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Analysis of Hinderances in tunnel technology in Gujranwala, Faisalabad and Multan divisions

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Abstract

The study was conducted to facilitate the potential growers in off season vegetable production by tunnel technology in Gujranwala, Faisalabad and Multan Divisions. Vegetable Production under tunnel technology is considered a business in Pakistan. It was clear indication that 70.19% of respondents were 26-50 years old followed by 15.38% up to 25 years old implying lower contribution and involving young people in tunnel farming business. Moreover farmers with age of above 50 years imply their inadequate technicalities and activities to make tunnel farming profitable. The old age people remained inconsistent in farm activities and adopt traditional practices. Education plays significant role in individual maturity and development. Literacy rate of selected areas appeared good as 87.5% people were rated as literate while rest 12.5% claimed illiterate and never attended formal education. However, among literate farmers majority was educated up to matric level (41.34%) followed by 26.92% up to middle level. This business was promoted in all temperate and sub tropical areas of the country including Punjab. After extensive survey experimentation, this technology declared technically feasible for commercial vegetable farming in Punjab. Farmers are already practicing this technology at their farms by the consultation of plant doctors of Agriculture Department tunnel farming successfully carried out in Punjab.

Keywords: Tunnel farming; Global; food; security; Gujranwala; Faisalabad; Multan; Divisions Punjab-Pakistan.

Introduction

The sector of greenhouse enterprises becomes a future due to exposure of the European market and development of international trade. Increased consumers demand for perishable vegetables creates the appropriate incentives to develop this sector and attracts the interest of farmers. Protected cultivation was introduced into the Greek Agriculture in the early sixties with great expectations. The total area of protected cultivation increased significantly, however the several financial problems halted the expansion of tunnel technology

(Tzouramani *et al.*, 1995). The demand for high quality vegetables is increasing globally to ensure nutrition. Demand is increasing day by day and changing dietary patterns of urban class. Inadequate commercial off-season farming, storage and processing facilities, the supply remains volatile resulting tunnel farming is facing many problems. When market remains flooded with the vegetables without any demand; the price of vegetables goes down. In off-season limited supply of vegetables is persisting at considerably higher prices for consumer.

The total population of Punjab is 85.65 million shares in country's population were 55.63% (Anonymous, 2006). The people lived in rural areas were 69% and in urban was 31% (Anonymous, 2004). The soil is sandy loam and fertile in nature with well developed canal irrigation system in Punjab (Chaudhary, 1994; Khalil and Jan, 2002). The literacy rate of Punjab was 55.0%; male ratio was 65.0% and female proportion 44.0% (Anonymous, 2006). In rural areas total literacy rate was 44.3% out of which male and female ratio was 56.6% and 31.7% during 2001-02 (Anonymous, 2004). In rural areas of Punjab 57.85% population directly involved in agriculture and total male participation was 39.99%, out of which 33.76% and 5.75% were skilled and unskilled. About 17.86% of females engaged in agriculture, out of them 11.70% and 6.15% were skilled and unskilled (Anonymous, 2003a). The total labor force participation was 32.48%, out of which 50.05% male and 14.01% female. In rural area total participation rate was 33.01%, out of which 49.62% male and 15.08% females. The available data showed a vivid gap between male and female participation in all the activities that compel an individual to seek those factors which were responsible to keep the women deprived off in all walks of life. However the present study had been planned to assess the overall constraints affecting the momentum of tunnel farming in Pakistan and factors affecting the penetration of tunnel farming in global food security.

Materials and Methods

The study was conducted in Gujranwala, Faisalabad and Multan. The areas selected with dominated population depending upon agriculture particularly vegetable farming, tunnel farming is widespread because of favorable environment conditions.

Selection of Sample

The villages are selected in each Division and prepared a list of tunnel growers using base line survey according to pre designed questionnaires with the consultation of Plant Doctors of Punjab Agricultural Extension and Plant Protection Departments.

