Research Article……….

International Journal of Agricultural Invention

(online available at www.agriinventionjournal.com)

***International Journal of Agricultural Invention* 7(1): 39-45: June, 2022**

ISSN: 2456 – 1797 (P)

To study the effect of compatible pesticides spray against major pests and diseases of Apple

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ARTICLE INFO

Original Research Article

Received on February 25, 2022

Revised on March 22, 2022

Accepted on March 29, 2022

Published on April 15, 2022

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PUBLICATION INFO

International Journal of Agricultural Invention (IJAI)

RNI: UPENG/2016/70091

ISSN: 2456-1797 (P)

Vol.: 7, **Issue:** 1, **Pages:** 39-45

Journal Homepage URL

http://agriinventionjournal.com/

DOI: 10.46492/IJAI/2022.7.1.8

ABSTRACT

A two year field trial at Shalimar campus, SKUAST-Kashmir was conducted to study the compatibility of various insecticides and fungicides against major pests and diseases of apple. Insecticides and fungicides are recommended to be sprayed separately without admixing suspensions involving huge labour and time components. Different pesticides and fungicides were sprayed with at five different phenological stages (fruit-let, fruit development stage-I and fruit development stage-II). Standard controls comprising of recommended sprays were also given at these stages for comparison, in addition to unsprayed check. Observations with respect to foliage and fruit scab, *Alternaria* leaf blotch and percent mortality of European red mite (ERM) and San Jose Scale (SJS) were recorded at fruit-let, fruit development stage-I and fruit development-II stages. The pesticidal combination exhibiting physical incompatibility was discarded in the initial phase. Combined spray of fungicide and insecticide proved equally effective in controlling diseases and pests of apple in different stages. The experimental plants sprayed with mixtures of fungicides and insecticides at recommended concentrations exhibited significant reduction in apple scab, ALB, EMR and SJS in comparison to unsprayed check at fruit-let stage. Results revealed that treatment T_5 (difenconazole + phosalone) proved superior in minimizing foliar scab incidence and intensity whereas treatment T_3 (difenconazole + chlorpyriphos) and T_{16} (difenconazole) had minimum incidence (0.80%) and intensity (0.30%) of fruit scab. The trees sprayed with hexaconazole followed by chlorpyriphos (T_9) result lowest disease incidence (0.23) of ALB and lowest intensity (0.17) was found in Haxaconozol followed by Milbactin (T_{10}). T_4 (Difenconazole + Milbactin) proved most effective in inflicting maximum ERM mortality (68.6%) and was at par with T_7 (65.6%) followed by T_{14}. Treatment T_1 (Haxaconozole + Milbectin) shows 57 per cent mortality of SJS and was at par with T_3 (Difenconazole + Chlorphriphos) and T_{12} (Chlorpyriphos) treatments. At fruit development stage-I, all the treatments controlled apple scab, ALB, ERM and SSJ significantly as compared to unsprayed check (table 2). T_5 (Zineb +Chlorpyriphos) had least foliage scab incidence (2.63%) and T_{13} (Mancozeb) showed lowset intensity (0.70%), whereas T_5 (Zineb + Chlorpyriphos) exhibited least fruit scab incidence (6.50%) followed by T_8 (Mancozeb followed by Chlorphriphos) and lowest intensity were recorded in T_2 (Mancozeb + Chlorpyriphos) and T_8 (Mancozeb followed by Chlorphriphos) (02.03%). ALB incidence was significantly controlled by T_3 (Mancozeb + Dicofol) and intensity was significantly controlled by T_1 (Mancozeb + Quinalphos) followed by T_2. Percent mortility of ERM was highest by T_{12} (Dicofol) (80.4 %) followed by treatment T_5 (Zineb + Chlorpyriphos) (75.9) per cent. In case of SJS, treatment T_{10} (Quinalphos) and T_7 (mancozeb + Quinalfos) was most promising with 79.3 and 78.3% mortality, respectively. At fruit development II, all the treatments significantly controlled apple scab, ALB, ERM and SJS in comparison to unsprayed check (table 3). Least leaf scab incidence and intensity was showed by treatment T_5 Bitertinol+ Propargite (8.63 and 2.41 %, respectively) However, least fruit scab incidence was observed in trees sprayed with T_3 (Flusilozole + Summer spray oil) while treatment T_2 (Flusilozole + Propargite) showed lowest fruit scab intensity of 3.27 per cent. Bitertinol + summer spray oil (T_6) sprayed trees had least ALB incidence (5.97%) while T_7 (Difenconazole + Dimethoate) had least ALB intensity (2.65%). Percent mortility of ERM was highest by T_{14} Propargite effectively controlled ERM and was at par with treatment T_{15} and T_8. Similarly In case of SJS treatment T_7 (Difenconazole with Dimethoate) and T1, T4, T6, T9, T10 and T13 showed statistically similar performance. Thus compatible chemicals can effectively minimize labour, time and inputs.

