International Journal of Agriculture Innovations and Research
Volume 6, Issue 1, ISSN (Online) 2319-1473
Manuscript Processing Details (dd/mm/yyyy) :
Received: 21/06/2017 | Accepted on : 27/06/2017 | Published : 05/07/2017

# Economic Impact Assessment of Farmer-Led Innovations

**Hema Baliwada, J. P. Sharma, R. R. Burman, M. S. Nain, P. Venkatesh and Anil Kumar**

***Abstract* – The present article is an attempt to explore the economic impact of farmer-led innovations developed at grass root level. The study was undertaken in Punjab and Uttar Pradesh during 2015-16. Total 50 innovative and recognized farmers were selected by stratified sampling. The determinants for the genesis of farmer-led innovations were analyzed. Friedman's test static results revealed that major determinants identified in the present study were socio-psychological determinants (Q value = 52.146). It was found that among socio-psychological determinants, problem solving nature (mean rank 4.59) and creativity in thinking (mean rank 4.57) were the major contributing factors. Further information seeking behavior of the innovators was analyzed (Friedman's test statistic Q value = 123.16) and it was found that different mean ranks indicate the frequency of the contact to the institute by the innovators. The two major institutes/organizations where innovators seek information were KVKs (mean rank 6.07) as they were located in every district and in reach of the farmers followed by state agricultural universities (mean rank 5.14). The economic impact of different category of farmer-led innovations like crop production, horticulture, farm machinery, processing and value addition; and animal husbandry was analyzed. Before and after analysis was performed to assess the economic impact of the innovations and the paired 't' test revealed that, the results are significant at 5 per cent level and profit maximization was witnessed for all the innovations. Among the different categories, processing and value addition innovations are more profitable to the farmers as the range of B:C ratio (0.32) is wide after innovation. On the other hand, farm machinery innovations were not having much economic gain (B:C ratio 0.02) to the innovators as they were mainly developed to increase the efficiency of the machinery.**

***Keywords* – Determinants, Economic Impact, Farmer-Led Innovations and Socio-Psychological.**

## I. INTRODUCTION

Indian agriculture ranks second position in worldwide farm output (Business Standard 2016, CSC 2016) as it continuously witnessing technological innovations from research institutions. On the other hand, contrary to this popular perception, also witnessing farmer-led innovations which emerge from the informal research at grass root level. Wettasinha et al., (2008) defined farmer-led innovations are the processes of developing new or modification, adaptation, and experimentation of own or external ideas, practices, techniques or products by individuals or group of farmers without direct support from external agents or independently of formal research. These farmer-led innovations are inexpensive, easily accessible, locally appropriate and already tested in real farm practice impacting rise in farm output and income. Innovations are required to develop new products, services, markets, reduce costs, improve efficiency, productivity, performance, quality, etc. They are the key to growth, prosperity and problem solving. Generally farmers are conceptualized as sink and not as source of ideas, innovations and entrepreneurial initiatives. Innovation is not always a top-down or controlled process. But there are many grass root innovations developed by the farmers which are largely unnoticed by the scientific community.

The farm innovators may be exploring the new possibilities just out of curiosity, or may be responding and adapting to changes in the condition of natural resources, availability of assets, markets and other socio-economic and institutional contexts. These situations ignite the farmers to take initiatives at their own capabilities to solve their problems. The results of farmers' innovation processes are inexpensive, easily accessible, locally appropriate and already tested in real farm practice. They are therefore more rapidly accepted by other farmers than the results of formal research. The sources of innovation ideas- exogenous (formal) innovations mostly evolved from research institutes and extension based organizations and the endogenous (informal) innovations mainly discovered through grandparents, fellow farmers, lead farmers, self-initiation and trial and error. The innovations range from experimenting with new ideas, modifying or adding value to existing or external practices to complete discovery of better farming practices. Sometimes interplay of ideas from multiple sources could lead to emergence of farmer led innovations (Wunscher, 2014). According to Bayer (2013) who observed that the reasons for innovations are curiosity (34.9%), to increase production (24.3%) labour saving (9.4%), food security (7.7%), to reduce expenses (5.5%), reduce inputs used (3.8%), to increase income (3.8%), increase safety (3.0%), improved quality (3.0%), coincidence (1.7%), environmental reasons (1.3%) and market demands (1.3%).

