58)	85 (35.42)	60 (25.00)
Critical stages for moisture stress	60 (25.00)	75 (31.25)	105 (43.75)
Fertilizer management	105 (43.75)	80 (33.33)	55 (22.92)
Sources of various fertilizers	80 (33.33)	90 (37.50)	70 (29.17)
Utility of Boron application	115 (47.92)	100 (41.67)	25 (10.42)
Utility of S application	105 (43.75)	86 (35.83)	49 (20.42)
Manual weed management	28 (11.67)	40 (16.67)	172 (71.67)
Herbicide application	110 (45.83)	85 (35.42)	45 (18.75)
Management of sucking insect pests	115 (47.92)	90 (37.50)	35 (14.58)
Management of foliage eating insect pests	130 (54.17)	79 (32.92)	31 (12.92)
Management of alternaria	98 (40.83)	96 (40.00)	46 (19.17)
Management of powdery mildews	100 (41.67)	85 (35.42)	55 (22.92)
Management of SND	90 (37.50)	81 (33.75)	69 (28.75)
Supplemental pollination	115 (47.92)	95 (39.58)	30 (12.50)
Harvesting	40 (16.67)	95 (39.58)	105 (43.75)
Value addition by use of sunflower heads	115 (47.92)	95 (39.58)	30 (12.50)
Value addition for producing honey	90 (37.50)	120 (50.00)	30 (12.50)
Market prices	145 (60.42)	80 (33.33)	15 (06.25)
Information on weather	128 (53.33)	70 (29.17)	42 (17.50)

* Figures in parenthesis are percentages

Table 2 Investments in terms of human resources, partners and finances in the programme

Human resources	No./ Value (₹)
Scientists from DOR	7
Technical persons from IKSL for OBD recordings	2
Technical persons for dissemination	2
Registered participants	1,500
Total	1,511
Partners	
IFFCO Kisan Sanchar Limited	
Service provider (Airtel)	
local NGOs (REEDS and RSS)	
Money spent	
Procurement of green sim cards	15,840
Publication of pamphlets	7,000
Transportation charges for registration and discussions with farmers	15,000
Cost for recording of messages	10,000
Cost for the service providers for dissemination	25,000
Salaries of scientists and technical persons	300,000
Total	372,840

Outcomes- level 5 (short term)

Listening behaviour: Only 20.0 per cent of the farmers listened to all the 25 messages and majority of farmers (34.58%) listened to 8-15 messages. Majority of the farmers (70.35%) listened to messages and 26.25 per cent of the farmers listened to messages, simultaneously doing some work either at field or home. Few have taken notes (1.67%) or recorded the messages (1.25%). Majority of the farmers (84.17%) have only listened to the messages without discussing with friends or family members and negligible per cent of farmers had sought additional information by calling back either DOR staff or the IKSL help line (2.50%). Overall, majority of the farmers (66.67%) were in the below average listening behaviour category (Table 3).

Table 3 Listening behaviour of the surveyed farmers

Variable		Frequency (%)
1. Listening frequency		
a. listened to all 28 messages		48 (20.0)
b. Listened to all 19-27 messages		64 (26.67)
c. Listened to all 10-18 messages		83 (34.58)
d. Listened to fewer than 10 messages		45 (18.75)
2. Listening pattern		
a. Listening and simultaneously doing some work		63 (26.25)
b. Only listening		170 (70.83)
c. Listening and taking notes		04 (01.67)
d. Recording		03 (01.25)
3. Listening response		
a. Only listening		202 (84.17)
b. Discussion with friends		26 (10.83)
c. Discussion with family members		18 (07.50)
d. Seeking additional information with IFFCO/DOR		06 (02.50)
Overall listening behaviour (a + b + c)		
	Low	160 (66.67)
	Medium	60 (25.00)
	High	20 (8.33)
Mean: 6.80	SD: 2.52	Range: 3-11

