Effectiveness of Training on Integrated Farming Systems on Knowledge Gain and Choice of Crop-Animal Technology among Tribal Farmers in Telangana State

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ABSTRACT

Rainfed agriculture occupies 60 per cent of cultivable area contributing to 40 per cent to food basket. The training curriculum in for dryland region, deals with various efficient tools, techniques and methods of soil and water conservation with major emphasis on rain water management techniques such as in-situ conservation practices, micro irrigation systems and efficient Integrated farming systems for livelihood development. A Study conducted to assess the effectiveness and impact of training on the tribal farmers on knowledge gain based on pre and post evaluation scores and factors contributing to knowledge gain using factor analysis. It was found that many subject areas such as NRM management, soil health management practices, agro techniques, pests and diseases management, dryland horticulture have enhanced knowledge. Factors affecting knowledge gain were also determined using factor analysis and found that only practices related to soil and water conservation, animal health and livelihood have contributed to the major change in knowledge. It is clear from above study that training of tribal farmers, owning land and cattle, the uptake of knowledge remain higher with integration of both crop and animal technologies in the training curriculum and increasing economy of tribal farmers under changing climate conditions.

Key words: *Rainfed agriculture; NRM management; Dryland;*

Rainfed agriculture constitutes 65 per cent of total acreage contributing to 40 per cent of food basket in India. In rainfed areas water is considered to be the main constraint. Major challenge lies in enhancing productivity of every drop of water into crop. Techniques on enhancing water productivity through training, imparting knowledge and skills, on better rain water management techniques, use of *in-situ* and *ex-situ* moisture conservation practices, water harvesting methods, cultivation of rainfed crops with less water requirements and animal health care practices and rearing for additional income to protect from drought are important strategies adopted in rainfed areas to mitigate uncertainty and sustain income to farmers. An integrated farming system model, encapsulated with crop- animal technology components highlighting efficient utilization of water resources was designed into a need based curriculum for training of farmers in watershed area. *Singh et al. (2011)* reported that three fourth of watershed farmers do not possess knowledge of watershed activities and have little interest to participate. Farming system, therefore, refers to deliberate raising of crops, forest and fruit trees, animals including fisheries, piggery and duck farming, sericulture, mushroom, on a given unit of a land to increase the productivity and profitability to upgrade natural resource base and to achieve overall improvement of environment.

Training is considered important, crucial and continuous requirement for agricultural development. According to *Rao et al (1997)* training needs, its content, methodologies and approaches change with development phases, strategies adopted and clientele. Regular training

of farmers on management of water resources, maintenance of channels to prevent evaporation through mulching should be made part of extension agent activities (*Devi et al., 2015*). Training curriculum relevant to watershed development programs with focus on enhancing water productivity comprises knowledge areas of *ex-situ and in-situ* soil and water conservation practices, crops, animal husbandry, agro forestry systems and management of social institutions. According to *Singh et al. (2011)* watershed development program is a holistic approach that comprises not only crop husbandry but also allied activities. Assessment of knowledge gain after completion of training is found important indicator to assess the effectiveness of training. Effectiveness usually measured at different levels. According to *Kaufman and Keller (1994)*, who measured effectiveness at 4 distinct dimensions and foremost and simplified one where participants reaction to the program is considered that indicated the level of satisfaction about training (relevance level); attributes pertaining to knowledge, skills and attitude referred to as participant learning; the application of learning on farms (transfer of learning) and the fourth level is to increase in productivity and efficiency of trainees (results). In this study the second dimension of evaluation was applied to assess the effectiveness of training on Integrated Farming system (IFS) focusing on Knowledge gain as indicator for effectiveness. The content of training curriculum included efficient natural resource use, integration of crop-livestock technologies and livelihood strategies. The paper focus on prime objective to study the effectiveness of training on IFS on the extent of knowledge gain and to determine the factors which have influenced the change towards knowledge gain.