The determinants of farmer-led innovations are hard to isolate. While some farmers innovated out of necessity, adversity or opportunity, others took a more systematic approach to innovation, such as the farmer who, on an annual basis, reviews past outcomes as a means to improving his farming practices (European Union, 2011). The main motivation factors for conducting the innovation practices are out of curiosity, increase in production, reduction in production costs and necessities. According to Kummer (2011), the two most important motives are curiosity (34.9%) and increase in production (24.3%). Different institutions/organizations like Indian Council of Agricultural Research, Deemed Universities, National Innovation Foundation of Department of Science and Technology etc., have been working to give financial assistance to these farm innovators for scaling up their innovations. With the provision of this organizational

support, there are opportunities for intensifying the creativity of farm innovators. It in turn has given sufficient scope for replication of technically feasible and economically viable innovations in similar elsewhere situations.

Many of the previous studies conducted by experts showed that impact and differential effect of different farmer-led innovations varies with region, community and country. Farmer-led innovations in developing countries would lead to increase in production, thereby reducing poverty among the rural people (Spielman 2009, Mariam et al. 2011). It is argued that innovation generation practices of farm households may also be making impact in poor people's livelihoods and might form the basis for food security (Letty et al. 2011). Most of the innovations are labour saving, thus, reduction in production costs and freeing labour for off-farm employment (Wunscher 2014). Innovations can also be distinguished by their impact on economics and market which affect their modeling; these categories include increased yield, shelf life and quality, reduced cost and risk, and increased environmental-protection (Sunding et al. 2000). Another dimension used for measuring the impact of farm innovations on livelihood and wellbeing were returns versus expenditure on stimulating/ supporting informal innovations and number of joint experimentation processes supported (Brigidletty et al. 2012). Impact of innovation is assessed based on rural people's ability to better utilize the natural resource base and thus enhance their production, increase food security and nutrition and diversify their livelihood and preserve the ecosystem (UN 2008, Morris et al. 2007 and Gildemacher et al. 2009). According to Tambo (2014) increased production is the major outcome of most of the farmers' innovations followed by increased satisfaction and knowledge. The estimation of effect or impact of innovations, before or after their adoption, provides valuable information for decision-makers of businesses, organizations, sectors and geographical units. The impact of innovations may be social, economic and environmental, also include intermediate areas such as institutional, political, scientific and productive ones. Keeping the present scenario in view, an attempt was made to understand the determinants for the genesis and analyze the economic impact of farmer-led innovations.

## II. Methodology

A list of innovative farmers recognized and awarded by various institutions such as ICAR (Indian Council of Agricultural Research), PPVFRA (Protection of Plant Varieties and Farmer's Rights Authority), Ministry of Agriculture and Farmers Welfare, NIF (National Innovation Foundation) and TIFAC (Technology Information, Forecasting and Assessment Council) of Department of Science and Technology, IARI (Indian Agricultural Research Institute), State Agricultural Universities was prepared. Data from the secondary sources revealed that Uttar Pradesh and Punjab have more number of innovative farmers compared to other states. Therefore the present study was conducted in these two purposively selected states i.e., Uttar Pradesh and Punjab. The whole population of innovative farmers was divided into 5 broad categories. The broad areas of innovation selected for the study were crop production, horticulture, farm machinery, processing and value addition and animal husbandry. There after 5 innovative farmers were selected from each category by stratified random sampling. The respondents from the two states constituted the total sample size of 50. These selected farmers fall into the 7 districts of Punjab (Batinda, Faridkot, Hoshiarpur, Nawanshahar, Ludhiana, Patiala and Sangrur) and 10 districts of Uttar Pradesh (Aligarh, Bulandshahr, Ghaziabad, Hapur, Kanpurnagar, Kannauj, Meerut, Muzaffarnagar, Rampur and Saharanpur).

## III. Results and Discussion

Four generalized categories of determinants which were relevant to the present study for the genesis of innovations (technical, economic, marketing and socio-psychological) were identified and administered to the respondents and the responses were recorded on a 5 point continuum. Friedman's test was carried out to analyze the significant difference between the categories. The results (table I) revealed that the mean ranks of different statements under each category differed significantly.

