RESEARCH

Pest and Disease Management of Apple Orchards of Himachal Pradesh : A Potential Area for Optimization

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ABSTRACT

This paper is an extract from a study titled "Impact of Skill Management on the Sustainability of Apple Orchards in Himachal Pradesh". The study attempted to explore and understand the sustainability aspects of the Himachal Pradesh apple industry. It did so by studying the farm practices of a sample of apple orchardists from the two highest apple producing districts of the state- Shimla and Kullu. The aim being, to objectively analyze the farm management practices to uncover areas of operation which are not yet optimally managed but show potential in creating a positive impact on the production, productivity, profitability and sustainability of the apple industry of Himachal Pradesh by skillful management. The study was carried out from a manager's perspective rather than an agro-scientist's.

Primary data was collected with the help of a survey which was conducted in 2009 in both the districts. The sample size was 100; 50 from each district. Findings of the survey were further supplemented with secondary data. In addition to this, expert opinion and an extensive survey of literature was carried out.

KEY WORDS: Apple Industry, Himachal Pradesh, Skill Management, Customized Training, Optimization and Sustainability.

INTRODUCTION

The growth of agricultural production in India assumes crucial importance due to an ever-increasing demand for agricultural products generated by the world's second highest population. However, in the hilly states of India like Himachal Pradesh, Jammu and Kashmir, Uttarakhand, etc, agriculture suffers from certain limitations especially in the production of traditional crops and food grains. Consequently the relative contribution of horticulture is increasing significantly in these states. This study is an attempt at highlighting how better management of farm operations in apple orchards may lead to judicious resource utilization as well as improve the production and productivity of the whole apple industry. In other words, may lead to **'optimization'** and sustainability of this industry. The main study deals with a number of factors or skills as they are termed and this paper is based upon one out of those, namely, **'Pest and Disease Management'.**

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Insects, pests and diseases frequently causing havoc to crops are quoted by Sharma R. C. (2000)[1]to be one of the major shortcomings of horticulture. The year 1995 is a case in point, when; premature leaf fall affected more than 40 per cent of all apple orchards in Himachal Pradesh. According to Sharma, Sharma, & Sharma (2004)[2], due to premature leaf fall, the quality of produce was affected adversely and fruit bearing capacity was reduced. A study by Sharma J. N. (2000)[3] revealed that the root cause of the problem was a fungal disease called Marssonina Blotch or more commonly 'Apple Blotch'.

Similarly, Apple scab, another monumental disease the world over and a major disease in apple growing areas of India has been known to cause tremendous loss since 1973 when it spread to the Red Delicious variety. As per Thakur (2000)[4], the large scale damage and spread of apple scab created an alarming situation and the problem managed to engage the attention of the Indian Council of Agricultural Research, Directorate of Plant Protection, Quarantine and Storage and the Govt. of India whence it was promptly declared as one of the five main problems of national importance. Although measures were taken to control the disease effectively in Jammu and Kashmir where it was first detected, it made an appearance in Himachal Pradesh in 1977. Within six years it assumed epidemic proportions and affected 40,000 hectares of the state, made 10 per cent of the fruit unfit for market consumption and caused a loss of Rs.1.5 crore to the state's exchequer in the 1983 epidemic. Thakur (2000)[5] asserts that scab cannot be eliminated in totality but can be managed by a three step approach: i) Protection against primary infection - (biological control), ii) Protection against secondary infection - (chemical control) and iii) Growing scab resistant varieties - (resistance breeding). In view of economic ramifications incurred on the control of pests and diseases he advocates an inter-disciplinary approach for devising an integrated control program which should be need based, economical and environmentally safe.

The above instances merely hint at the tremendous impact the mismanagement or lack of appropriate management of the pest and disease skill can have on the production, productivity and profitability of an apple orchard. Apart from the above two examples, there are a number of pests and diseases which are widely reported and quoted in a number of sources. This paper is limited to discussing how well the pest and disease skill was managed in the sample population in 2009 and whether it could be considered as a non-optimized skill which would require training augmentation. Furthermore the paper will explore whether a common pest and disease program would be sufficient for both the districts under study or a customized strategy would be more suitable

DEFINITIONS

Customization is defined as making to order or modifying according to individual requirements (H.W.Fowler, F.G.Fowler,& R.E.Allen, 1994)[6]

Optimization is defined as "to make the best or most effective use of (a situation, an opportunity etc.)"(H.W.Fowler, F.G.Fowler,& R.E.Allen, 1994)[7]. In the context of the present study, it signifies the most effective use of limited and scarce resources like water for irrigation and human resources. Optimization involves creative

manipulation around factors which are largely uncontrollable e.g. global warming, erratic and unpredictable precipitation etc. as well as a proactive approach as opposed to a symptomatic one in various areas like disease and pest management etc.