Types of Respondents

To achieve positive objectives of the study and collected the relevant information from different stakeholders it was necessary to identify the respondents. Therefore, farmers of all type small, medium and large doing farming was worked as respondents. However, major concern was depicted that they should be adopted tunnel farming for vegetables cultivation.

Data collection

Data was collected by interviewing the farmers according to well designed pre-tested questionnaire. Interviews with respondents to update their field knowledge and recorded information. More than 60% of the respondents were interviewed at their homes while the rest of them were at their farms. After careful scrutiny of all interview schedules out of 120 only 104 interview schedules were selected as valid one and served as sample size (Mohammad *et al.*, 2001).

Data analysis

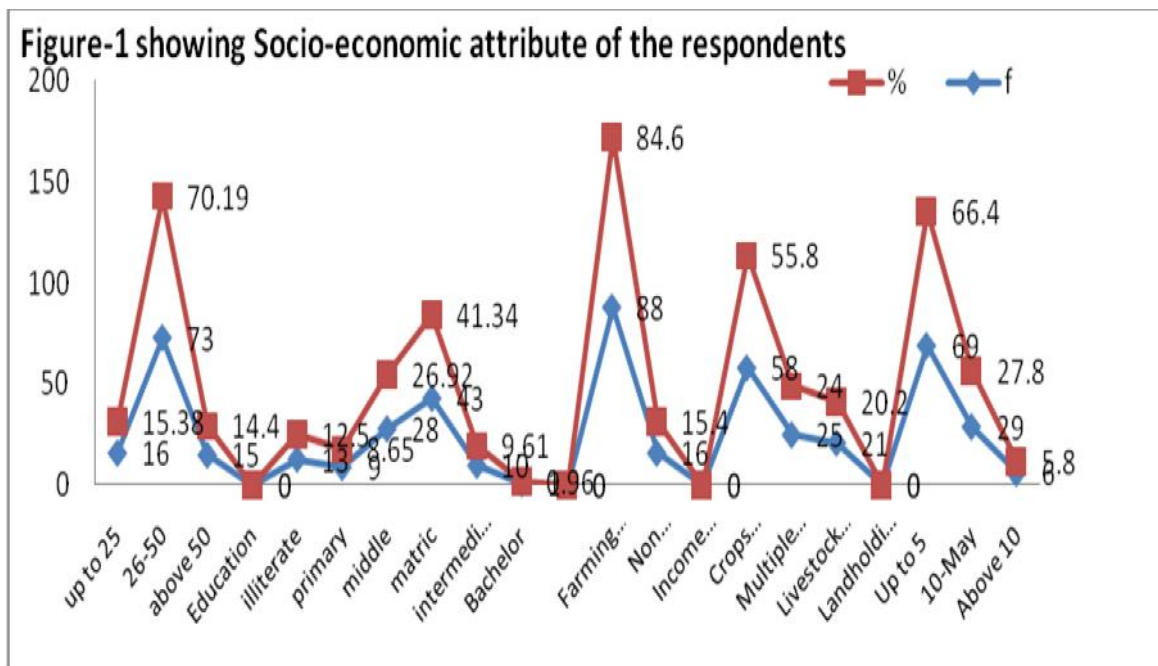
Collected data were coded initially in Microsoft excel and later on Sheet of Statistical Package for Social Sciences (SPSS). Both descriptive and inferential statistics was applied. Descriptive statistics was applied on socio-economic attributes of the growers for frequency distribution. Logit regression was used analysis of constraints magnitude (Steel and Torrie, 1997).