From the Friedman test results in table I, it is clear that the major influencing factor in technical determinants ($Q = 171.57$, $p < 0.05$) for the genesis of innovations is contact with institutions with mean rank 6.38. Contact empowers the knowledge of farmers through the use of different sources of literature, existing support, farmer's rights like patents, modern infrastructure and latest technology. In economic determinants ($Q = 51.74$, $p < 0.05$), the benefit of economics of scale (mean rank 4.96) was the major contributing factor followed by business idea to convert into enterprise (mean rank 4.65). It is mainly due to the farmer's tendency to go for innovations to increase their production or income. Among the marketing determinants ($Q = 161.19$, $p < 0.05$), the highest mean rank of 6.26 is given for certification of innovations as certification is a strong credential that illustrates knowledge in a specific innovation and gives credit and authenticity to the innovators. It is clear that among socio-psychological determinants ($Q = 33.71$, $p < 0.05$) the major one is problem solving nature of innovators (mean rank 4.59) either to increase production, income or efficiency of the innovation.

### *Overall Comparison of Determinants*

The overall comparison of determinants was carried out and it was found that socio-psychological determinants are the major influencing factors for the genesis of innovations with mean rank 3.35. It is the creativity and attitude that largely makes the farmer to go for innovations. These findings are in line with the results of Shilpashree (2011), stated that the psychological characteristics or social characteristics or innovativeness are playing an important role in getting the recent information. Innovation is viewed as the outcome of various actors combining knowledge from different

sources. Wolf (2008) results also similar with the above findings which reported that the process of combining knowledge requires different forms of interaction. Informal structures, inter-personal contact and even physical mobility are all considered mechanisms for the mobilization of knowledge and stimulating innovations. The second major one is technical determinants (mean rank 2.76) followed by economic determinants (mean rank 2.25). The least influencing are marketing determinants with mean rank 1.64 (table II).

Further Friedman's test statistics was carried out to analyze the significant difference between the categories of determinants. The results revealed that the computed p-value is significant at five per cent level ($p < 0.05$) with observed Q value 52.146 which is higher than the critical value 7.815. It can be inferred that the degree of influence of different determinants for the genesis of innovations are significantly different.

*Information Seeking Behaviour*

The different institutes (NGOs, private agencies, fellow farmers, district agricultural offices, research institutions, state agricultural universities and KVKs) from where the information can be obtained to the farmers were identified and innovators were asked to rank their preference on a five point continuum

Data in the table III highlights the information seeking behavior of the innovators. It is evident from the Friedman's test that the mean ranks varies for different institutes/organizations. The different mean ranks indicate the frequency of the contact to the institute by the innovators. Majority of the respondents seek information from KVKs (mean rank 6.07) as they are located in every district and are in reach of the farmers. It is followed by other organizations like state agricultural universities (mean rank 5.14), research institutions (mean rank 4.25), district agricultural offices (mean rank 4.06), fellow farmers (mean rank 3.25), private agencies (mean rank 3.05) and NGOs (mean rank 2.18). Further Friedman's test statistics results revealed that the computed p-value is significant at five per cent level ($p < 0.05$) with Q value 123.16. It can be inferred that the degree of influence of different institutions are different according to innovators perception.

*Economic Impact*

To analyze the economic impact, before and after analysis was performed with 10 innovations from each selected category like crop production, horticulture, farm machinery, processing and value addition; and animal husbandry. As the innovations within the category (10 each) were different, they were brought into uniform scale like total cost, total return, profitability and benefit cost ratio. For analyzing the economic impact, the cost of using the innovation was taken for before and after period, similarly return was also calculated. From cost and return, profitability and B:C ratio was worked out. Then the category wise economic impact was analyzed by paired't' test to identify whether any significant difference exists compared to before and after the period of innovation. The differences of means were also worked out for selected parameters like total cost, total return, profitability and B:C ratio.

*Profitability through Crop Production Innovations*

Paired 't' test analysis highlights the significant difference with respect to 10 crop production innovations in terms of total cost, total return, profitability and B:C ratio (table IV). The before (Rs 25350/acre) and after (Rs 36230/acre) mean values of total cost indicated that, in crop production innovations, the total cost increased after innovation. Paired 't' test statistics results revealed that the computed p-value is significant at five per cent level ($p < 0.05$) with t value 7.255. It can be inferred that the innovations significantly differed in total cost before and after innovation. This may be due to the additional cost of innovation practiced by the farmer. With increase in total cost, there is substantial increase in B:C ratio from 1.83 to 2.10. It can be concluded that even after increased cost of cultivation, the crop production innovations are profitable to the farmers with enhanced B:C ratio. This is similar to the findings of Wunscher (2014) reported that increased productivity was the major outcome of most of the farmers' innovations. Most of the innovative practices listed by the farmers were yield-related (e.g. crop varieties, soil fertility and pest and disease control). The other outcomes related to increased production were increased income, saved labour cost and food security.