Skill may be defined as " Ability and capacity acquired through deliberate, systematic and sustained effort to smoothly and adaptively carry out complex activities or job functions involving ideas (cognitive skills), things (technical skills), and / or people (interpersonal skills)." (H.W.Fowler, F.G.Fowler,& R.E.Allen, 1994)[8].

Integrated Pest Management (IPM) is defined by the Minnesota department of agriculture (Anonymous)[9], as "an approach which first assesses the pest situation, evaluates the merits of pest management options and then implements a system of complementary management actions within a defined area."

OBJECTIVE

The objective of the research paper is to explore the extent of synchronization of plant protection expenditure to the actual insect, pest and disease problems and also to assess whether plant protection is a crucial enough aspect to warrant a more skillful strategy.

The literature survey resulted in a list of most common insects, pests and diseases found in apple orchards of Himachal Pradesh. The sample farmers were questioned regarding the sighting of the listed insects, pests and diseases and their management. They were also questioned about farm expenditure incurred that year under various cost heads of which expenditure on plant protection was one.

To know whether the problem of insects, pests and diseases has any significant influence on the farm profit and whether expenditure on plant protection exhibits any relation with the reported incidence of pests and diseases, two hypotheses were developed and tested. The hypotheses are listed below:

HYPOTHESIS A:

$H A_0$: Plant protection expenditure influences profit.

$H A_1$: Plant protection expenditure does not influence profit.

HYPOTHESIS B:

$H B_0$: Plant protection expenditure is aligned with the incidence of pests and diseases.

$H B_1$: Plant protection expenditure is not aligned with the incidence of pests and diseases.

RESEARCH DESIGN - In this study, the **universe** includes all apple orchardists of districts Shimla and Kullu of Himachal Pradesh. The **population** refers to the apple growers of the largest apple producing blocks of the respective districts. These are **Jubbal- Kotkhai** block of district Shimla and **Naggar** block of district Kullu. The sample size for the present study is 100, 50 each belonging to Shimla and Kullu districts and out of these 50, 25 each have been taken from two different randomly selected **Patwar circles** in the largest apple producing **development blocks** of the two districts. Care has been taken to ensure the proportionate representation of marginal, small, medium and large category growers. Non probability- quota sampling design was used for the present study.

The objectives of the research paper have been satisfactorily analyzed by the use of both primary and secondary data. The main source of primary data and the instrument of data collection for the study was the questionnaire. A predominantly structured questionnaire was used.

INFERENTIAL ANALYSIS - Primary data regarding reporting of pests and diseases and expenditure per farm was subjected to 'Pearson's Correlation analysis' and 'p values' calculated. As stated earlier, farmers were questioned about a number of commonly reported insects and diseases as per the review of literature. The diseases were categorized as viral, pathological and nutritional. The consolidated findings for the state of Himachal Pradesh and analyses follow.

LIMITATIONS OF THE STUDY

The data pertains to only the survey year so the findings may be taken as an indication rather than conclusive evidence regarding the pest and disease management skill of the sample. Secondly, the analysis is based on expenditure incurred on the spray of insecticides, pesticides and other medicines as this was the most popular pest and disease management method. The medicines sprayed were the ones recommended by the department of horticulture and did not differ in the two districts.

FINDINGS, IMPLICATIONS AND SUGGESTIONS

Table 1
Correlation Matrix for Reported Pests and Diseseases with profit and plant Protection Expenditure in Shimla

CORRELATION PARAMETERS		PPE	PFT	IMI	IMPD	IVD	IND	TID
	Pearson's Correlation	1	0.995**	0.095	0.326*	0.161	0.125	0.273
	Sig.(2-tailed)		0	0.512	0.021	0.265	0.386	0.055
PPE	**N**	50	50	50	50	50	50	50
	Pearson's Correlation	0.995**	1	0.095	0.331*	0.184	0.142	0.285*
	Sig.(2-tailed)	0		0.511	0.019	0.2	0.326	0.045
PFT	**N**	50	50	50	50	50	50	50
	Pearson's Correlation	0.095	0.095	1	0.581**	0.231	-0.426**	0.808**
	Sig.(2-tailed)	0.512	0.511		0	0.106	0.002	0

