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Climate Adaptation Skill Building among Smallholder Farmers - An Experimental Study on Effective Skill Training Methods in South Indian Villages

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Author's contribution

The sole author designed, analyzed and interpreted and prepared the manuscript.

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ABSTRACT

Climate Change has got far reaching adverse effect on Agriculture in developing countries accentuating rural poverty. The Food and Agriculture Organization (FAO) has been advocating for Climate-Smart Agriculture which encompasses, among other things: Sustainably increasing agricultural productivity and incomes; adapting and building resilience to climate change and reducing and/or removing greenhouse gases emissions, where possible. Adaptation measures include many agriculture techniques. The extension agencies in developing countries have the key challenge of enhancing the adaptation skill of small holder farmers to reduce their vulnerability.

Aim of the Experiment and Locale: The aim of this experiment was to test the comparative effectiveness of Video Teaching vis-a-vice Method Demonstration in imparting skills among smallholder farmers of a climate technology namely "Preparation of Enriched Farm Yard Manure". This six-month long experiment was conducted in drought-prone villages of Erode district of Tamil Nadu, South India.

Methodology: The sophisticated experimental design- The Randomized Block Design (RBD) was

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used to test the effectiveness of the treatments. The RBD was particularly chosen to follow the principles of the experimental design namely Replication, Randomization and Local Control. Three replications of experimental treatments: Video Teaching, Method Demonstration and Video Teaching + Method Demonstration were set up to expose 45 smallholder farmers carefully chosen as experimental subjects. The homogeneity of the technical content (Preparation of Enriched Farm Yard Manure) among all the three treatments was ensured through systematic standardization procedure with help of panel of experts. The possible extraneous variables arising out of differing socio-economic characteristics of subjects were controlled through pretesting and matching for homogeneity. The dependent variable was the Skill Gain among the subjects while the independent variables were the three treatments. Sequentially, first the subjects' skill level in handling the skill practice was assessed prior to the experiment. The subjects then were exposed to the treatments as per the design. Finally the skill levels of the subjects were again assessed immediately after the treatments. The Skill Gain was measured and the effect of the treatments was compared using Paired't' test and ANOVA test.

Results: The results showed that all the three treatments: Video Teaching, Method Demonstration and Video Teaching + Method Demonstration significantly raised the skill levels of subjects. At the end of the experiment the subjects exposed to these three treatments respectively possessed adjusted Mean Skill Scores of the three treatments were 13.90, 17.50 and 17.87 respectively. They were to possess 45.26 per cent, 77.53 per cent and 90.16 per cent of the skill sets required for scientific preparation of the Enriched Farm Yard Manure. ANOVA test showed F value of 10.37 (<.01) indicating significant effect of treatments. Thus, the treatments exposed to the subjects had the rank order of effectiveness as: Video Teaching + Method Demonstration, Method Demonstration and Video Teaching in terms of Skill Gain among the subjects.

Conclusion: Video Teaching is comparable, though not equally effective, with Method Demonstration, implying that it can be used to transfer climate adaptation skills across geographies.

Keywords: Agriculture extension education; climate adaptation; extension training; training effectiveness; video teaching; method demonstration; experimental design; randomized block design; smallholder farmer training.

1. INTRODUCTION

Climate Change is all pervasive in the recent years and its adverse impact is very much perceptible in the field of agriculture. The smallholder farmers derive their livelihoods from the natural resources – land and water which are irreversibly altered by climate change, endangering the livelihoods of the farmers. Over the centuries, smallholders have developed the capacity to adapt to environmental change and climate variability, but the speed and intensity of climate change is outpacing their ability to respond. In this context, the smallholders require technological support to minimize the impact of the adverse impact of the climate change. Plethora of technologies has been evolved through indigenous knowledge system as well as agriculture research over a period of time towards sustainable agriculture. The smallholders need to be trained on such technologies in an ongoing basis to adapt to the changing climate [1,2].