METHODOLOGY

Enhancing water productivity scheme, sponsored by ICAR for 5 year period was implemented in rainfed areas. Training of farmers and extension personnel on water productivity improvement was one of the objectives of the program. Tribal farmers have participated in training programs on improvement of water productivity. As part of the sponsored scheme by Institute farm Science centre, generally called as KVK, farmers trainings were organized and each training spanning eight days duration. Under the water productivity program a series of trainings relevant to water use efficiency, resource use efficiency sustainable agriculture practices, integrated farming systems with crop animal components, intercropping systems, farm mechanization were covered for farmers of Ranga Reddy district of Telangana State. Around 39 programs were covered under the scheme with participation of farmers at the rate of 50 farmers per batch (Table 1).

Table 1. Details of farmers training under water productivity scheme

Year	No of	No. of farmers						
	trg.	Total	M	F	Gen.	SC	ST	OBC
2007-08	01	50	50	-	10	11	-	29
2008-09	11	520	416	104	77	71	210	162
2009-10	08	420	398	22	89	45	136	150
2010-11	09	412	398	14	42	51	173	146
2011-12	10	525	452	73	94	52	84	295
Total	39	1927	1714	213	312	230	603	782

Table 2. Socio economic status of tribal farmers undergone training on rainfed agricultural technologies

Variable	Male	Female	Pooled
Age			
Young	56(54.36)	16(94.11)	72(60)
Middle	44(42.71)	1(5.88)	45(37.5)
Old	3(2.91)	0	3(2.5)
Total (n-120)	103(100)	17(100)	120(100)
Land possession			
Marginal	3(2.91)	3(17.65)	6(5)
Small	49(47.57)	0	49(40.83)
Medium	13(12.62)	0	13(10.83)
Large	38(36.89)	14(82.35)	52(43.33)
Total	103(100)	17(100)	120(100)
Education level			
Primary	55(53.40)	4(23.53)	59(49.17)
High School	32(31.07)	2(11.76)	34(28.33)
College	16(15.53)	11(64.71)	27(22.5)
Total	103(100)	17(100)	120(100)
Caste			
BC	0	0	0
ST	103(100)	17(100)	120(100)
OC	0	0	0
Others	0	0	0
Total	103(100)	17(100)	120(100)

(Figures in parenthesis indicate percentage)

An on-campus integrated farming system training program was undertaken to tribal farmers of semi-arid region. A schedule was constructed taking important knowledge points in each of the lectures and field visits on two-point scale 'yes' and 'no' items, and was subjected on trainees in same training twice before and

after the training. Based on the scores obtained pre and post training data were analyzed for knowledge gain and factors that contributed to change in knowledge. Around 120 farmers, both male and female farmers from tribal areas constituted the sample of the study and their socio-economic status were characterized (Table 2). Tribal farmers were purposively selected as tribal population, men and women, possessed land and cattle equally. A paired 't' test was employed to test the significance of differences of means between pre and post knowledge scores. To understand factors responsible for the knowledge gain the principal component analysis was carried out to divide the variation of means into components. The results of the analysis are presented and discussed below.

RESULTS AND DISCUSSION

From Table 3 the analysis of the pre and post training evaluation scores had revealed that there was significant 'knowledge gain' in areas of water conservation practices such as summer ploughing, contour bunding with 'A' frame, ploughing across slope; crop production practices namely starting with soil testing ensuring balanced nutrient application, furrow irrigation, application of DAP in last ploughing, use of vermicompost having nutrients higher than FYM, root nodules presence in leguminous crop contain rhizobium bacteria followed by gain in knowledge in pest management practices through use of neem seed kernel extract and use of marigold as trap crop. The knowledge aspects related to animal health practices found to show significant change to knowledge such as symptoms of FMD, isolation of animals affected with diseases in separate shed, young goats effected with tapeworms, and presence of vitamin K in colostrums milk and hybrid napier as hybrid fodder. Farmers through trial and error means have gained knowledge on use of fertilizers and soil and water conservation practices, however knowledge gained through training and skill demonstrations have

Table 3. Pre and Post evaluation paired sample test of technologies trained- a farmers perspective