IMI	**N**	50	50	50	50	50	50	50
	Pearson's Correlation	0.326*	0.331	0.581**	1	0.292*	-0.135	0.822**
	Sig.(2-tailed)	0.021	0.019	0		0.039	0.351	0
IMPD	**N**	50	50	50	50	50	50	50
	Pearson's Correlation	0.161	0.184	0.231	0.292*	1	0.343*	0.554**
	Sig.(2-tailed)	0.265	0.2	0.106	0.039		0.015	0
IVD	**N**	50	50	50	50	50	50	50
	Pearson's Correlation	0.125	0.142	-0.426**	-0.135	0.343*	1	0.054
	Sig.(2-tailed)	0.386	0.326	0.002	0.351	0.015		0.711
IND	**N**	50	50	50	50	50	50	50
	Pearson's Correlation	0.273	0.285*	0.808**	0.822**	0.554**	0.054	1
	Sig.(2-tailed)	0.055	0.045	0	0	0	0.711	
TID	**N**	50	50	50	50	50	50	50

Table 2
Correlation Matrix for Reported Pests and Diseseases with Profit and Plant Protection Expenditure in Kullu

CORRELATION PARAMETERS		**PPE**	**PFT**	**IMI**	**IMPD**	**IVD**	**IND**	**TID**
	Pearson's Correlation	1	0.990**	0.037	0.056	-0.311*	-0.008	-0.096
	Sig.(2-tailed)		0	0.800	0.701	0.028	0.959	0.507
PPE	**N**	50	50	50	50	50	50	50
	Pearson's Correlation	0.990**	1	0.039	0.042	-0.301*	-0.036	-0.109
	Sig.(2-tailed)	0		0.790	0.77	0.034	0.802	0.453
PFT	**N**	50	50	50	50	50	50	50
	Pearson's Correlation	0.037	0.039	1	0.056	0.051	-0.277	0.591**
	Sig.(2-tailed)	0.8	0.79		0.698	0.725	0.051	0
IMI	**N**	50	50	50	50	50	50	50

	Pearson's Correlation	0.056	0.042	0.056	1	-0.115	0.012	0.579**
	Sig.(2-tailed)	0.701	0.77	0.698		0.427	0.934	0
IMPD	**N**	50	50	50	50	50	50	50
	Pearson's Correlation	-0.311*	-0.301*	0.051	-0.115	1	-0.029	0.434**
	Sig.(2-tailed)	0.028	0.034	0.725	0.427		0.839	0.002
IVD	**N**	50	50	50	50	50	50	50
	Pearson's Correlation	-0.008	-0.036	-0.277	0.012	-0.029	1	0.191
	Sig.(2-tailed)	0.959	0.802	0.051	0.934	0.839		0.185
IND	**N**	50	50	50	50	50	50	50
	Pearson's Correlation	-0.096	-0.109	0.591**	0.579**	0.434**	0.191	1
	Sig.(2-tailed)	0.507	0.453	0	0	0.002	0.185	
TID	**N**	50	50	50	50	50	50	50

**Correlation is significant at the 0.01 level (2-tailed).
*Correlation is significant at the 0.05 level (2-tailed).

Table 3
Key of Abbreviations for Tables 1 And 2

S.NO.	ABBREVIATIONS USED IN CORRELATION MATRICES	
1	**PPE**	PLANT PROTECTION EXPENDITURE
2	**PFT**	PROFIT
3	**IMI**	INCIDENCE OF MAJOR INSECTS
4	**IMPD**	INCIDENCE OF MAJOR PATHOLOGICAL DISEASES
5	**IVD**	INCIDENCE OF MAJOR VIRAL DISEASES
6	**IND**	INCIDENCE OF NUTRITIONAL DISORDERS
7	**TID**	TOTAL INCIDENCE OF DISEASES

IMPLICATIONS AND SUGGESTIONS BASED ON TABLES (1 AND 2)

Plant 'protection expenditure' and 'profit' exhibited positive and highly significant correlation implying that plant protection is a crucial area and may have a strong bearing on the profit of a farm. Moreover, this is observed to be true for both the districts. It could mean that more profitable farms spend more on plant protection as well as those farms which spend more on plant protection report more profit. It also indicates that expenditure on plant protection has not reached its optimum level and an increase in plant protection yet, is likely to increase profitability of an apple farm in Himachal Pradesh.

In a nutshell, plant protection expenditure is

verified to be a crucial skill which influences profitability of a farm. Therefore the null hypothesis stands accepted.

