Breakthrough in Controlling the Menace of Premature Leaf fall in Apple Orchards of Himachal Pradesh

1. **Category:** Horticulture

2. **Challenge:**

Apple plantations in Himachal Pradesh state of India had been ravaged by mid-season defoliation of trees diagnosed to be caused by a leaf spot fungal disease Marssonina blotch due to *Marssonina coronaria* (Plate-1). This disease was also known to bring about a physiological disturbance in the apple trees and causing barrenness resulting in the crop failures, and agony to the growers. A prophylactic fungicidal spray schedule was recommended and followed by the apple growers for its management. There was no alternative as there was little information on mode of action of different fungicides apart from their protective activity against this pathogen. There was every likelihood of unnecessary spraying of fungicides mostly being used at higher dosages in the apple orchards thus causing environment pollution. At the same time, the livelihood of the farmers was on stake as this disease was taking a heavy toll of the yield and quality of their fruit produce.

Plate 1: Premature leaf fall of apple

3. **Initiative:**

A project titled, 'Studies on mode of action of fungicides and refinement of spray schedule against premature leaf fall of apple in Shimla district of Himachal Pradesh' was sanctioned under the GOI funded Rashtriya Krishi Vikas Yojna with a total outlay of Rs. 21.23 lakh with objectives viz., to establish the physical modes of action of different fungicides against *Marssonina coronaria* causing premature leaf fall of apple in green house and field conditions, and to develop disease forecasting procedures and refine integrated spray schedule for controlling premature leaf fall of apple and its validation in the field. Computer based automatic weather stations were installed at 3 locations viz., Rohroo, Kotkhai and Thanedhar of Shimla district of Himachal Pradesh for recording and further transmitting information on the weather conditions prevailing in these locations (Plate-2). Further analysis

of the data revealed that a temperature of at 20^0C, 100 per cent relative humidity and leaf wetness of 48 hours were the most congenial for the development of Marssonina blotch. Different available fungicides were evaluated for their efficacy as per the protective, curative and eradicative properties against this notorious pathogen. Dithiocarbamate fungicides mancozeb, metiram etc. provided maximum control of Marssonina blotch disease after their protective applications on apple plants both under semi-controlled as well as under field conditions. New generation strobilurin fungicides pyraclostrobin, kresoxim methyl and azoxystrobin proved strongest in their curative, pre-symptom and post-symptom activities against *Marssonina coronaria*, therefore, were more suitable for monitored disease control (Plate-3). Directed sprays of kresoxim methyl in monitored spray programme provided more than 90 per cent control of the disease, which was at par with the calendar based spray schedule comprising mancozeb (0.3%), carbendazim (0.05%), dodine (0.075%) and mancozeb flowable (0.35%).

4. Key result/insight/interesting fact:

Premature leaf fall of apple which had once become a menace in Himachal apple orchards giving sleepless nights to the farmers, administrators and scientists and virtually had become a riddle was finally controllable. It took less number of spraying rounds thereby saving the farmers from extra expenditure saving their time, money and energy. There is comparatively negligible effect on the environment while using new generation fungicides by avoiding heavy dosages of protectants. The farmers could save their apple crop by using this technology. At the same time the apple production will certainly increase by avoiding yearly menace of mid-season defoliation in apple trees thus increasing the farmers' income in the coming years. In this era of information technology when weather monitoring has become so handy and precise, this technology has become more relevant and practicable.

5. Impact:

This breakthrough helped in controlling the menace of pre mature leaf fall thus saving the livelihoods of lakhs of farm families. The apple crop which was almost in the devastation stage was protected very effectively maintaining thereby the confidence of farmers on the

advancements of research activities. This study was able to generate new information in the world literature on this subject.

Control ratings of the fungicides were developed on the basis of effectiveness of different test fungicides against Marssonina blotch in apple. The dithiocarbamate fungicides proved more effective protectant against Marssonina blotch as compared to others.