Many research studies showed that one of the serious constraints of smallholder farmers to adopt innovation was the lack of technical skill. Imparting skill is the pre-requisite to ensure adoption. Effective training method to transfer climate adaptation technologies is the key challenge for extension organizations across developing world [3]. Trainer has an important role to play towards the success of farmers' training. He/she has to properly design the training programme, select appropriate training method and evaluate the training to see the extent to which the training objectives have been met and to identify areas for improvement. Among the extension methods, it is well established that Method Demonstration is the most effective means of skill transfer to farmers. Method Demonstration is used to teach farmers how to perform certain tasks [4]. Nevertheless, Method Demonstration is a group method of training and mass coverage of farmers in short period of time to transfer skill, say just prior to sowing season of a rain-fed crop for mass adoption of technology across wide geographical area and diverse smallholder farmers is a huge challenge [5]. Number of farmers served by an extension worker in India is 5000, while it is 475 in some African countries and 675 in China [6].

This explains the limitation of Method Demonstration, being a manual-intensive method, in imparting climate adaptation technical skill among vast peasantry on a mass scale [7].

There is a need for finding suitable alternatives(s) to Method Demonstration. Television is already a popular mass method of training which can potentially impart skill to farmers in a big way. Van Den and Hawkins (1998), the international extension scientists, however, have stated that some kinds of knowledge can be transferred through mass media, whereas this not possible for other kinds of knowledge and skills. Given this theory in the backdrop, the experiments endeavoured to test the effectiveness of Video Teaching programme, amenable for television broadcast, in imparting technological skills to farmers.

The studies, as could be seen in Literature Search section, on imparting skill to the farmers over the years have started contradicting earlier myth that Method Demonstration was the only effective medium of skill transfer. The research conducted in the earlier part of this century have come out with contradicting results about comparability and substitutability of Video Teaching with Method Demonstration as extension technique to impart skill to farmers. The research has attempted to show in unambiguous terms the usefulness of Video-Teaching as medium of imparting skill to smallholder farmers. The study further has chosen a climate technology – Enriched Farmyard Manure - as the subject matter in order to bring out the efficacy of extension methods under consideration for disseminating climate adaptation practice, which is urgent issue among the extension professionals in developing countries.

The advantage of video programmes is that they can be duplicated in a cost effective way and played to farmers across wider geographies and can also be telecast through television to reach large number of farmers. The potential of Video Teaching to transfer skill in comparison with Method Demonstration needs scientific investigation to advocate the former in place of the latter for mass climate technology dissemination. The present study aims to empirically compare the effectiveness of Video Teaching vis-a-vis Method Demonstration to deliver the “How-to-do’ skill through field experiments in select villages of South India involving smallholder farmers as subjects. The specific objective of the study was:

To find out the relative effectiveness of Video Teaching and Method Demonstration individually as well as in their combinations experimentally in terms of Skill Gain on selected climate-technology among smallholder farmers (subjects).

The article, therefore, covers the field experimental test-results on the effectiveness of Video Teaching vis- a-vis Method Demonstration in imparting skills to smallholder farmers on a selected climate adaptation technique through experimentation done in village settings. The experiments were held among smallholders in climate affected drought region and the results would have far reaching implications across agriculture system disseminating Climate Smart technologies.

2. LITERATURE SEARCH

Some of the most important impacts of global climate change will be felt among the populations, predominantly in developing countries, referred to as “subsistence” or “smallholder” farmers. Their vulnerability to climate change comes both from being predominantly located in the tropics, and from various socioeconomic, demographic, and policy trends limiting their capacity to adapt to change. There is an obvious need to build capacities of farmers to embrace adaptation practices and skills to prevent them becoming vulnerable. Mass scale skilling of farmers in agronomic adaptation practices is urgent intervention needed across developing regions [3,8]. This implies the necessity to find ways of teaching skills in a mass scale. A panoramic view of research findings related to effectiveness of different extension methods and media is given in this section.

Fitts [9] indentified three phases in skill learning which included:

i. Skill learning beginning with a cognitive phase, usually of relatively short duration during which individual would cognize the nature of the skill an internal model for performance is constructed.
ii. During the intermediate or organizing phase the reporter -effectors-feedback operations gradually would become more highly organized with practice until the skill becomes automatic.
iii. In the performing phase, there would be continuing improvement over a long period of time. The combination of motor,

cognitive and affective characteristics would produce the stability and continued improvement.