*Profitability through Horticulture Innovations*

It is evident from the table V, that there is significant difference in terms of total cost, total return, profitability and B: C ratio of 10 horticulture innovations taken altogether. The before (Rs 48370/acre) and after (Rs 53100/acre) mean values of total cost indicated that, in horticulture innovations, there is not much difference in total cost after innovation. Paired 't' test statistics results revealed that the computed p-value is significant at five per cent level ($p < 0.05$) with 't' value 5.891. It can be inferred that the innovations significantly differed in total cost for before and after innovation but not to a higher extent. With the very little increase in total cost, there is increase in B:C ratio from 1.19 to 1.47. It can be concluded that the horticulture innovations were comparatively more profitable to the farmers. With very slight increase in cost; total return, profitability and B:C ratio are increased to a higher magnitude. The range of B:C ratio is also slightly higher after innovation. This shows that these innovations fetch more income to the farmers. The findings of present study were in line with the results of Wettasinha (2008) who reported that high value crops are costly to produce and risky to manage besides being more market dependent and highly perishable. This is so because these crops are more labour intensive, require frequent crop care, harvested more frequently and sold/marketed more often or on daily basis. Sule (2013) also found that innovation could be in the nature of reducing cost of production, improving quality or yield, and adding value to the basic product. Profitability through farm machinery innovations

*Profitability through Farm Machinery Innovations*

Table VI shows that there is significant difference of 10 farm machinery innovations in terms of total cost, total return, profitability and B:C ratio. The before (Rs

31250/acre) and after (Rs 36130/acre) mean values of total cost indicated that, in farm machinery innovations, there is not much difference in total cost after innovation. It is because of the fact that most of the farm machinery innovations are the little modifications to the existing machinery either to increase efficiency of the machine or to save labour cost. Paired 't' test statistics results revealed that the computed p-value is significant at five per cent level ($p < 0.05$) with t value 4.967. It can be inferred that the innovations significantly differed in total cost before and after innovation but not to a higher extent. Similarly, it is also evident that there is not much difference in return from Rs 36710/acre to Rs 43300/acre, increase in profitability from Rs 5460/acre to Rs 7170/acre and B:C ratio from 1.18 to 1.20. Even though the 't' values are significant at 5 per cent level, there is not much economic gain to the innovator. It can be summarized that the farm machinery innovations are mainly developed to increase the efficiency rather than profitability. Farm machinery innovations are not having much economic gain to the innovators as they were mainly developed to increase the efficiency of the machinery. The results were on par with the study of Fuentes et al., (2013) where the economic benefit is not everything; some innovations do not contribute significantly to enhancing the economic benefits, but do for the social and environment benefits. Similar result was also found in Heanue et al., (2013) reported that creative modifications of the innovations 'stock of knowledge' may be more important than creating new scientific knowledge.

*Profitability through Processing and Value Addition Innovations*

Paired 't' test data in table VII highlights the significant difference of 10 processing and value addition innovations in terms of total cost, total return, profitability and B:C ratio per one time production. The before (Rs 35687) and after (Rs 61380) mean values of total cost indicated that in processing and value addition innovations, the total cost increased to a higher magnitude after the innovation. Paired 't' test statistics results revealed that the computed p-value is significant at five per cent level ($p < 0.05$) with 't' value 4.587. It can be inferred that the innovations make significant difference in total cost before and after innovation. With increase in total cost, total return per one time production is also increased from Rs 42380 to Rs 86100, increase in profitability from Rs 6693 to Rs 24720 and increase in B:C ratio from 1.18 to 1.50. It can be concluded that the processing and value addition innovations are more profitable to the farmers. With increase in cost; total return, profitability and B:C ratio also increased to a higher extent. The range of B:C ratio is wide after innovation. This shows that these innovations are more beneficial to the farmers. The total cost after innovation is more for processing and value addition as it involves establishment of units but even with increased cost, these innovations are profitable to the innovators with enhanced B:C ratio. The findings of the present study were consistent with the findings of Wright et al., (2010) who reported that agricultural innovations were created for more yield, quality and quantity of production, as well as for the diversification of products.