Results and Discussion

From figure-1 it was clear indication that 70.19% of respondents were in age of 26-50 years followed by 15.38% up to 25 years implying lower contribution and involving young people in tunnel farming business. Moreover farmers with age of above 50 years imply their inadequate technicalities and activities to make tunnel farming profitable. However it was the indication of that old age people remained inconsistent in farm activities and adopt traditional practices. Education plays significant role in individual maturity and development. Literacy rate of

selected areas appeared good as 87.5% people were rated as literate while rest 12.5% claimed illiterate and never attended formal education. However, among literate farmers majority was educated up to matric level (41.34%) followed by 26.92% up to middle level. Generally, tunnel farming needs technical knowledge and equipped with agricultural knowledge but among respondents none of the grower was agricultural graduate. This situation showed pity and

dictated the major cause of down falling of tunnel farming. Only negligible percentage (0.99) was possessing education of bachelor level. Globally agriculture is assumed as mainstay of huge population. People remain directly or indirectly associated with agriculture. Likewise among the selected respondents majority 84.6% respondents worked in farming in major occupation.



This dominance implied the supremacy of farming as occupation in Pakistan. About one fifth (15.4%) respondents were depending upon non farming activities. To run life cycle smooth and carry farming activities in profitable way income for investment is primary need. Connecting with major occupation response, more than half (55.8%) respondents were relying for income on crops farming followed by one fifth respondents (20.2%) relying on livestock. One fourth respondents (24%) depending upon multiple sources including farming and private driven

businesses. World is surrounded by 86% small farmers possessing land up to 5ha. This land is going to squeeze due to extended industrialization which is a severe threat to global food security. Representing global farming about 66.4% respondents were small farmers possessing up to 5ha followed by the slightly higher than one fourth (27.8%) of total respondents being medium farmers with 5-6 hectares of land. 5.8% of respondents was possessing land more than 10ha as large farmers.

Table:2 Logit regression on the influence of socio-economic characteristics of farmers on the adoption of tunnel farming

Parameters	Coefficients	Standard Error	t Stat	P-value
Intercept	2.821706772	1.271936	2.21843	**0.029041
Age	0.523599029	0.192597	2.718626	*0.007865
Education	0.041205312	0.055653	0.740391	*0.006099
Occupation	-0.216078078	0.166348	-1.29895	0.197278
Income source	0.104052282	0.102178	1.018346	0.311243
Input prices	0.348422708	0.190433	1.829631	**0.070616
output retail price	-0.038672951	0.130887	-0.29547	0.768317
Transportation	-0.106276758	0.10841	-0.98032	0.329556
Water supply	0.113296443	0.09747	1.162377	0.248156
Marketing information	-0.20776722	0.109465	-1.89803	**0.060897
Processing and storage	-0.132051827	0.083624	-1.57912	0.117818
Landholding size	0.218507691	0.109977	1.98684	**0.049981
Extension services	0.101377685	0.056987	1.77896	**0.078623
Multiple R 0.806314855; R ² 0.650143645; **5% significant level; *1% significant level				

From Table-2 it was depicted that brief interpretation of socio-economic characteristics influence on adoption of tunnel farming is dependent variable relying upon numerous independent factors. Value of R² appeared about 65% representing the fitness of model implying that 65% in the variation of the dependent variable are accounted for by the independent variables. Independent factors like age,

education, income source, land holding size, input prices, water availability, supply and extension advisory services having positive association with adoption. Other independent factors like occupation, output retail price, transportation, marketing element and processing storage were having inverse relationship with adoption.

Significant association of age and education at 1% significance level implied that with the increasing age individual becomes mentally mature and enable to understand innovative practices. Tunnel farming adaptation is bit complex as précised management required well equipped with educational exposure. Educated farmers created multifold benefits rather than illiterate growers. Input prices for tunnel farming denoted significant association at 5% significance level describing building and managing tunnel farming infrastructure evolved with higher prices. Globally 86% farmers are small farmers possessing less than 5ha. However this socio economic status always compels them to be dependent upon external supports. Erratic market situation pose serious threat to the

farmers hindering them to go for adaptations of innovative technologies. Marketing is a global issue as marketing chain is full of gaps and possession of intermediaries. Resultantly, growers always remain fail to get direct benefit because of inadequate access to market and marketing information. Growers always tend to emphasize on bridge the link with information like extension advisory services. Extension services posed significant association at 5% significance level implying extension services may work as change agent and can boost tunnel farming adaptation through their effective motivation to the farmers. Growers always remain surrounded with numerous risks and issues affecting their performance. Those risks may vary in nature and point a dire need to diminish their impact.

