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A study on cognitive and psychomotor factors of hill farmers on adoption of agri-horti farming system

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ABSTRACT

Adoption of agri-horti system and associated factors need to be viewed in totality which calls for the empirical evidences to design pin pointed programmes in order to enhance productivity. The study conducted in Doda district of Jammu and Kashmir state revealed that the farmers' adoption level of seed component of field crops and plant protection components of fruit crops were found to be low. Most of the respondents reported high level of training needs with respect to training and pruning, field sanitation, weed management, selection of fruit plants and diseases management. The farmers' characteristics like family occupation, land holding, economic motivation, innovation proneness and information sources utilization were found to be positively and significantly associated with their training needs. The farmers' preferences regarding training programme organization included one week duration, more focus on practical aspects with demonstration method and organization of training in small group in their own locality before sowing and planting season. Therefore, the study has highlighted the need for restructuring the training programmes to benefit the farmers operating agri-horti farming system. Such an approach would boost production and generate additional income for producers and other small scale operators along the value-chain.

Key words: Adoption and knowledge level, Agri–horti farming system, Field crops, Horticultural crops, Training needs.

Agri-horti farming system views the farm in a holistic manner and considers interactions between components and of the components with the agro-eco system. Such dynamic farming system calls for the interdisciplinary team of scientists and the extension experts to continuously interact and work with the farmers in the identification of problems and finding their solutions to accelerate agricultural production. The success of agri-horti system depends on generation and transfer of technology related to most suitable combination of field crops and horticultural crops like fruits, vegetables and ornamental crops. The state of Jammu and Kashmir is blessed with varying agro climatic conditions thus making it suitable for growing of wide variety of field crops and horticultural crops under sub tropical, intermediate and temperate zones. The area under horticultural crops in Jammu and Kashmir (J&K) have increased from 12000 ha in 1953-54 to 221000 ha in 2010 and overall productivity of 1.2 tonnes/ha during 1953-54 to around 4.95 tonnes/ha, showing both vertical and horizontal expansion. To improve the domestic marketing and promote export of major commercial fruit crops, the state has been declared as 'Agri Export Zone for Apples and Walnuts'. Development and adoption of high yielding varieties and hybrids of fruit crops have contributed to phenomenal growth of 11.2 per cent (Indian Horticulture Database 2009).

The demand for increased production through agri-horti system calls for the human resources development and other similar programmes to take a holistic view of the supply chain-from seed to table. Small fruit growers need to be empowered technologically, economically and socially to enable them to take informed decisions for achieving socio-economic progress. The forecasting of the technological interventions for increased production of fruits through agri-horti farming system calls for the empirical evidences regarding the adoption level of farmers. So a study was conducted in Doda district of J&K state with specific objectives to assess the knowledge and adoption of recommended farm practices in agri–horti system and to generate empirical data on various socio personal and psychological factors associated with farmers training requirements along with the insight in various facets of training programme organization.

MATERIALS AND METHODS

The Doda district was purposively selected as it represents high value temperate fruits production in the state of J&K both in terms of area and production. Doda is

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the third largest district of J&K with 11,691 sq km area, 35 inches average annual rainfall and 0.6 million population. It has diverse climatic conditions and stretches from 32 degree-53' and 34 degree-21' north latitude to 75°-1' and 76°-47' east longitude. As per agricultural census of 2005-06, the district has 41510 ha cultivable area and 55950 number of farm holdings with an average size of 0.74 ha. The farmers of Doda district cultivate field crops, horticultural crops and practice other allied enterprises to earn their living. Among field crops maize, wheat, paddy, barley and rajmash are the important crops while kala zeera (*Nigella sativa*), chilies (*Capsicum sp)* and potato (*Solanum tuberosum)* are important commercials crops. Among temperate fruits apple (*Malus domestica)* and pear (*Pyrus communis)* occupy the major area. The river Chenab is the major drainage source of the district. The district consists of two Sub Divisions namely Bhaderwah and Gandoh *(Bhalessa),* eight community development blocks, 232 *panchayats* and 406 villages.

The study was conducted in Doda district during 2010 and 2011 by following multistage sampling technique. Four blocks namely Bhaderwah, Thatri, Bhala and Marmath were selected out of the eight community development blocks of Doda district. Four villages were selected randomly from each selected block. In all 16 villages were selected. The selection of the respondents in the village was made on population proportionate basis making a total sample of 120 respondents. A pre-tested interview schedule was prepared and used to collect the data from the sampled farmers. The schedule consisted of two separate parts for field crops and horticultural crops. The collected data were subjected to statistical analysis of using frequency, weighted mean, percentage, standard deviation and correlation.