*Profitability through Animal Husbandry Innovations*

Table VIII highlights paired 't' test data which indicates that there is significant difference of 10 animal husbandry innovations in terms of total cost, total return, profitability and B:C ratio per one time production. The before (Rs 37720) and after (Rs 47400) mean values of total cost indicated that in animal husbandry innovations, the total cost increased after innovation. Paired 't' test statistics results revealed that the computed p-value is significant at five per cent level ($p < 0.05$) with 't' value 4.391. It can be inferred that the innovations significantly differed in total cost before and after innovation. It can be concluded that the animal husbandry innovations are profitable to the farmers as with increase in cost; total return, profitability and B:C ratio are also increasing after innovation.

## IV. Conclusion

This study provides an analysis of the factors that determine the genesis and economic impact of farmer-led innovations. The results from Friedman's test revealed that socio-psychological determinants were the major factors. Therefore the farmers should be empowered in developing innovations through various means like awareness and exposure to outside, providing training programmes, visits to different successful innovation units, ensure participation in exhibitions and kisan melas which provides a platform for direct interaction with experts and fellow progressive farmers to share their ideas. Further the innovators should be recognized properly to motivate the other fellow farmers to go for adoption of these innovations. The study also concluded that the economic impact of farmer-led innovations varied for different identified category of innovations. In analyzing the economic impact of crop production innovations, even with increased cost of cultivation after innovation, the crop production innovations were profitable to the innovators with enhanced B:C ratio. In case of horticulture category, with very slight increase in cost; total return, profitability and B:C ratio were higher and fetched more income. It was found that farm machinery innovations were not having much economic gain to the innovators as they were mainly developed to increase the efficiency of the machinery. The total cost after innovation was more for processing and value addition; and animal husbandry innovations as it involves establishment of units but even with increased cost, these innovations were profitable to the innovators with enhanced B:C ratio. Among the analyzed categories, processing and value addition innovations fetch high income to the farmers. Boosted by rising demand and feasibility, the economically viable farmer-led innovations are the new growth areas for Indian agriculture. Hence, organizations which are promoting the scaling up of farmer-led innovations should give prior importance to the farmer-led innovations in general and processing and value addition innovations in particular while providing financial assistance. Further, this will encourage research and development activities in areas of

technology generation blending with institutional research and transfer for sustainable livelihood in rural areas.

## V. Implications of the Study

Findings of this study will help development practitioners, academicians and planners to understand the importance of farmer-led innovations and impact. The findings of this study will also provide directions of research for prioritizing the research projects. Documentation and dissemination of best practices of innovative farmers will go a long way in motivating other farmers and replication of such innovations elsewhere in similar situations.

## References

[1] Bayer S, What determines innovation capacity in farm households? Insights from rural Ghana, (2013) https://editorialexpress.com/cgibin/conference/download.cgi?db_name=CSAE2014&paper_id=391.

[2] Brigidletty, Zanele Shezi and Maxwell Mudhara, Agricultural Grassroots Innovation in South Africa: Implications for Indicator Development, Ideas for New Research Projects on LICS in Africa, African Globelics Seminar, Tanzania, 2012.

[3] Business Standard, India: An agricultural powerhouse of the world, 2016, Available at http://www.business-standard.com/article/b2b-connect/india-an-agricultural-powerhouse-of-the-world-116051800253_1.html

[4] CSC (Common Service Center), Report on Agriculture, 2016,Availableathttps://csc.gov.in/index.php?option=com_content&view=article&id=218&Itemid=362

[5] European Union report, Recognising the Unrecognised: Farmer Innovation In Northern Malawi: Find Your Feet. The Development Fund, 2011.

[6] Gildemacher P, Maina P, Nyongosa M, Kinyae P, Woldegiorgis G, Lema Y, Damene B and Oriz. Participatory analysis of the potato knowledge and information system in Ethiopia, Kenya and Uganda, Innovation Africa: Enriching farmers' livelihoods, Earthscan: London, 2009, 153–65.

[7] Kummer S, Organic farmers' experiments in Austria. Learning processes and resilience building in farmers' own experimentation activities, (Doctoral thesis, University of Natural Resources and Life Sciences, Vienna), 2011.

[8] Letty B, Noordin Q, Magagi M and Waters-Bayer A, Farmers take the lead in research and development, The World watch Institute- State of the World: Innovations that Nourish the Planet. The World watch Institute, Washington DC, 2011.