Table: 3 Logit regressions on the influence of institutional elements on the adoption of tunnel farming

Parameters	Coefficients	Standard Error	t Stat	P-value
Intercept	1.79546	2.266496	0.79217	0.430319
Access to credit facility	-0.46023	0.317721	-1.44855	0.150901
Marketing condition	0.103442	0.219157	0.471998	**0.638058
Goods grading	-0.10394	0.087575	-1.18689	**0.238359
Culture and customs	0.295264	0.164441	1.795555	**0.075885
Source of credit or money	0.534992	0.289812	1.845996	**0.068144
Availability of production	-0.12434	0.089812	-1.38448	0.169596
Labor distribution	-0.23236	0.085798	-2.70819	*0.008082
Investment	-0.43662	0.165945	-2.63114	*0.009995
Maintenance of tunnel	0.506799	0.107732	4.704249	**0.056906
Elements of climate	-0.00238	0.477731	-0.00498	**0.096037
Temperature	0.004072	0.172861	0.023555	0.98126
Multiple R	0.744106428; R ² 0.553694379; **5% significant level; *1% significant level			

From Table-3, adoption of innovation is a rigorous process particularly for those farmers with reduced adaptive capacities and resource tag. Adoption is a slower process depended upon several essential elements. It can be accessed from the adopter's category that only 16% farmers are innovators. Adoption depends upon several institutional grounds like access to information, credit, market and technical

labor. Otherwise non availability of these essential becomes hindering factors like climate change is posing serious threats to crops productivity. Marketing condition posed significant association at 5% significance level implying that with the mounting expression of stable market catches the interest of growers to grow more.

Culture and customs significantly associated with tunnel farming adoption at 5% significant level. Our findings explained stereotype behavior of growers towards traditional farming. Growers viewed that their reduced adaptive capacities, small land holdings put us on risk always. Therefore growers tend towards traditional farming to stabilize their livelihoods. Growers were of the view point that advisory services embark discrimination among farmers with their ultimate focus on large growers. Tunnel farming evolved huge investment beyond the capacity of small farmers. Hence, source of credit showed significant association with adoption of tunnel farming.

Issues involved in tunnel farming

For instance subsidies by public and private firms in infrastructure and inputs may foster adoption. Among several other issues labor shortage is another emerging issue. In case of tunnel farming technically trained labor is required to understand the complexities and technicalities of tunnel farming like spraying, regulating temperature and insects pests and diseases control inside the tunnel. Management of these aspects under climate consideration is always technical.

Table:4 Logit regression on the influence of environmental constraints on the adoption of tunnel farming

Parameters	Coefficients	Standard Error	t Stat	P-value
Intercept	1.028772	0.804579	1.278646	0.204104
Light	-0.26978	0.099542	-2.71019	*0.007966
Rainfall	-0.015	0.073003	-0.20546	0.837651
Temperature	0.053468	0.125917	1.218798	*0.005907
Vegetation problems	0.006846	0.075361	0.090836	0.927812
Plants cultivation	0.06939	0.075139	0.923496	0.358064
Weeds	-0.03131	0.157311	-0.19903	0.842663
Insects pests diseases	0.252452	0.146492	1.723321	**0.08805
Multiple R	0.382660287; R ² 0.746428990; **5% significant level; *1% significant level			