Direct and purposeful experience is the rich, full-bodied experience that is the bedrock for education. It is the purposeful experience that is seen, handled, tested, touched, felt and smelled. This experience is commonly referred to as “something one can get his hands on’, wherein the individual will have direct participation, with responsibility for the outcome. A demonstration is a visualized explanation of an important fact or idea or process [10].

There was little evidence in the research literature that any medium of instruction was intrinsically or invariably superior to any other medium of instruction. A single method or a single medium of instruction would not suffice. The media were complementary, not competitive and that a combination of media in the instructional process was superior to any one alone [11]. The adoption of practices was high when more than five methods were used as compared to single and two to five methods [12]. Combined use of several methods was of utmost importance in extension teaching and Combination of two teaching methods was significantly superior to single method [13,14]. Mankar [15] concluded that the most effective communication in bringing about change in behavioural components – knowledge, attitude and skill of the farmer was through method demonstration cum leaflets. To evaluate the effectiveness of any training programme the level and direction of behavioural changes produced in the trainees have to be measured [16,17]. Mixed media had brought about significant behavioural changes among the farmers [18]. Media combinations were more effective than the single medium but the media combinations did not differ among themselves [19]. Eighty three per cent of learning takes place through sight. Visual media not only arouse interest among the learners but also enrich learning situation by sustaining interest, promoting better understanding and motivating thinking and action [20]. TV holds enormous potential as an educator [21,22]. Social drama and video or “narrow casting’ were the aspects of TV that helped in improving the media’s capacity as an educator in the African Society. Paul et al. [23] reported that 74 per cent of the farmers considered result demonstration as highly effective. Individual and group contact methods were the most effective methods in diffusion of agriculture practices [24]. Learners perceived that use of other teaching aids such as live plant specimen and field trips were more effective that video tapes. They also perceived the use of video as a positive supplement to the management course, but not as a substitute for traditional teaching methods [25]. Farm and home visits, result demonstration and group discussion in extension were ranked I, II and III respectively in terms of their effectiveness in inculcating knowledge and skill among farmers [26]. A study of Rudihal et al. [27] indicated that after the training, increase in knowledge level was seen to the tune of 64 per cent in grafting technique. Flash card, flannel graphs and flip charts were ranked I, II and III respectively, in the order of importance by both extension scientists and extension workers [28]. The studies quoted above are unanimous in their conclusion that combination of extension methods produces better result compared to single method. This might be because of the higher number of senses of the learners involved in combination techniques. Lecture with flip chart and slides plus discussion forum resulted in maximum knowledge gain on participants followed by lecture with slides plus discussion forum and lecture with flip chart plus discussion forum [29]. In order to transfer knowledge aspect of a skill practice, video teaching was the best followed by practising through coaching and demonstration. Mean skill on packaging of carnation flowers was the highest among the cut-flower growers taught by practicing through coaching followed by those trained by video teaching and demonstration in that order. Similarly, there existed a significant difference among the mean skill of above three groups [30]. The interpersonal recall audio group rated their skills as improving significantly greater than that of interpersonal recall video group as reported by Spam [31]. One-fourth of the subjects were found to have acquired skill perfectly and fully owing to their exposure to broadcast and little less than one-forth could not make out anything out of the broadcast [32]. Television was a potential medium in imparting skill among the mass audience [33,34]. Highly significant difference in acquisition of skill was noticed after exposure of the video presentation through selected modes. The modes, interview followed by straight talk treated with 2D and 3 D visuals resulted in high level of mean skill acquisition. Farmers’ understanding level of the subject matter being taught and the positive attitude towards adoption new ideas presented were substantially higher when the audiovisuals including video teaching were used in the training programme [35].