[9] Morris M L, Kelly V, Kopicki RJ and Byerlee D, Fertilizer use in African agriculture: Lessons learned and good practice guidelines, World Bank, Washington DC, 2007.

[10] Shilpashree B S, A Profilistic Study on Awardee Farmers in North Karnataka, (MSc Agric Thesis, University of Agricultural Sciences, Dharwad), 2011.

[11] Spielman D J, The art and science of innovation systems inquiry: Applications to Sub- Saharan African Agriculture, Technology in Society, 31(4) (2009) 399-405.

[12] Sunding D and David Zilberman, The agricultural innovation process: Research and technology adoption in a changing agricultural sector, Handbook of Agricultural Economics, University of California, Berkeley, 2000.

[13] Tambo A Justice, More than adopters: the welfare impacts of farmer innovation in rural Ghana, Selected Paper prepared for presentation at the Agricultural and Applied Economics Association's, AAEA Annual Meeting, Minneapolis, 2014.

[14] UN, Innovation for sustainable development: Local case studies from Africa, Division for Sustainable Development, United Nations: New York, 2008.

[15] Wettasinha C, Wongtschowski M and Waters-Bayer A, Recognizing local innovation: experience of PROLINNOVA partners, Silang, Cavite, the Philippines: International Institute of rural Reconstruction / Leusden: PROLINNOVA International Secretariat, ETC Eco Culture, 2008.

[16] Wolf SA, Professionalization of agriculture and distributed innovation for multifunctional landscapes and territorial development, Agriculture and Human Values, 25 (2008) 203-207.

[17] Wunscher T, More than adopters: the welfare impacts of farmer innovation in rural Ghana, Selected Paper prepared for presentation at the Agricultural and Applied Economics Association's, AAEA Annual Meeting, Minneapolis, 2014.

## Author's Profile

**Dr. Hema Baliwada,**
Ph.D. (Agricultural Extension) presently working as Scientist at ICAR-CTRI, Rajahmundry, Andhra Pradesh, India.

International Journal of Agriculture Innovations and Research
Volume 6, Issue 1, ISSN (Online) 2319-1473

Table I. Determinants for the genesis of innovations as per Friedman test (N = 50)

| | | Particulars | Mean Rank | Groups | | |
|---|---|---|---|---|---|---|
| Technical determinants | 1. | Aware of testing facilities | 2.32 | A | | |
| | 2. | Access to literature | 2.91 | A | B | |
| | 3. | Aware of modern technology and infrastructure facilities | 3.24 | A | B | |
| | 4. | Aware of farmers rights like patents | 3.59 | A | B | |
| | 5. | Provision of timely inputs | 3.96 | | B | |
| | 6. | Extension support (training, demonstration, meeting, exposure visit, melas, etc) | 5.60 | | | C |
| | 7. | Contact with Institutions/organizations | 6.38 | | | C |
| Economic determinants | 1. | Provision of insurance facility to the innovations | 2.73 | A | | |
| | 2. | Government support (credit, subsidy) | 3.14 | A | B | |
| | 3. | Aware of commercialization process | 4.09 | | B | C |
| | 4. | Private / NGO funding | 4.18 | | B | C |
| | 5. | Access to credit facilities | 4.25 | | B | C |
| | 6. | Business idea | 4.65 | | | C |
| | 7. | Benefits of economics of scale | 4.96 | | | C |
| Marketing determinants | 1. | Processing facilities | 2.41 | A | | |
| | 2. | Transport facilities | 2.41 | A | | |
| | 3. | Timely market information | 3.60 | A | B | |
| | 4. | Availability of market facilities | 3.88 | | B | C |
| | 5. | Packaging of the products | 4.35 | | B | C |
| | 6. | Quick payment to the produce | 5.09 | | | C |
| | 7. | Certification of innovations | 6.26 | | | D |
| Socio-psychological determinants | 1. | Increase in competitiveness | 2.94 | A | | |
| | 2. | Reduction of drudgery | 3.27 | A | | |
| | 3. | Leadership in the community | 3.93 | A | B | |
| | 4. | Striving for social recognition | 4.14 | A | B | |
| | 5. | Enterprise diversification | 4.56 | | B | |
| | 6. | Creativity in thinking | 4.57 | | B | |
| | 7. | Problem solving | 4.59 | | B | |