From Table-4, environmental constraints showed significant impact on cultivation of vegetables under tunnels. Light and temperature showed highly significant association on 1% level of significance. It is widely discussed that change in climate globally tends to hold impact on vegetable cultivation. Problems originated from extreme events like temperature are challenging to predict. Bhardawaj (2012) dictated that erratic high temperature spells consequently reduced vegetables productivity. Vegetables are generally sensitive to environmental stresses thus extended high temperature and limited soil moisture cause reduction in yield. About 50% crops loss has been reported globally due to environmental stress. For instance, high temperature may cause huge decline in tomato production due to stunted fruit set and smaller and lower quality fruits. Similar technicalities are faced by growers and they remain unable to regulate temperature, light and other factors essential for better productivity. Insect pests

and diseases showed significant impact on 5% significance level. Prajapati (2010) viewed those tunnel vegetables growers faced problems of insect pests which was entirely due to ignorance of handling. Diseases like root rot in cabbage, alternaria leaf spot in cauliflower, damping off during seedling stage occurred often in the vegetables. Ignorance of the use of pesticides against pests was a major problem. Bezabih and Hadera (2007) indicated insect, pests and disease outbreak to be the major sources of the decline in productivity in Eastern Ethiopia. Weeds outbreak also showed negative association but non-significant implying that with the increasing magnitude of weeds productivity level of vegetables goes down. Its common concept, that weeds compete for resources being applied to the vegetables. However, growers' remain unsuccessful to control weeds inside the tunnel being unaware about the technicalities and management practices.

Table: 5 Risks analysis affecting growers interest level towards tunnel farming

Parameters	Coefficients	Standard Error	t Stat	P-value
Intercept	-0.70371	0.848962	-0.82891	0.409235
Macro flora	-0.50677	0.208744	-2.42769	0.017079
Vegetables import	-0.06456	0.109677	-0.58861	**0.055752
Unstable market/price	0.222234	0.06561	3.387208	*0.001029
High Investment	0.380629	0.141436	2.691181	*0.008414
Less education	0.098514	0.064361	1.530636	0.129183
Unstable livelihoods/poverty	0.360635	0.102827	3.507195	*0.000693
Seasonal limitations	-0.14931	0.110685	-1.34899	0.180548
Labour intensives	-0.13936	0.079622	-1.75022	**0.083309
Multiple R 0.569506813; R ² 0.632433808; **5% significant level; *1% significant level				

Table-5 showed that growers were discussed about their future interest in tunnel farming and analysis of factors decreasing their interest. Unstable market, price, investment and unstable livelihoods/poverty showed significant association at 1% significance level. Inadequate availability of market for off season vegetables is major issue while price variation of off season vegetables is another crucial and critical issue. Often, price of vegetables produced off seasons cheaper during harvesting season and gradually increase as stock decreases and also sell at cheap prices at growing locations than distance away. Growers didn't afford to manage cold storage therefore supply of the off-season vegetables to the market are not being regulated. Moreover, varying mode of transportation caused differentiation and discrimination in price of vegetables and growers of remote areas had to sell their produce at lower price than those accessible areas.

Several types of greenhouse constructions and various types of applied technology for off-season greenhouse production may be identified. The total investment cost of greenhouse construction plays a vital role in the decision of an investor (Tzouramani et al., 1995).

Construction expenses constitute a very significant part of the greenhouse production cost, influencing the financial effectiveness of a greenhouse enterprise. Constructions improved significantly providing higher yields and better product quality but at the same time the expenses and risks for the initial investment are higher. Unfavorable weather conditions e.g. frost, torrential rainfall, strong wind during growing season and harvesting time cause reduction in vegetables production and loss bear to the farming community.

Conclusion

At the end it was concluded to enhance tunnel farming saturation in light of upcoming global food scarcity, nutritional standards and to produce food for the enormous population around the global and to need ever growing population. However tunnel technology is basic need for food security in Punjab. The farmers are advised to grow off-season vegetables in the tunnels for increasing their income and also naturally growing populations with the consultation of plant doctors of Agriculture Departments.

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