3. RESEARCH METHODOLOGY

The scientific method of analysing the effectiveness of the training methods under consideration necessitated the researcher to manipulate some variables. And hence Experimental Research Design was adopted in place of usual *expost-facto* research adopted for social research in general. Among the experimental designs, the sophisticated one namely Randomized Block Design (RBD) was followed for the experiment. Different components of the procedure followed are narrated hereunder:

3.1 Selection of Climate Technology

Rain-fed groundnut, a major crop in the study area is cultivated mainly by smallholder farmers. The crop was mostly cultivated in dry land which depended on rainfall for supporting the crop. Given the climate variability the rainfall had been increasingly uncertain and the crop failure due to drought was common in the area. The agriculture university, the jurisdiction of which the study area comes under, evolved several climate resilient technologies for the rain-fed groundnut. Therefore climate technologies advocated for dry land groundnut crop were purposively selected for testing the extension methods under this experiment. Of scores of technologies meant for rain fed groundnut, one key technology was chosen through expert-judgement method. Accordingly, a list of rain-fed groundnut climate resilient technologies was prepared and was given to 30 judges consisting of 10 scientists, 10 extension workers and 10 farmers asking them to rate the technologies in three–point continuum with respect to their importance to enhance the climate resilience of the crop. The responses were analysed to come out with a handful of most important technologies. Of these technologies, *'Preparation of Enriched Farm Yard Manure (FYM)'* was chosen to be used in the experiment based on its newness, importance, the skill involved in its preparation and its suitability to test all the training methods under consideration.

3.2 Significance of Enriched Farm Yard Manure in Climate Smart Agriculture

The Enriched Farm Yard Manure (Enriched FYM) helps farmers follow the triple climate adaptation strategy being advocated by Food and Agriculture Organization. They are: Composting, Manure Management and Fertilizer Micro Dosing. Farmyard manure is an important ingredient in building up of soil organic matter which fosters growth of crop root system enabling the crop to extract scarce soil moisture. Further, the organic matter substantially enhances the water holding capacity of soil and absorbs and retains maximum rainwater. Smallholder famers are taught judicious use of animal manure as a climate adaptation practice. Farm Yard Manure emits Methane, one of the Green House Gases causing the climate change. The practice of enriched farm yard manure reduces exposure of manure to the atmosphere thereby curtails the quantum of methane release. Composting involves removing crop residues to allow them to decompose and then adding them back to the soil to improve soil fertility, texture and water infiltration. In Indian smallholder context, composting involves blending of animal manure and crop residue and allowing them to decompose. Micro dosing of fertilizer helps right quantity of fertilizer to be made available for the crop to maximize fertilizer use efficiency [3]. Fertilizer use efficiency highly depends on whether condition. The climate variability substantially alters the efficiency level. The fertilizer so blended with farmyard manure gets released slowly and is available over the crop period.

3.2.1 Definition of enriched farm yard manure

Enriched Farm Yard Manure (Enriched FYM) refers to Farm yard manure blended with right quantity of Super Phosphate fertilizer, allowed for a month's time before its application to the crop field.

3.3 Locale of Study and its Description

3.3.1 Selection of district

Erode district of Tamil Nadu in South India was purposively selected for the study. The district had vast extent of drought prone smallholder farming. Besides, the area under groundnut crop in the district was over 40,000 hectares spread over varying cropping systems representing an ideal setting for the conduct of the experiment. The district was under the jurisdiction of the *alma mater* of the author-Tamilnadu Agriculture University, where from he had drawn resources /support for the experiment.

3.3.2 Selection of taluk

Since enriched FYM is technology meant for rain-fed groundnut, a *taluk* in the selected district with highest area under rain-fed groundnut crop was purposively selected for the study. Accordingly, *Perundurai taluk* became the choice for the experiment. Seventy per cent of the crop cultivated in the *taluk* is under rain-fed area while major soil type of the *taluk* being red sandy soil (82 per cent) suitable for groundnut cultivation. Majority of the farmers in the *taluk* were smallholder farmers. The cropping pattern followed in the *taluk* was: Groundnut- Fodder Sorghum-Fallow.

3.3.3 Selection of blocks and villages

Kunnathur block and *Oothukuli* block located in the two extremes of *Perundurai taluk* were chosen to have a fair representation of different microclimates and cultural practices adopted to conduct the experiments in consultation with the officials of the State Department of Agriculture keeping in mind the physical facilities available, distribution of groundnut crop growers in different socio-economic strata. The three villages in the blocks chosen were: *Valayapalayam, Netichipalayam and Kangiyam Palayam*.