KEYWORDS

Pesticides, Apple, Pests, Diseases, Compatibility

HOW TO CITE THIS ARTICLE

Gupta, S., Gupta, V., Sharma, N., Sinha, A. K. (2022) To study the effect of compatible pesticides spray against major pests and diseases of Apple, *International Journal of Agricultural Invention,* 7(1): 39-45. DOI: 10.46492/IJAI/2022.7.1.8

Apple is the predominant temperate fruit crop in India which accounts for about 10% of total fruit production of the country. Although India ranks 10^{th} in world production of apple, yet the decreasing trend in productivity of its orchards, in the last decade has caused a serious concern to the fruit growers and planners of the Country.

India is known for producing different varieties and variability's among fruit crops. However, it has been ranked at sixth position in apple producing countries in the world. Apple is an important temperate fruit crop in India in terms of acreage, production, economic value and popularity among the society as it is the most important deciduous fruit tree with regard to the production. In India its cultivation is mainly confined in the states of Jammu and Kashmir, Himachal Pradesh and Uttarakhand. Jammu and Kashmir has the highest average yield and accounts 67% of total apple production and 50% of its export in the country, hence a substantial foreign exchange earner and important for economic growth. Productivity of apple in J & K is much higher (10.85 mt/ha) than national average of 6.86 tons/ha. India annually exports apple worth Rs 400 million out of which Rs. 200 million of apples comes from Jammu and Kashmir. It provides job opportunity to 1.2 million people directly or indirectly.

This apple crop has been a main source of income of 2.85 lakh farming community of the valley which earns about 2500 to 3000 crore rupees annually to the state exchequer (Indian Horticulture Database, 2014). Although the agro climatic conditions of the state are congenial for apple production yet the productivity of quality fruit is substantially low. Apple has been cultivated in almost all the ten districts of Kashmir valley with an average area of 125615.6 ha and production of about 1134637 metric tonnes with a productivity of 10.85 MT ha-1. Although it's annual production is higher than other states but from last few years it is decreasing, irrespective of the fact that average land under apple cultivation has explicitly increased without rapid increase in production. A lot of reasons are responsible for its decline but indiscriminate use of pesticides in modern agriculture has increased the input cost of cultivation of apple and disturbed the ecological inter-relationship by massive killing of farmer friendly insects along with detrimental insects (Anonymous, 2015, Baba *et al.*, 2015, Bilal *et al.*, 2015 and Foster *et al.*, 2000).

The main objective of this study was to reduce or amalgamate the number of pesticide sprays, to develop economic spray schedule of recommended pesticides, to study the effect of compatible pesticidal spray against major diseases and pests of apple and to study the effect of compatibility spray mixture on fruit set, yield, etc.

Materials and Methods

A field trial on compatibility of various pesticides was conducted at Shalimar campus where Apple trees cv. 'Red Delicious' were sprayed with different pesticides and fungicides alone and with combinations at different phenological stages (fruit-let and fruit development stage-I and -III). Standard controls comprising of recommended sprays were also given at these stages for comparison, in addition to unsprayed check. Observations with respect to foliage and fruit scab, *Alternaria* leaf blotch and percent mortality of European red mite (ERM) and San Jose Scale (SJS) were recorded at fruit-let, fruit development stage-I and development stage-II stages. Further, pesticides tested at Shalimar (Srinagar) and found compatible at the above mentioned stages for final recommendations. Fungicides and insecticides are recommended to be sprayed separately without admixing suspensions involving huge labour and time components. Working out the compatibility of different pesticides shall help to save time, cost and energy. The research is likely to boost the economic status of orchardists by using compatible pesticides for disease and insect-pest control.

Results and Discussion

The work on assessing the compatibility of some pesticides recommended in spray schedule-was conducted at Shalimar campus. The pesticidal combination exhibiting physical incompatibility were discarded in the initial phase and the effect of compatible chemicals on major diseases and pests as well as other adverse effects, if any, were assessed on apple cv. "Red Delicious". The trees were sprayed at fruit-let, fruit development stage-I and fruit development stage-II with compatible pesticides (mixture) at recommended concentrations and observations recorded at fruit-let, fruit development-I and fruit development-II stages. The experimental plants sprayed with mixtures of fungicides and insecticides at recommended concentrations exhibited significant reduction in apple scab, ALB, EMR and SJS in comparison to unsprayed checkat fruit-let stage (table 1).