Water productivity enhancement technologies	1	2	3	4	5	6
Summer ploughing	1.79	2.00	-0.211	0.413	-3.141	.003*
Contour bunding with 'A' frame	1.66	2.00	-0.342	0.481	-4.386	.000*
Ploughing across slope	1.63	2.00	-0.368	0.489	-4.646	.000*
Bio-diesel production with Jatropa	1.55	1.97	-0.421	0.500	-5.187	.000*
Earthworms used for vermicomposting	1.74	1.95	-0.211	0.474	-2.737	.009^{NS}
Soil testing ensures balanced nutrients application with seed rate.	1.53	1.97	-0.447	0.551	-4.969	.000*
SRI requires 2 kg seed rate	1.53	2.53	-1.00	3.379	-1.830	.075^{NS}
Furrow irrigation adopted for maize	1.66	2.00	-0.342	0.481	-4.386	.000*
DAP applied in last ploughing	1.55	1.89	-0.342	0.582	-3.621	.001*
Vermicompost possess micronutrients more than in FYM	1.53	1.97	-0.447	0.555	-4.969	.000*
Root nodules in leguminous crop contain rhizobium bacteria.	1.47	2.00	-0.526	0.506	-6.412	.000*
Bird control in sunflower crop with glossy ribbon	1.61	1.97	-0.368	0.489	-4.646	.000*
Vegetative propagation improves quality of fruit trees.	1.82	1.97	-0.158	0.437	-2.229	.032^{NS}
Adopt IPM for environment quality	1.74	1.97	-0.237	0.431	-3.389	.002*
Neem seed kernel extract preparation control pest damage.	1.73	2.0	-0.263	0.446	-3.635	.001*
Marigold used as trap crop tomato cultivation.	1.53	2.0	-0.474	0.506	-5.771	.000*
$ZnSO_4$ control Rodents	2.05	2.0	-0.053	3.361	0.097	0.924^{NS}
FMD symptoms include formation of boils in mouth of cattle.	1.58	1.92	-0.342	0.627	-3.363	.002*
Animals affected diseases are kept in separate sheds	1.73	1.98	-0.237	0.542	2.694	.011*
Calves fed with colostrum improve immunity.	1.5	1.66	0.000	0.735	.000	1.000^{NS}
Young Goats (kids), effected with tapeworms.	1.66	1.92	0.342	0.582	3.621	.001*
Vitamin. K is found colostrum milk.	1.58	1.95	-0.368	0.5W	-4.195	.000*
AI important for improving High breed cattle.	1.71	1.97	-0.263	0.503	-3.224	.003
Hybrid napier a hybrid	1.55	1.92	-0.368	0.541	-4.195	.000*
Livelihood improvement with poultry, pickle making etc.	1.71	1.89	-0.184	0.609	-1.865	.070^{NS}

1-Mean Pre-training score 2-Mean Post-Trainingscore 3-Paired differences in mean
4-Paired differencesin S.D. 5-Paired't' test 6-Siginificant

longer impact which could be translated to practice provided adequate resource and funds are available to implement. Knowledge, forms the basis and first phase of adoption process, that gives adequate information of technology or practice and next information farmer tries to process is about method of application and assessment of benefits and risks involved all together lead to adoption of technology (*Meijer et al., 2014*). *Venkattakumar & Sontakki (2014)* have reported that the trainees who have reflected on the training outcomes and are mostly uncertain in the context of institutional support, therefore, undecided and were not sure of application of knowledge gained, as mentioned earlier that the institutional support may not be adequate for the reasons and constraints of funds, access to support facilites.etc.,

PCA Factors influencing knowledge gain : Factor analysis of knowledge items based on post training scores had extracted total six factors with knowledge items spread across all six factors and the first factor labeled as 'plant and animal health management practices' getting highest eigen value 11.28 and maximum extent of variation of 45% to knowledge gained during the training. Other factors showed eigen value less than 2.0 with less variation ranging between 4-7 per cent (Table 4).