Table II. Overall comparison of determinants by mean ranks (N=50)

| Determinants | Mean rank | Groups | | |
|---|---|---|---|---|
| Marketing | 1.64 | A | | |
| Economic | 2.25 | | B | |
| Technical | 2.76 | | B | |
| Socio-psychological | 3.35 | | | C |

Table III. Information seeking behaviour of innovators based on Friedman's test (N=50)

| Institute | Mean rank | Groups | | | |
|---|---|---|---|---|---|
| NGOs | 2.18 | A | | | |
| Private agencies | 3.05 | A | B | | |
| Fellow farmers | 3.25 | A | B | | |
| District Agricultural Offices | 4.06 | | B | C | |
| Research Institutions | 4.25 | | B | C | |
| State Agricultural Universities | 5.14 | | | C | D |
| Krishi Vigyan Kendras (KVKs) | 6.07 | | | | D |

Table IV: Profitability through crop production innovations by paired 't' test ($n_1$=10)

| Category (Rs/acre) | Mean | | | Standard deviation | Standard error mean | t value |
|---|---|---|---|---|---|---|
| | Before | After | Difference | | | |
| Total cost | 25350 | 36230 | 10880 | 4742.19 | 1499.61 | 7.255* |
| Total return | 47420 | 76840 | 29420 | 14426.96 | 4562.20 | 6.449* |
| Profitability | 22070 | 40610 | 18540 | 10385.58 | 3284.21 | 5.645* |
| B:C ratio | 1.83 | 2.10 | 0.27 | 0.25 | 0.08 | 3.264* |

* p<0.05 significant difference at 5 per cent level

Table V: Profitability through horticulture innovations by paired 't' test ($n_2$=10)

| Category (Rs/acre) | Mean | | | Standard deviation | Standard error mean | t value |
|---|---|---|---|---|---|---|
| | Before | After | Difference | | | |
| Total cost | 48370 | 53100 | 4730 | 2539.05 | 802.91 | 5.891* |
| Total return | 57030 | 75700 | 18670 | 6900.57 | 2182.15 | 8.556* |
| Profitability | 8660 | 22600 | 13940 | 6151.09 | 1945.14 | 7.167* |
| B:C ratio | 1.19 | 1.47 | 0.28 | 0.19 | 0.06 | 4.623* |

* p<0.05 significant difference at 5 per cent level

Table VI. Profitability through farm machinery innovations by paired 't' test ($n_3$=10)

| Category (Rs/acre) | Mean | | | Standard deviation | Standard error mean | t value |
|---|---|---|---|---|---|---|
| | Before | After | Difference | | | |
| Total cost | 31250 | 36130 | 4880 | 3106.91 | 982.49 | 4.967* |
| Total return | 36710 | 43300 | 6590 | 3830.70 | 1211.37 | 5.440* |
| Profitability | 5460 | 7170 | 1710 | 876.16 | 277.06 | 6.172* |
| B:C ratio | 1.18 | 1.20 | 0.02 | 0.01 | 0.003 | 6.705* |

* p<0.05 significant difference at 5 per cent level

Table VII. Profitability through processing and value addition innovations by paired 't' test ($n_4$=10)

| Category (Rs/per production) | Mean | | | Standard deviation | Standard error mean | t value |
|---|---|---|---|---|---|---|
| | Before | After | Difference | | | |
| Total cost | 35687 | 61380 | 25693 | 17714.17 | 5601.71 | 4.587* |
| Total return | 42380 | 86100 | 43720 | 14810.41 | 4683.46 | 9.335* |
| Profitability | 6693 | 24720 | 18027 | 18970.08 | 5998.86 | 3.005* |
| B:C ratio | 1.18 | 1.50 | 0.32 | 0.48 | 0.15 | 2.059* |

* p<0.05 significant difference at 5 per cent level

Table VIII. Profitability through animal husbandry innovations by paired 't' test ($n_5$=10)

| Category (Rs/per production) | Mean | | | Standard deviation | Standard error mean | t value |
|---|---|---|---|---|---|---|
| | Before | After | Difference | | | |
| Total cost | 37720 | 47400 | 9680 | 6971.81 | 2204.68 | 4.391* |
| Total return | 42650 | 60810 | 18160 | 10082.46 | 3188.35 | 5.696* |
| Profitability | 4930 | 13410 | 8480 | 5295.44 | 1674.56 | 5.064* |
| B:C ratio | 1.16 | 1.31 | 0.15 | 0.09 | 0.02 | 4.933* |

* p<0.05 significant difference at 5 per cent level