Table 1. Effect of combined sprays of fungicides and insecticides on apple scab, *Alternaria* leaf blight and European red mite (ERM) of apple at fruit-let stage at Shalimar

T. N.	Treatment	Foliage Scab		Fruit Scab		*Alternaria* Blight		Per Cent Mortality	
		Inc. (%)	Int. (%)	Inc. (%)	Int. (%)	Inc. (%)	Int. (%)	ERM	SJS
T_1	Hexaconazole 5EC (30 ml)* + Milbectin 1EC (100 ml)	2.00 (6.62)	0.70 (3.90)	3.47 (10.62)	0.73 (4.63)	0.47 (3.80)	0.43 (3.76)	54.0 (47.29)	57.0 (49.02)
T_2	Hexaconazole 5EC (30ml) + Phosalone 35EC	2.33 (8.56)	0.97 (5.17)	1.70 (7.39)	0.33 (3.16)	0.80 (4.52)	0.43 (3.56)	26.0 (30.85)	36.0 (36.87)
T_3	Difenconazole 25WP (30ml) + Chlorphriphos 20EC (100 ml)	1.70 (7.45)	0.87 (4.90)	0.80 (5.10)	0.30 (2.52)	0.33 (2.68)	0.20 (1.48)	45.3 (42.86)	52.0 (46.14)
T_4	Difenconazole 25WP (30 ml) (30 ml) + Milbectin 1EC	1.37 (6.63)	0.53 (3.89)	1.37 (6.60)	0.20 (2.41)	0.30 (2.80)	0.23 (2.08)	68.6 (55.91)	11.0 (19.37)
T_5	Difenconazole 25WP (30 ml) + Phosalone 35EC	0.23 (1.59)	0.33 (2.68)	1.07 (5.89)	0.17 (2.25)	0.37 (2.51)	0.43 (3.06)	32.6 (34.81)	38.0 (38.05)
T_6	Triadimefon 25WP (50g) + Chlorpyriphos 20EC (100 ml)	1.70 (7.44)	2.03 (7.49)	3.27 (10.06)	0.80 (4.86)	0.47 (3.62)	0.50 (3.93)	38.20 (38.25)	48.0 (43.85)
T_7	Triadimefon 25WP (50g) + Milbectin 1EC (100 ml)	2.07 (8.02)	1.13 (5.79)	6.73 (14.72)	1.07 (5.51)	1.07 (5.47)	0.40 (2.91)	65.6 (54)	9.3 (17.75)
T_8	Triadimefon 25WP (50g) + Phosalone 35EC (100 ml)	2.50 (8.86)	1.03 (5.55)	2.87 (9.73)	0.67 (4.32)	1.78 (6.58)	0.57 (4.28)	33.0(35 .06)	47.3 (43.45)
T_9	Hexaconazole 5EC (30 ml) followed by Chlorphriphos 20EC (100 ml)	3.20 (9.81)	1.03 (5.59)	2.83 (9.58)	0.70 (4.42)	0.23 (2.55)	0.53 (4.05)	22.6 (28.38)	45.3 (42.86)
T_{10}	Hexaconazole 5EC (30 ml) followed by Milbectin 1EC (100 ml)	2.30 (8.56)	0.80 (5.10)	0.87 (4.90)	0.37 (2.51)	0.30 (2.52)	0.17 (2.25)	50.0 (45)	38.0 (38.05)
T_{11}	Check (Water spray)	18.37 (24.76)	5.17 (12.83)	10.60 (18.96)	6.13 (14.21)	6.03 (13.14)	3.40 (10.60)	7.3 (15.67)	11.0 (19.37)
T_{12}	Chlorpyriphos 20EC (100 ml)	10.70 (18.48)	4.40 (11.58)	6.67 (14.88)	3.37 (10.47)	4.90 (11.94)	0.73 (4.83)	54.3 (47.46)	50.6 (45.34)
T_{13}	Milbectin 1EC (100 ml)	14.10 (21.48)	3.57 (10.22)	6.83 (15.12)	3.53 (10.75)	3.27 (10.20)	1.07 (5.86)	36.0 (37.22)	7.0 (15.34)
T_{14}	Phosalone 35EC	14.53 (21.63)	3.10 (10.09)	7.53 (15.90)	4.10 (11.63)	4.17 (10.72)	0.77 (4.92)	58.6 (49.95)	49.0 (44.42)
T_{15}	Hexaconazole 5EC (30 ml)	3.07 (10.01)	1.33 (5.74)	2.80 (9.19)	3.17 (8.34)	0.90 (4.93)	0.53 (4.16)	2.6 (9.28)	5.0 (12.92)
T_{16}	Difenconazole 25WP (30 ml)	0.53 (3.97)	0.53 (3.89)	0.80 (5.12)	0.80 (4.62)	1.43 (5.65)	0.47 (3.89)	3.0 (9.97)	3.3 (10.46)
T_{17}	Triadimefon 25WP (50g)	0.77 (4.09)	1.07 (4.78)	1.33 (6.60)	0.83 (4.83)	0.63 ()4.24	0.47 (3.71)	1.6 (7.26)	2.0 (8.13)
CD (P = 0.05)		6.50	2.78	3.19	3.78	4.08	2.54	9.19	7.67