The cognitive and psychomotor factors for the study have been operationalised as the adoption of various recommended scientific practices of major fruits and field crops on the basis of farmers' possessed knowledge and the expressed training needs to fill the adoption gap in agri horti farming system by the hill farmers. The adoption level of field crops as well as horticultural crops were calculated for each practice separately on three point continuum by assigning 2, 1 and 0 numerals to fully adopted, partially adopted and not adopted respectively for each respondent against each practice and were summed up to obtain adoption score. Total score obtained by each respondent against all practices was calculated for each respondent separately and the adoption quotient was worked out for each individual using following formula:

$$\text{Adoption quotient} = \text{Obtained adoption scores of an individual} \times 100 \div \text{Total obtainable score}$$

On the basis of mean and standard deviation (< mean-standard deviation, mean ± standard deviation and > mean + standard deviation) the categorization into low, medium and high were made. Similarly, for training needs 3, 2, 1 and 0 numerals were assigned to most needed, needed, somewhat needed and not needed areas of training and accordingly the mean training need score of each area of training was calculated by averaging farmers' responses.

RESULTS AND DISCUSSION

The results of the study are presented and discussed under the broad heads including adoption of scientific cultivation of field crops and horticultural crops by the farmers; training needs of farmers in agri-horti system and perceived preferences for training programme organization. The findings supplemented with relevant past researches and the inferences drawn are as follows:

Adoption level of scientific practices in field crops and horticultural crops

From Table 1 it is clear that most of the respondents (64.2%) belong to medium adoption level followed by low level (26.6%), whereas only 9.2 percent fall under high level of adoption. It is evident from Table 2 that the broader areas of farm practices like manure components and agronomical components were adopted at medium level, while seed component and plant protection component were adopted at low level. However, harvesting component was found to be highly adopted. This may be due to the fact that the land holdings of the farmers are mostly on sloppy areas where the soils are less responsive to the fertilization. Means of irrigation are limited and the rate of returns from inputs are low, therefore, people preferred to go for subsistence farming rather than commercial cultivation. Farm practices in case of field crops like seed components and plant protection were adopted less. This may be due to the fact that the high quality seeds and plant protection chemicals including pesticide and insecticide are hardly available to the farmers. The land holding is small and less productive and use of chemical fertilizers and pesticides increase cost of production. Adoption of agronomical component and manure and fertilizer component were medium because of the fact that these two components required human labour which is available within the family. Farmyard manure was applied heavily in crops due to easy availability as almost all the farming families' rear sufficient

Table 1 Categorization of respondents on the basis of their level of adoption of scientific package in field crops

Category	Adoption quotient	Frequency	Percentage
Low	< 26.72	32	26.6
Medium	26.72-46.4	77	64.2
High	> 46.4	11	09.2
Total		120	100.0

Table 2 Practice wise adoption score of scientific package in field crops

Farm practice	Adoption quotient	Category
Seed components	21.1	Low
Agronomical components	36.4	Medium
Manure and fertilizer components	32.2	Medium
Plant protection components	23.8	Low
Harvesting components	63.0	High

Table 3 Categorization of respondents on the basis of their adoption level of scientific package in horticultural crops

Category	Adoption quotient	Frequency	Percentage
Low	< 28.31	26	21.7
Medium	28.31-50.48	78	65.0
High	> 50.48	16	13.3
Total		120	100

number of animals like cows, bullocks and sheep whereas chemical fertilizers were sometime not available on time. The results are in confirmation with Bhagat *et al.* (2002), Nain *et al.* (2007) and Singh *et al.* (2011), whereas it was concluded that a large portion of the untapped potential farm yield could be exploited by using optimum inputs and by adopting appropriate production techniques.