Opinions of farmers: Half of the farmers (50.00%) thought that the messages were presented in time coinciding with the crop growth and 40 per cent of the farmers felt, messages were late. The farmers, who had sown the crop early in *rabi* during second fortnight of September in Prakasham district felt, the messages were late. Majority of the farmers (57.92%) reported that the content of the messages was highly relevant, quality of audio was good (70.83%), messages were highly technical (44.58%), content was adequate (40.83%) and highly useful (61.66%). Overall, 74.58 per cent of the farmers had medium opinion of the mobile phone based messages followed by 18.75 per cent and 6.67 per cent with low and high opinion respectively (Table 4). Xiaolan Fu and Shaheen Akter (2012) reported that more than 75 per cent of the farmers view mobile phone assisted services useful, quality of the services and the speed of services delivery have been improved significantly as a result of mobile phone intervention.

Table 4 Opinions of farmers on mobile phone based audio messages

Variables	Categories	Frequency (%)
a. Timeliness of the messages		
	Coinciding with the crop growth	120 (50.00)
	Early	24 (10.0)
	Late	96 (40.0)
b. Relevance		
	Highly relevant	139 (57.92)
	Somewhat relevant	83 (34.58)
	Irrelevant	18 (07.50)
c. Audio quality		
	Good	170 (70.83)
	Fair	48 (20.0)
	Poor	22 (09.17)
d. Message treatment		
	Less technical	65 (27.08)
	Moderately technical	68 (28.33)
	Highly technical	107 (44.58)
e. Content adequacy		
	Adequate	98 (40.83)
	needs more details	86 (35.83)
	not at all adequate	56 (23.33)
f. Content usefulness		
	Very useful	148 (61.66)
	Little useful	70 (29.17)
	Not useful	22 (9.17)
Overall opinion (a+b+c+d+e+f)		
	Low	45 (18.75)
	Medium	179 (74.58)
	High	16 (6.67)
Mean = 11.13	SD = 3.12	Range = 6-17

Knowledge of farmers: About 66.67 per cent of the farmers were in moderate knowledge category before hearing the audio messages over mobile phones (answered 15 to 22 questions) and this increased to 70.42 per cent after hearing the messages over mobile phones (answered 18 to 23 questions). The farmers in low knowledge category decreased from 16.25 per cent (answered <15 questions) to 8.33 per cent (answered <18 questions) and in high knowledge category increased from 17.08 per cent (answered more than 22 questions) to 21.25 per cent (answered more than 23 questions) in pre- and post-dissemination groups, respectively. The mean scores, range of scores for knowledge were higher in post-dissemination group than those of pre-dissemination group and the paired t value was significant between the groups (17.48, $p < 0.01$) (Table 5). The mobile phone based audio messages have helped in increasing the knowledge of sunflower farmers. Kumar and Padmaiah (2012) reported significant improvements in knowledge of castor growers due to mobile phone based agro-advisories. Pawan Kumar (2011) reported that the information obtained through mobile phones improved soil health, which resulted in increased agricultural productivity and farm income.

Table 5 Farmers' knowledge on sunflower production technologies

Knowledge categories	Pre-dissemination	Post-dissemination
Low	39 (16.25)*	20 (08.33)
Medium	160 (66.67	169 (70.42
High knowledge	41 (17.08)	51 (21.25)
Mean	32.71	38.6
SD	3.16	4.71
Range	26-42	26-47
Paired 't' value	17.486 ($p < 0.01$)	

*Figures in parenthesis are percentages

Outcomes-level 6 (medium term): Behaviour/Practice change: Farmers in low adoption category decreased from 17.50 to 10.42 per cent in pre- and post-dissemination groups, respectively and that of high adoption category increased from 15.83 to 22.08 per cent indicating the impact of mobile phone based dissemination. The mean adoption scores increased from 28.27 to 31.10 in pre- and post-dissemination groups, respectively. The paired t value was significant (14.5, $p < 0.01$) between pre- and post-dissemination scores (Table 6).