Note: ml* = Milliliter per 100 liters of water
g** = gram per 100 liter of water
Spray conducted at petal fall stage, Observations recorded at fruit let stage
Hexaconazole 5EC being incompatible with chlorpyriphos 20EC and also incompatible with data in parentheses are angular transformed values

Table 2. Effect of combined sprays of fungicides and insecticides on apple scab, *Alternaria* blotch and European red mite (ERM) & San Jose scale of Apples at fruit development stage–I at Shalimar

T. N.	Treatments	Foliage Scab		Fruit Scab		*Alternaria* Blight		Per Cent Mortality	
		Inc.	Int.	Inc.	Int.	Inc.	Int.	ERM	SJS
T_1	Mancozeb 75WP (300g)* + Quinalphos 25EC (100 ml)**	4.93 (12.76)	1.43 (6.68)	14.73 (22.48)	2.17 (8.45)	10.20 (17.54)	0.90 (5.12)	40.6 (39.58)	75.5 (62.37)
T_2	Mancozeb 75WP (300g) + Chlorpyriphos 20EC (100 ml)	3.73 (10.93)	1.13 (5.85)	11.40 (19.54)	2.03 (8.19)	8.10 (16.08)	2.53 (8.58))	63.3 (52.71)	74.3 (59.54)
T_3	Mancozeb 75WP (300g) + Dicofol 18.5 EC (108 ml)	3.13 (10.12)	1.53 (7.03)	10.40 (18.33)	3.03 (9.99)	6.47 (13.70)	4.6 (10.110	75.6 (60.39)	32 (34.45)
T_4	Zineb 80WP + Quinalphos 25EC (100 ml)	2.97 (8.74)	1.83 (7.70)	12.13 (19.51)	2.93 (9.67)	9.00 (17.19)	4.17 (11.53)	64 (53.13)	73.3 (58.88)
T_5	Zineb 80WP + Chlorpyriphos 20EC (100 ml)	2.63 (8.44)	2.43 (8.69)	6.50 (14.67)	3.13 (10.06)	12.53 (20.19)	2.88 (9.31)	75.9 (60.59)	37.2 (37.58)
T_6	Zineb 80WP + Dicofol 18.5EC (108 ml)	5.87 (11.52)	1.10 (5.61)	13.33 (20.62)	4.13 (11.65)	7.37 (14.92)	3.60 (10.36)	80.4 (63.72)	70.5 (57.10)
T_7	Mancozeb 75WP followed by Quinalfos 25EC (100 ml)	4.27 (10.08)	1.60 (7.22)	15.53 (23.15)	4.47 (12.17)	15.17 (22.02)	7.60 (15.12)	35.2 (36.39)	78.3 (62.23)
T_8	Mancozeb 75WP (300g) followed by Chlorphriphos 20EC (100 ml)	4.77 (11.75)	0.80 (4.70)	8.63 (16.22)	2.03 (7.95)	14.73 (20.22)	7.87 (14.03)	68.6 (55.92)	70.6 (57.16)
T_9	Check (water spray)	33.57 (35.14)	14.60 (20.64)	51.03 (45.66)	25.90 (29.00)	46.83 (43.11)	33.27 (32.82)	16.6 (24.04)	17.1 (24.42)
T_{10}	Quinalphos 25EC (100 ml)	27.73 (31.11)	10.03 (18.11)	35.00 (36.16)	12.90 (18.04)	40.13 (38.98)	15.17 (22.25)	40.7 (39.64)	79.3 (62.93)
T_{11}	Chlorphriphos 20EC (100 ml)	24.00 (29.26)	9.23 (17.17)	39.80 (38.91)	13.00 (20.78)	30.13 (32.07)	10.77 (18.64)	69.6 (56.54)	78 (62.03)
T_{12}	Dicofol 18.5EC (108ml)	21.27 (27.06)	9.80 (18.17)	22.00 (27.91)	7.83 (16.07)	14.53 (21.33)	6.13 (13.84)	80.4 (50.94)	40.7 (39.64)
T_{13}	Mancozeb 75WP (300g)	5.40 (12.81)	0.70 (4.76)	10.43 (18.76)	3.57 (10.87)	9.03 (17.00)	3.03 (8.53)	-	-
T_{14}	Captan (300g)	3.60 (10.60)	1.50 (6.88)	18.33 (25.30)	4.07 (11.19)	14.23 (20.02)	4.64 (11.88)	-	-
T_{15}	Zineb 80WP	6.47 (13.92)	1.40 (6.78)	13.63 (21.09)	4.57 (12.30)	20.17 (25.82)	6.77 (13.13)	-	-
CD (P = 0.05)		7.89	6.02	9.35	8.99	14.85	10.66	4.31	3.62