The data in Table 3 indicate that majority of the respondents (65.0 %) belonged to the medium category of adoption, whereas 21.7 per cent and 13.3 per cent of them fall under low and high adoption category respectively. From Table 4, it is revealed that adoption level of practices like selection of fruit plants and intercultural operations was high. Farm practices like water management and planting of fruit plants were adopted at medium level, whereas farm practices like selection of site, layout and land preparation, plant protection measures and nutrient management were adopted at low level. Further, it was observed that the farmers were comparatively knowledgeable in identification of major diseases of apple like scab (*Venturia inaequalis)*, powdery mildew (*Podosphaera leucotricha)*, collar rot (*Phytophthora* spp) and canker (*Pseudomonas syringae)* but had not adopted their control measures. Similarly, in case of insect management farmers had least adopted control measures for sooty blotch *(Phyllachora pomigena),* mites (*Aculus schlechtendali*), stem borer *(Apriona cinerea)* and san jose scale *(Quadraspidiotus perniciosus*). The physiological disorders like pre harvesting drop, alternate bearing and June drop were known to the farmers but not addressed by majority of the farmers. Majority of the farmers did not adopt application of muriate of potash and number of irrigations required to be given for higher production. The knowledge regarding top working of old plants for their rejuvenation was limiting factor in proper adoption of intercultural operations. Regarding selection of plants/ propagation material – the right ratio selection of pollinizers and the selection of cultivars were grey areas of adoption of scientific fruit production.

Most of the respondents fall under medium level of adoption. The main reason may be farmers' perception of horticultural crop as an additional source of regular income for 15-20 years. It also helps in the control of soil erosion as most of the fields are situated on the hill slope. The state horticulture department has undertaken watershed development programme on a large scale where planting material and barbed wire are also provided to the farmers free of cost. It had attracted a large number of farmers as it

Table 4 Practice wise adoption of scientific package in horticultural crops

Farm practices	Adoption quotient	Category
Selection of site	18.6	Low
Soil parameter	18.3	Low
Lay out and land preparation	18.4	Low
Selection of fruit plants	50.9	High
Planting of fruit plants	43.0	Medium
Intercultural operations	56.3	High
Nutrient management	26.3	Low
Water management	29.8	Medium
Plant protection measures	27.4	Low
Harvesting and marketing	28.3	Medium

fulfills the dual purpose of additional income and soil conservation. The farm practices like selection of site, soil parameters, layout of orchard, land preparation, plant protection and nutrient management were adopted at low level which might be due to lack of resources required to perform such activities. Farmers have small size land holding where they are left with little choice for selection of site. Moreover, there is no soil testing laboratory in the nearby area. Therefore, most of the farmers knew little about soil parameters, site selection and layout plan of orchards.

Practices like planting of fruit plants and water management measures were adopted at medium level as the results of such practices could be visible to them. At some of the places, farmers have constructed ponds to harvest rain water and utilized it for the required irrigation of horticultural crops. Selection of fruit plants and intercultural operations were highly adopted as these activities affect the production and economic value of fruits and farmers are fully convinced on this fact. In the overall sample, technical knowledge level of farmers was related to the farmers' adoption level. Similar results were earlier reported by Kashem and Hussain (1992), Wirasinghe (1977), Peer *et al.* (2011) and Mahaliyanaarchchi (1996).

Training needs of farmers in agri-horti system

Among the training needs of farmers, the sub area on intercultural operations like training and pruning of horticultural crop topped the ranking followed by selection of fruit plants, whereas lay out plan for horticultural crops was found to be at the bottom of training need index (Table 5). This may be due to the fact that most of the temperate and semi temperate fruits require regular pruning and the fruit is formed on previous year's growth. Training of fruit trees also lead to the attainment of favorable structure which is very essential for the proper circulation of air and ample supply of sun rays to each of the leaves for favourable fruit colour development.

The respondents considered the layout plan of horticultural crop as least important for training due to limited choice left with the farmer as far as size of land holding is concerned. Other sub areas such as selection of

Table 5 Perceived training needs of farmers in agri-horti farming system

Areas of training need	Mean score	Rank
Soil suitability for horticultural crop	1.24	XI
Selection of site for plantation	1.63	IV
Selection of crop	1.53	VI
Selection of horticultural crop & its variety	1.66	
Selection of field crop& its variety	1.40	
Layout plan of horticultural crop	0.86	XII
Selection of fruit plant to be planted	1.81	II
Sowing/planting	1.50	VII
Method of sowing /planting	1.34	
Seed rate/ Number of plants	1.52	
Seed treatment/ drenching of pits	1.64	
Intercultural operation	1.84	I
Training and pruning	2.01	
Field sanitation	1.95	
Whitewashing of plants	1.49	
Thatching	1.55	
Hoeing	1.05	
Weed management	1.80	
Earthing up	1.21	
Nutrients management	1.47	VIII
Doses of nutrient/ fertilizer	1.87	
Time of nutrient/ fertilizer application	1.58	
Method of application	0.96	
Water management	1.54	V
Number and time of irrigation	1.60	
Method of irrigation	1.48	
Pest management	1.26	X
Identification of insects	0.92	
Control of insects	1.60	
Disease management	1.73	III
Identification of diseases	1.50	
Control of diseases	1.96	
Harvesting, packaging and storage	1.29	IX

fruit plants, disease management, selection of site for plantation, water management, selection of crops, sowing, nutrient management, harvesting and storage and soil suitability for horticultural crop were ranked at medium level in respect of perceived training needs.