3.4 Standardizing the Climate Technology Content

The subject matter content delivered through two training methods was made identical as follows: Method Demonstration of preparation of Enriched FYM, following the university standardized procedure, was enacted by a selected extension demonstrator. The same was video-graphed to prepare the Video Teaching material by the University Video Unit. At each / combination of treatment(s) during the experiment, the same extension demonstrator was involved in demonstrating the method and the same video was played before the experimental subjects (smallholder farmers). Further, the video programme and method demonstration were subjected to standardization before a group of judges from the faculty of extension. The above programmes were played/ demonstrated before them one by one to get their judgements on the equality of content of the methods with respect to subject matter coverage, sequence of presentation and clarity (both audio and visual). Necessary alterations were made in the method(s) based on the suggestions received from the judges.

3.5 Dependent Variable: Skill Gain

In this study, the dependent variable – Skill Gain – was taken as the parameter to measure the effectiveness of Video Teaching and Method Demonstration. Skill in this study was defined as the psycho motor ability of the subjects to carry out a given task. It involves physical and mental co-ordination in performing a task. Skill in this study was *operationalised* as the ability of an experimental subject to prepare enriched farmyard manure scientifically. It is the number of steps performed correctly by the subjects in scientific preparation of Enriched FYM.

Skill Gain was *operationalised* as the improvements in the number of steps correctly performed by subjects (farmers) in scientific preparation of enriched FYM due to exposure to the experimental treatment. The measurement of skill in this experiment was done using the procedure developed by Chandrakandan [32] with an improvement made to enhance its validity. The steps involved in measurement are detailed below:

> The skill component in preparation of enriched FYM was divided into eight distinct steps. Each step was assigned a score based on the weight age arrived through judges opinion. If a subject was able to perform the first step correctly, he/she was given the score corresponding to that step and he was asked to proceed to carry out the second step. The correct performance of each step was given appropriate score. In case the subject was unable to perform a particular step, he/she was taught that particular step alone and then allowed to proceed to the next step. Steps correctly performed by the subject without the assistance of the investigator alone were assigned scores (as per the Score Panel (Vide Table 2) and the steps for which assistance was extended did not receive any score (score 0). Based on the number of steps involved in preparation of Enriched Farmyard Manure, the scores obtainable by subjects ranged from 0 to 19.

3.5.1 Weight-age for skill steps

In order to scientifically determine the weight age to the skill steps the investigator subjected the steps to judgement of extension experts by asking the latter to rate the steps in three point continuum based on the complexity involved to perform them. The responses were obtained from 20 experts and the total scores for each step were arrived. The scores of all the steps were juxtaposed to calculate the mean and standard deviation of the distribution. The level of complexity of each step and the weightage for them based on the criterion are given in Table 1.

The eight steps involved in preparation of Enriched FYM are listed in Table 2 along with the score assignable to each step as per the scoring norm stated in Table 1.

3.6 Research Design

Experimental design was chosen for the study since it is the only research design which would enable the researcher to maximise the experimental variance, control the extraneous variance and minimize error variance and ultimately to establish the cause-effect relationship between the treatments (training methods) and skill gain.

Randomized Block Design (RDB) was adopted for the present experiment as it could satisfy all the principles of experimental design namely – Replication, Randomization and Local Control [36]. The design could be otherwise called a Matched Group Design. It was based on the principle that the experimental unit (or subjects) could form a block or group. As a matter of fact, a group of subjects said to be homogeneous with respect to the matching variables and they form a Block. It was expected that each block of subjects would be equivalent in the absence of experimental treatment than a set of subjects selected at random. Owing to this reason, Randomized Block Design was preferred to Randomized Group design.

In this design, all subjects were first tested on a common or pre-test measure (also called the matching variable) and then they were formed into groups (as many as needed for the experiment) on the basis of the performance on the matching variable. The groups thus formed were said to be equivalent groups. Subsequently, treatments were applied to each block /group. If these groups had equivalent means on the dependent variable before the experimental treatment was given and if a significant difference occurred after administering the experimental treatment, then the resulting difference in the dependent variable might safely be attributed to the experimental treatment.