Table 6 Farmers' adoption of sunflower production technologies

Adoption categories	Pre- dissemination	Post- dissemination
Low	42 (17.50)*	25 (10.42)
Medium	160 (66.67)	162 (67.50)
High	38 (15.83)	53 (22.08)
Mean	28.27	32.1
SD	2.55	3.51
Range	26-39	26-44
Paired 't' value	14.17 ($p < 0.01$)	

*Figures in parenthesis are percentages

Outcomes-level 7 (long term): Economics: The seed yield increased marginally during *kharif* (750 kg/ha) and *rabi* (1250 kg/ha) seasons in post-dissemination group (Fig. 2), but statistically significant differences were not observed between pre- and post-dissemination groups. The COC and GMR increased slightly, but the BCR remained almost same for pre-(*kharif*: 1.85, 2.57) and post-dissemination (*rabi*: 1.89, 2.58) groups (Fig. 3). This indicated that the increase in GMR was not reflected in higher BCR due to increase in COC. Aker and Mibiti (2010) reported that mobile phone coverage and adoption had positive impacts on agricultural and labour market efficiency and welfare in certain countries. Jenson (2007) indicated that adoption of mobile phones by fishermen and wholesalers was associated with a dramatic reduction in price dispersion, complete elimination of waste and near-perfect adherence to the law of one price. Both consumer and producer welfare increased. Mobile phones allowed fishermen to get timely price information and decide on the best place to land and sell their daily catch. Abraham (2007) observed that widespread use of mobile phones increased the efficiency of markets by decreasing risk and uncertainty for fishermen in Kerala.

External factors: External factors will have either supporting or antagonistic effects on the outcomes of the programme. Particularly, the decision to adopt a technology/practice depends on many external factors such as institutional, policy environment and community. The institutional factors like timely availability of required inputs in the markets, their quality and cost affects the adoption decision of farmers. Even though the knowledge scores were higher (mean: 38.6), the adoption scores were lower (mean: 32.1) due to these external factors. The policy of the State regarding minimum support price to sunflower may act as a trigger for adoption of new techniques, which may influence the adoption scores. The farmers might have been exposed to information on sunflower from other community sources, which were not accounted in the study. Apart from this, other factors such as the climatic conditions influence the adoption decisions of the farmers. During *kharif* there was prolonged dry spells after sowing of the crop, hence farmers had not taken the risk of higher investment in nutrient management particularly boron and sulphur application, which may be one of the reason for low adoption scores.

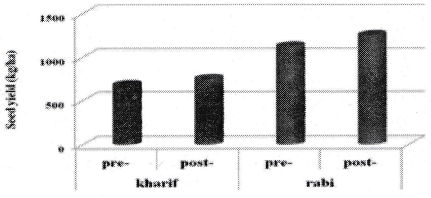

Fig. 2. Seed yield of sunflower for pre- and post-dissemination groups

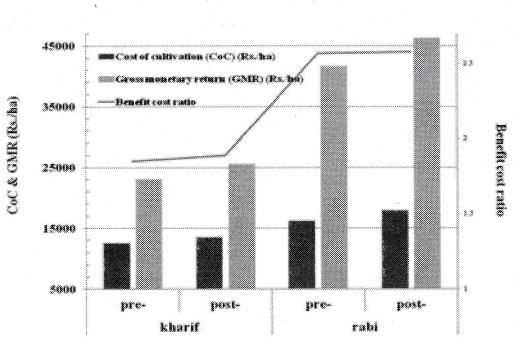

Fig. 3. Economics of sunflower cultivation for pre- and post-dissemination groups

This study has clearly bought out the use of mobile phone networks for dissemination of agricultural knowledge as one of the powerful means of increasing access to quality information to farmers who may not be reached by the extension programmes. With the increased availability, access and ownership of mobile phones in India, mobile based agro-advisories would play a significant role in reducing the information gap and information asymmetry between the farmers. It can be concluded that mobile phones based advisories can create awareness and make knowledge accessible to farmers. To some extent mobilize communities

to adopt best practices and make research findings easily available to farmers in a simple and understandable language. To improve knowledge and adoption of improved practices, training sessions and demonstrations should be organized immediately after the broadcast of advisory in order to impart the required skills. Other formats such as question-answer, quizzes and pull based advisories may also be combined to create and sustain the interest of farmers in the advisories and improve their uptake.

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