Ratings of physical mode of action of fungicides against *Marssonina coronaria* causing Marssonina blotch of apple under semi-controlled conditions

Fungicide treatment	Dose (%)	Control rating			
		Protective	After infection	Pre-symptom	Post-symptom
Control	..	16	16	16	16
Mancozeb	0.3	1	12	12	12
Captan	0.3	15	15	15	15
Dodine	0.1	3	6	6	6
Copper oxoychloride	0.3	14	14	14	14
Metiram	0.3	2	13	13	13
Benomyl	0.1	8	7	7	7
Carbendazim	0.1	7	4	4	4
Thiophanate methyl	0.1	9	5	5	5
Shield	0.3	12	11	11	11
Kresoxim methyl	0.1	4	1	1	1
Azoxystrobin	0.1	6	3	3	3
Pyraclostrobin	0.1	5	2	2	2
Hexaconazole	0.1	11	9	9	9
Difenoconazole	0.1	13	10	10	10
Tebuconazole	0.1	10	8	8	8

The after-infection, pre-symptom and post-symptom activity of strobilurins, benzimidazoles, and triazoles exceeded that of protection. In this mode of action, they outperformed standard fungicides like mancozeb and metiram, whose strength lies largely in protection against Marssonina blotch. New generation strobilurins had highest rating (1-3) followed by benzimidazoles (4-7).

6. Lessons learned:

There may be emergence of new diseases and pests infecting the apple crop with the potential of completely eroding the farming system, but as a scientist one should strive hard and must work devotedly against all odds to find the remedies. You may not get admiration or acknowledgement from the fellow companions or the farming community but one should

remember his mission of serving the mankind. The smiles on the faces of the farming community is yours reward particularly for whom the livelihoods are almost challenged without any ray of hope. To every problem there is always a solution, only it is needed to have patience, zeal and passion to find it.

7. Supporting quotes and images

Following recommendation has emerged out of this investigation and thus has been proposed to be included in the Package of Practices of Dr YS Parmar University of Horticulture and Forestry, Nauni-Solan H.P. for the management of Marssonina blotch causing premature leaf fall of apple: 'In excessively humid and rainy conditions, strobilurin type fungicides like kresoxim-methyl (0.1% Ergon 44.3 SC) and pyraclostrobin (0.1% Cabrio Top 60 WG) may be used to control this disease effectively owing to their excellent curative and eradicant action against the pathogen. Their application should be preferred in combination with other broad-spectrum protective fungicides.'

Plate 2: i-Metos automatic weather station installed in an apple orchard

Plate 3: Atypical lesions on apple leaves showing pre-symptom activity

8. Additional information:

1. Project partners and/or donors who supported the work: Govt. of India under RKVY
2. Links of supporting materials, such as news items, photos or flicker and presentation on slide share: -
3. Contact person for this story:
   Name: Dr JN Sharma
   Position: Director of Research, Dr YS Parmar University of Horticulture and Forestry, Nauni-Solan, Himachal Pradesh; E-Mail: jnsharma1960@yahoo.co.in
4. Other information: Established credentials as five publications have been brought from this work including one Ph.D. thesis and a technical bulletin

9. Checklist

No.	Question to consider	Yes	No.
1	Is the story interesting to the target audience of the project/ activity report?	√	
2	Does the story explain what new insights the project brings? What is the main lesion learned from this story? Does the story describe a key insight on what works and what doesn't and something that future projects could build On	√	
3	Does the story describe the outcomes the project produced and the people who are benefitting? What changes-in skills, knowledge, attitude, practice, or policy-has the project brought about and who is benefitting from these changes?	√	
4	Does the story make a compelling point that people will remember? Does the story show how the project makes a difference to improving livelihoods and lessening poverty?	√	
5	Does the story provide an interesting fact that people will remember? For example, how yields increased, how many hectares of land could become more productive from this innovation or technology?	√	
6	Does the story explain what kind of impact this innovation or technology could have if scaled up?	√	
7	Does the story show which partners contributed and how?	√	
8	Does the story include quotes from stakeholders of beneficiaries?	√	
9	Have I provided links to other media (journal articles, website news, newsletter, blogs annual reports of other Programme/project) that also feature this story?	√	
10	Have I provided the contact details of people who can provide more information?	√	