3.7 Subject Selection and Allotment

The experimental subjects (smallholder farmers) were chosen to be homogeneous groups and then allocated to different blocks of the experiment.

The chosen subjects were pretested for their prior Skill on the subject matter as well as for their antecedent variables like Age, Annual Income, Socio-Economic Status, Deferred Gratification, Extension Participation, Mass Media Exposure, Value Orientation, Economic Motivation, Secular Orientation, Urban Contact and Scientific Orientation.

Table 1. Criteria used and weight-age given to the steps involved in preparation of Enriched FYM employed for measuring skill of subjects

S. no	Complexity	Criterion	Weight age
1	Low	Steps with scores below (mean – 1 standard deviation)	1
2	Medium	Steps with scores between (mean-1 standard deviation) and (mean + 1 standard deviation)	2
3	High	Steps with scores above (mean+ 1 standard deviation)	3

Table 2. Score panel for eight steps involved in preparation of enriched FYM

Step	Item	Score assignable
1	Taking right quantity of farmyard manure	2
2	Preparation the FYM by pulverizing and bringing to right fineness	1
3	Taking right quantity of super phosphate	3
4	Mixing the superphosphate with FYM	2
5	Preparation of mud slurry	2
6	Plastering the mixture air tightly with the help of mud slurry	3
7	Stirring the plastered heap uniformly after 15 days	3
8	Re-plastering the stirred up mixture	3

All the scores obtained under antecedent variables were converted into Z score to categorize the subjects into three categories Block I, II and III subjects. All those subjects having average Z score of less than minus one (< -1) were Block I subjects. Those with -1 to + 1 score formed the Block II subjects and those with score > 1 formed the Block III subjects.

The Skill test having eight steps had a maximum score of 19 and minimum of zero. The respondents scoring a low knowledge score range of 0 - 6 were allotted to Block I subjects and others ceased to be members of any treatment. Similarly, those subjects scoring 7 - 12 score were brought under Block II, while those with 113 -19 scores formed part of Block III subjects.

There were three homogeneous groups of five subjects in a block to test the three treatments, they represented one replication. Similarly, there were other two replications with similar number of subjects in each. Altogether, 45 subjects drawn from three select villages of the study area were engaged in the experiment. The layout of the research design in captured in Table 3.

3.8 Skill Gain Measurement

The subjects' skill of was measured in two stages: pre and post exposure to the treatment within the overall layout of the research design. The skill level of the subjects in pre exposure situation was assessed by assigning the appropriate scores for the performance of the steps by the subjects (the same was used to allocate subjects for different blocks of the design as explained earlier). The skill in the post exposure situation was assessed again as per the procedure. The difference between the pre and post-exposure scores was taken as the measure of Skill Gain.

4. RESULTS AND DISCUSSION

The experiment has brought to light relative positions of Video teaching, Method Demonstration and their combination in terms of their effectiveness in imparting skills to smallholder farmers.

4.1 Effect of Treatments in Skill Gain

The results of skill acquired by the experimental subjects due to exposure to the three treatments are presented in Table 4.

On perusal, Table 4 reveals that all the three treatments increased the skill level of the subjects significantly with slight variation among themselves regarding the extent of increase. Among the treatment, the combinations: Video Teaching + Method Demonstration was found to have increased the skill to the extent of (90.16 per cent) followed by Method Demonstration. Thus combination of methods is superior to any single method. The result is in line with findings of Vishnoi and Sinha, [13], Choudhary and Singh [14] and Spector [18]. The experiment has revealed that Video Teaching per se is found to enhance level of skill of farmers. This finding is significant because there has been widely held notion that audio visuals like video is very effective in improving the cognitive process of information transfer as well as strengthening the emotional process (motivation of the learners). There had been little evidence about their impact on the psychomotor domain.

4.2 Relative Effectiveness of Treatments on Skill Gain

Accordingly, the relative effectiveness of the three treatments tested has been analysed using covariance analysis and the results are presented in Table 5.