Table 4. Extracted factors with Eigen value after rotation

Factor	Eigen Value	Variance %	Cumulative
First	11.28	45.12	45.12
Second	1.795	7.14	52.25
Third	1.31	5.24	57.25
Fourth	1.26	5.06	62.54
Fifth	1.19	4.76	67.30
Sixth	1.02	4.08	71.38

From Table 5, the results revealed in detail the composition of different factors. The first factor had indicated highest variation in knowledge gain items which were related to plant and animal health management. Some of the knowledge gained areas: furrow irrigation adopted for maize, root nodules in leguminous crop contain rhizobium bacteria, neem seed extract preparation for control pest damage, Marigold used on trap crop in tomato cultivation, Foot and Mouth Disease (FMD) symptoms include formation of sores in mouth of cattle, Animals effected with disease are kept in separate sheds, Vitamin K is found in huge quantities in colostrum & milk, Artificial insemination (AI) improved high bred cattle, Hybrid Napier and Livelihood improvement with poultry, pickle making accounted to 45 percent variation which was possible with trained subject matter specialists providing training on both plant and animal components. *Lukuyu et al. (2012*) reported that in their evaluation study of 'farmer trainers' approach found that dissemination of crop technologies is less risky and less complex than animal technologies. A well-trained extension personnel would effectively disseminate information on complex livestock knowledge with confidence whereas farmers as trainers could pick up easily simple crop technologies than the complex animal technologies such as artificial insemination techniques which were stated to be risky and skill oriented.

The second factor encompassing technologies related to 'soil and water conservation (SWC) and IPM accounting to 7 per cent variation with low eigen value of 1.79. The trainee farmers of the particular training might have perceived the long term benefits of these technologies and have rated low. The constituting variables of second factor were summer ploughing, contour bunding with 'A' frame, DAP applied in last ploughing, bird controlled in sunflower with glossy ribbon, vegetative propagation improves of fruit trees quality and finally adopt IPM for environment quality. Such technologies also require demonstration on fields through participatory action research where stakeholders share learning experiences. *Perret & Stevens (2006)* stated that some practices like water conservation technologies for implementation requires collective decision making and farmers groups are important. Similar analogy could be drawn for adoption for IPM practices like the controlling birds. Second factor reports knowledge of technologies which require community action.

Third factor indicated the 'soil fertility management practices' contributed to knowledge gain in items related to 'earthworms used for vermicompost' and 'soil testing ensured balanced nutrients application' require more of input support and additional infrastructure, have accounted to 1.31 eigen value and 5 percent variation.

The factors fourth to sixth accounted to low variation and not regarded to have much gain in knowledge.

CONCLUSION

Farmers gained knowledge on IFS module through training in respect of plant and animal health management practices more than soil and water conservation aspects as perceived benefits of technologies tangible in monetary terms and easy in application. In rainfed areas, soil and water conservation technologies help conserve soil moisture, a critical input for enhancement of crop

Table 5. Results of PCA for effective knowledge gain in integrated Farming Systems training programme (Post-training scores)

Important areas of knowledge gain in IFS training	Principal components					
	1	2	3	4	5	6
Furrow irrigation adopted for Maize	0.536					
Root nodules in leguminous crop contain rhizobium bacteria	0.611					
Neem seed extract preparation control pest damage	0.594					
Marigold used on trap crop in tomato cultivation	0.577					
FMD symptoms include formation boils in mouth of cattle	0.583					
Animals affected with disease are kept in separate sheds	0.709					
Vit K is found in huge quantities in colostrum & milk	0.759					
AI important improved and high bred cattle	0.688					
Hybrid napier is a hybrid	0.668					
Livelihood improvement with poultry, pickle making etc.	0.606					
Summer ploughing		0.690				
Contour bunding with 'A' frame		0.581				
DAP applied in/out ploughing		0.678				
Bird controlled in sunflower with glossy ribbon		0.678				
Veg. propagate improves of fruit trees quality		0.609				
Adopt IPM for environment quality		0.793				
Ploughing across slope			0.857			
Earthworms used for vermin-compost			0.658			
Soil testing ensured balanced nutrients application with seed rate			0.745			
Furrow irrigation adopted for maize			0.608			
Vermicompost possess more micronutrients than FYM			0.730			
Calves fed with colostrums improve				0.821		
SRI requires 2 kg seed rate					0.892	
$ZnSO_4$ control Rodents						0.800

productivity need more emphasis in training programmes. Agriculture policies need to integrate more incentives and subsides for adoption of such technologies in addition to provision of desired motivation, resources, encouragement of community participation and technical support cumulatively which acts on knowledge, change of attitude and perception which further lead to higher adoption rates.

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