The results with regard to association of socio-economic factors with training need are given in Table 6. The variables like family occupation, land holding, economic motivation, mass media exposure and innovativeness were found to be positively and significantly associated with training needs of respondents, whereas the variables like age, social participation and adoption had a non-significant relation with training needs of the respondents. The results also confirm to the findings of Prakash and Kushwah (1995).

Perceived preferences for training programme organisation

It is evident from Table 7 that majority of respondents preferred training up to one week followed by fifteen days

Table 6 Correlation between independent variables and training needs in agri-horti system

Independent variables	r Value
Age	–0.05
Family occupation	0.223 *
Land holding	0.197 *
Media exposure	0.311*
Social participation	0.127
Economic motivation	0.351 *
Innovativeness	0.454**
Adoption	0.089

**Significant at 1 per cent level and * Significant at 5 per cent level

duration because farmers opined that they hardly get much time in between two long growing seasons of crops. Moreover, due to long and severe winter farmers do lot of preparations before the onset of the winter which also limit the time for long duration training. Regarding coverage of the theory and practical in training programmes, it was found that 72.5 percent of the respondent preferred 25 per cent theory and 75 per cent of practical. This may be due to the fact that farmers are more concerned for results and hardly look for theoretical understanding of the concepts. Through practical part of training they may be able to learn more by doing the practice. Further, majority of the respondents preferred training to be organized before the start of cropping season so that they can implement the learned practices in the field during the active cropping season rather than attending training. The respondents preferred demonstration method for their training as it allowed comparison between two practices for better understanding and skill enhancement. Majority of the respondent (72.5%) liked to undergo training in the group of 20 persons and preferably day boarding type of training in their own locality by scientists of agricultural university or Krishi Vigyan Kendra (KVK). Being resource poor they cannot afford to undergo training organized at distant places. Moreover, they opined that while attending the training programme in their own locality they could manage their household work as well as farming activities. The findings are in support of Bhagat and Nain (2005) whereas it was found that the majority of the farmers preferred training before the activity at village level with a mix of training cum demonstration cum tour methodology.

CONCLUSION

The farmers operating agri-horti farming system are willing to have more knowledge of the scientific farm practices of field crops and horticultural crops. Increasing number of farmers were adjusting the cropping system such as intercropping of cereal crops with horticultural crops. However, adoption of scientific practices to boost the production and productivity in both field crops as well as horticultural crops was found of medium level only although there was a high level of adoption of harvesting

Table 7 Perceived preferences of farmers regarding training programme organization

Particulars	Frequency	Percentage
Duration of training		
Up to two days	16	13.3
Up to one week	84	70.0
Up to two weeks	20	16.6
Theory versus practical		
75% theory & 25% practical	12	10.0
50% theory & 50% practical	21	17.5
25% theory & 75% practical	87	72.5
Month/ season of training		
Before the start of the activity	21	17.5
Before the start of the season	47	39.2
Lien period	36	30.0
During the cropping season	16	13.3
Training methods		
Lecture method	5	4.2
Practical	36	30.1
Field visit	23	19.1
Demonstration	30	25.0
Combination of two or more methods	26	21.7
Size of training group		
20 people	87	72.5
30 people	33	27.5
More than 30 people	0	0.0
Venue of training		
In your locality	77	64.2
At the institute where the experts are available	33	27.5
Some central place	4	03.3
District headquarter	6	05.0
Type of training		
Vocational	23	19.2
Day boarding	67	55.8
No Preference	30	25.0
Sponsored	8	06.6
Self-sponsored	5	04.2
No Preference	107	89.2
Organising agency		
State horticulture department	24	20.0
Agricultural University / KVK	83	69.2
Non-governmental organization	1	00.8
Input supply agency	12	10.0

and storage. In order to enhance the adoption of scientific package in agri-horti system, there is a need to adopt a mix of extension methods for verbal understanding of scientific principles with description and explanation of processes and causal relationships. There is need to include participatory methods like learning by doing farm practices in conditions closely resembling their farming situations. The findings sufficiently indicate that training of farmers in agri-horti farming system is urgent need of the hour. The interface of farmers, scientists and extension officers from agriculture and horticulture departments certainly could motivate farmers to adopt the scientific practices of agri-horti farming system.

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