Being subjected to Covariance Analysis the adjusted means in Table 6 are moderated by taking into account the initial scores as well. The significance of the apparent variation in the mean scores was put to further scrutiny using the covariance analysis (ANOVA) table (Table 6).

The variation among the blocks did not matter much to the total variation as the F value (1.53) was not significant. Similarly, there was no interaction effect between the blocks and the treatments as evident from non-significant F value (1.20). The treatments differed significantly (F= 10.37) among themselves at 0.01 level of probability. In order to estimate the critical distance between the treatments on the effectiveness continuum, the value on Critical Difference was calculated and it was found to be 3.12.

Using the Critical Difference value, the treatments have been clustered forming different clusters in the descending order of their effectiveness as shown in Table 7.

From Table 7, it was obvious that combination of methods occupied the higher positions in the order of effect on skill gain. The treatments in the descending order of effectiveness were: Video Teaching + Method Demonstration (T3), Method Demonstration (T2), Video Teaching (T1).

Table 3. Layout of randomized block design

	Village 1 (replication 1)	Village 2 (replication 2)	Village 3 (replication 3)	No. of subjects
Block I (Skill score 0 – 6) & & average Z score of < -1)	Video teaching T1	Video teaching + Method demonstration T3	Method demonstration T2	*15*
Block II (Skill score of 7 - 12 & average Z score of -1 to +1)	Video teaching + Method demonstration T3	Method demonstration T2	Video teaching T1	*15*
Block III (Skill score 13-19) & average Z score of > -1)	Method demonstration T2	Video teaching T1	Video teaching + Method demonstration T3	*15*
No. of subjects	15	15	15	

Table 4. Mean skill gain due to exposure to the treatment (n = 45)

Treatment no	Treatment	Skill score		Mean skill gain score	Per cent of total skill gained after the experiment	Paired 't' test
		Before	After			
T1	Video teaching	5.53	14.13	8.60	45.26	5.75*
T3	Method demonstration	2.80	17.53	14.73	77.53	12.83**
T5	Video teaching + method demonstration	0.60	17.73	17.13	90.16	26.21**

** & ** respectively indicate significance at 0.05 and 0.01 level of probability*

Table 5. Adjusted means of skill score after treatment exposure

Block / Treatment	I	II	III	Mean score
T1	13.03	12.61	16.07	13.90
T3	16.86	17.56	18.09	17.50
T5	15.98	19.16	18.46	17.87

Table 6. Adjusted analysis of covariance (skill) (n = 45)

Source of variation	Degrees of freedom	Sum of squares	Mean square	SE	F value
Block (adj)	2	18.18	9.09	1.58	1.53 NS
Treatment (adJ)	2	122.88	61.44	1.56	10.37**
Block X Treatment (adj)	4	28.56	7.14	1.54	1.20 NS
Error (adj)	28	166.00	5.93	-	-

Significance at 0.01 level of probability; Critical difference = 3.12

Table 7. Clustering of treatments based on critical difference (skill)

Treatment number	Rank in descending order of effectiveness	Treatment	Adjusted mean	Clusters indicating statistically similar treatments
T3	I	Video teaching + Method demonstration	17.87	Cluster I
T2	II	Method demonstration	17.50	
T1	III	Video teaching	13.90	Cluster II

Combination of methods naturally engages more senses of the subjects reducing the monotony and thereby increasing the understanding of the steps involved in the Enriched FYM (the skill practice) demonstrated. The Method Demonstration, though being a single method, provided a direct purposeful experience to the viewers (subjects) and that might be the reason for its better effect on skill gain than Video Teaching, the other single method. It was obvious from the above that all those treatments having method demonstration as one of the components were more effective in imparting skill than the rest. This result reconfirmed the superiority of Method Demonstration in the task of imparting skill to farmers.

The purpose of the experiment was to compare Video Teaching with Method Demonstration to explore the possibility of the former becoming a meaningful substitute to the latter, which is costly and time-consuming. Besides, mass coverage of smallholders within a short period of time is near impossible through Method Demonstration. The experiment revealed that Video Teaching (T1) was effective in imparting skill in absolute terms. This is evident from the significant increase in skill level of the subjects exposed to the treatment. The fact that Video Teaching is less effective than Method Demonstration is well acknowledged. This finding further corroborated that of Karthikeyan [30]. Given the limitations of Method Demonstration for mass coverage, the efficacy of Video Teaching is worth acknowledging.