IMPLICATIONS AND SUGGESTIONS

It is observed in both the districts that the incidences of major insects, major pathological diseases and viral diseases are correlated with the total incidence of disease and the correlation is highly significant. Therefore it is inferred that these three categories constitute the crux of the pest and disease problem. Nutritional disorders have not been reported by either of the districts significantly so as per this survey, the farmers do not consider their farms to be nutritionally compromised.

IMPLICATIONS AND SUGGESTIONS FOR DISTRICT SHIMLA

In district Shimla incidence of major insects and incidence of nutritional disorders showed a negative and highly significant correlation. This could indicate that 'major insects' visiting apple farms of district Shimla prefer farms having nutritionally superior plants. This is an interesting find and could be considered as an area for further investigation.

Plant protection expenditure and reported incidence of major pathological diseases exhibited a positive and significant correlation. This may indicate that plant protection expenditure of Shimla farmer is influenced by the incidence of major pathological diseases. A similar relationship is observed between profit and reported incidence of major pathological diseases indicating that possibly the major pathological diseases are being successfully controlled and have a positive bearing on profit. A positive and significant correlation between profit and total incidence of diseases requires further investigation which is beyond the scope of the present research paper.

A number of factors showed a positive but non-significant correlation so no inferences are being drawn on the basis of those factors. However, it is noteworthy that plant protection expenditure showed a positive but non-significant correlation with major insects, viral diseases and nutritional disorders as well as with profit. If increased, it may have a further positive impact on profit. This is so because of the observation that increased plant protection expenditure on major pathological diseases is producing a favorable impact on profit and the major pathological diseases are the focus of expenditure as of now.

No indicative or conclusive clues emerge from the observed negative and non-significant correlations. In short, in district Shimla, plant protection expenditure appears synchronized with the reported incidence of major pathological diseases. It is not verified whether this is the case in case of major insects, nutritional disorders and viral diseases.

IMPLICATIONS AND SUGGESTIONS FOR DISTRICT KULLU

Positive and highly significant correlations of incidence of major insects, major pathological diseases and viral diseases with the total incidence of diseases indicates that these three constitute the most important insect, pest and disease problems for district Kullu.

Negative and significant correlation observed between plant protection expenditure and viral diseases points towards the possibility that control

measures against viral diseases are a priority in the district. Positive and significant correlation is not observed in district Kullu.

There were a number of factors which showed a positive but non- significant correlation so are being overlooked. Nevertheless it may be inferred from the positive correlation of plant protection expenditure with profit as well as incidence of major insects and major pathological diseases, that there appears scope for increasing expenditure on these two categories. Like Shimla, there were a number of negative and non-significant correlations exhibited in district Kullu which do not amount to much statistically.

CONCLUSION

In the case of hypothesis A, the null hypothesis is accepted for both the districts. It is verified that "Plant protection expenditure does indeed influence profit".

In the case of hypothesis B, it is observed that in both the districts the incidence of major insects, major pathological diseases and viral diseases constitute the main pest and disease problem. However, as per the responses, it appears that in district Shimla, plant protection expenditure is synchronized with the control of 'major pathological diseases' whereas in Kullu, although not as clearly but the focus seems to be on the control of 'viral diseases'. The null hypothesis fails to be accepted; therefore the alternate hypothesis stands accepted. It may be stated that plant protection expenditure in both the districts is not synchronized optimally with the incidence of pests and diseases. Therefore it will not be wrong to state that the pest and disease skill in the apple orchards of Himachal Pradesh is not optimized.

On the basis of the above analysis, it is suggested that since the pest and disease problem is a crucial area for the profitability of a farm, plant protection expenditure needs to be better synchronized with the reported problems. In district Shimla, increased expenditure on the control of insects and viral diseases is suggested in addition to expenditure on major pathological diseases. In district Kullu, increased expenditure for the control of insects and major pathological diseases in addition to viral diseases is suggested. Integrated pest management if adopted is likely to give good results.

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QUOTES

Live as if you were to die tomorrow. Learn as if you were to live forever
Mahatma Gandhi

The best way to find yourself is to lose yourself in the service of others
Mahatma Gandhi

Let us sacrifice our today so that our children can have a better tomorrow
Dr. A. P. J. Abdu Kalam

I, for one, thoroughly believe that no power in the universe can withhold from anyone anything they really deserve
Swami Vivekananda

If you can give them positive ideas, people will grow up to be men and learn to stand on their own legs
Swami Vivekananda

First, believe in the world-that there is meaning behind everything
Swami Vivekananda