The results partly qualified the statement on the role of mass media made by Van Den and Hawkins [4]. They have stated that some kinds of knowledge can be transferred through mass media, whereas this is not possible for other kinds of knowledge and skills. They exemplified the statement and said that the basic idea of Integrated Pest Management that chemicals can destroy the ecological balance by killing the predators of dangerous insects, might be taught through television, but the skills required to recognize different kinds of insects only be taught in the field. In the light of this, the emphasis of this finding is that Video Teaching, as a group technique, does enhance the skill of farmers and the same video programme when telecast over television, as mass medium to reach large mass of farmers, is likely to have the same effect [37].

5. CONCLUSION

The climate change is real. Its adverse impact on agriculture has been well recognized world over. It is high time that the agriculture practices got readjusted with a view to increase productivity, resilience and reduce the green house gases. This is the essence of climate-Smart Agriculture advocated by Food and Agriculture Organization (FAO).

There are well established indigenous practices and scientifically evolved technologies to meet the climate challenge in agriculture to make the agriculture resilient to the adverse effect of climate change. The principal issue is that the practices and technologies have not been shared among the smallholder farmers across geographies in developing countries so as to take advantage of such practices.

Development Communication in general and farmers' training in particular are imperative to build awareness about such practices and farmers' skills in using those practices. The smallholders are geographically dispersed in developing countries [38]. Climate resilient technologies need to reach them in short period of time before crop-sowing season, for instance. Skill building is principally a group training method. It is manual-intensive and time-consuming.

Method Demonstration had been natural choice of extension agencies in developing countries to impart skill to farmers. Method Demonstration is a technique shown to people who are convinced already they want to use a technology [4]. It is, however, laborious and time-consuming and hence may not be amenable for large scale skill building at short period of time. Climate resilient technologies require farmers' skill to put to effective use. They are time-sensitive. Therefore, search for suitable alternative to Method Demonstration is the natural option for extension agencies disseminating climate smart agricultural practices.

This experiment compared Video Teaching with Method Demonstration in terms of its potential to impart skill in use of Enriched FYM, an important climate resilient technology to smallholder farmers. The results showed that all the three treatments: Video Teaching, Method Demonstration and Video Teaching + Method Demonstration significantly raised the skill levels of subjects. At the end of the experiment the subjects exposed to these three treatments respectively possessed adjusted Mean Skill Scores of the three treatments were 13.90, 17.50 and 17.87 respectively. They were to possess 45.26 per cent, 77.53 per cent and 90.16 per cent of the skill sets required for scientific preparation of the Enriched Farm Yard Manure. ANOVA test showed F value of 10.37 (<.01) indicating significant effect of treatments. Thus, the treatments exposed to the subjects had the rank order of effectiveness as: Video Teaching + Method Demonstration, Method Demonstration and Video Teaching in terms of Skill Gain among the subjects.

The results of the experiment revealed that though Video Teaching is not as effective as the Method Demonstration in comparative terms but it was found to enhance the skill of farmers in absolute terms. Video Teaching is a group method and yet can potentially be scaled up into a mass method through television broadcast to reach wider target farmers. The results have empirically corroborated the findings of Karthikeyan, [30]. They found that high significant difference in acquisition of skill was noticed after exposure of the video presentation through selected modes. The modes, interview followed by straight talk treated with 2D and 3 D visuals resulted in high level of mean skill acquisition. The results arising out of this experiment is more concrete in terms of the field-based skill practice tested (preparation of Enriched Farm Yard Manure) and innovative way of measuring the skill.

The extension agencies in Indian villages could use Video Teaching to disseminate climate resilient technologies. This experiment could have wider implication in climate adaptation approaches in other Asian and African countries too. Similar experiments may be tried in African continent as well to evaluate Video Teaching in skilling of smallholders there.

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COMPETING INTERESTS

Author has declared that no competing interests exist.

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