Note: g* = gram per 100 liters of water
ml** = milliliter per 100 liters of water
Spray conducted at fruit let stage
- Captan 80 WP being incompatible with quinalphos 25EC Chlorpyriphos 20EC & Dicofal were discarded for spray
- Data in parentheses are angular transformed values

Table 3. Effect of combined sprays of fungicides and insecticides on apple scab, *Alternaria* blotch and European red mite (ERM) & San jose scale of apples at fruit development stage–II at Shalimar

T. N.	Treatments	Foliage Scab		Fruit Scab		Alternaria Leaf Blotch		Per Cent Mortality	
		Inc.	Int.	Inc.	Int.	Inc.	Int.	ERM	SJS
T_1	Flusilozole 40EC + Dimethoate 30EC (100 ml)**	12.57 (19.37)	3.73 (11.04)	14.00 (21.62)	3.73 (10.93)	16.60 (23.76)	3.21 (10.07)	41.6 (40.16)	77.7 (61.82)
T_2	Flusilozole 40EC + Propargite 57EC (88 ml)	10.65 (18.95)	3.33 (10.47)	14.80 (22.56)	3.27 (10.25)	13.44 (20.67)	3.53 (10.23)	39.56 (38.93)	51.4 (45.80)
T_3	Flusilozole 40EC + Summer spray oil (750 ml)	13.07 (21.07)	4.57 (11.77)	9.50 (17.83)	4.20 (11.70)	10.90 (18.41)	4.67 (11.73)	71.06 (57.41)	68..8 (56.04)
T_4	Bitertinol 25WP (50g)* + Dimethoate 30EC (100 ml)	10.90 (19.15)	3.63 (10.75)	12.77 (20.73)	4.97 (12.21)	8.88 (17.31)	2.95 (9.71)	43.46 (41.20)	76.8 (61.20)
T_5	Bitertinol 25WP (50g) + Propargite 57EC (88 ml)	8.63 (16.90)	2.41 (8.88)	11.57 (19.54)	3.70 (10.93)	12.24 (18,12)	3.66 (10.15)	39.56 (38.93)	45.1 (42.18)
T_6	Bitertinol 25WP (50g) + Summer spray oil (750 ml)	9.44 (17.77)	2.91 (9.74)	12.77 (20.69)	5.10 (13.04)	5.97 (14.02)	2.99 (9.28)	38.16 (38.11)	70.9 (57.35)
T_7	Difenconazole 25EC (30 ml) + Dimethoate 30EC (100 ml)	16.47 (22.75)	5.74 (13.37)	16.00 (23.12)	5.37 (13.34)	12.67 (20.65)	2.65 (9.12)	45.80 (42.59)	78.8 (62.62)
T_8	Difenconazole 25EC (30ml) + Propargite 57EC (88 ml)	12.33 (20.01)	3.64 (10.95)	13.57 (21.07)	4.17 (11.64)	18.31 (24.72)	4.90 (12.07)	72.8 (58.56)	38 (38.05)
T_9	Difenconazole 25EC (30ml) + Summer spray oil (750 ml)	12.76 (20.31)	4.21 (11.68)	15.10 (22.67)	5.17 (13.03)	17.00 (23.42)	3.97 (11.10)	46.27 (42.82)	71.9 (57.98)
T_{10}	Bitertinol 25WP (50g) followed by Dimethoate 30EC (100 ml)	14.80 (22.28)	4.85 (12.31)	19.17 (25.82)	4.73 (12.50)	18.90 (24.37)	8.03 (15.33)	38.73 (38.47)	71.8 (57.92)
T_{11}	Bitertinol 25WP (50g) followed by Propargite 57EC (88 ml)	12.32 (20.22)	3.89 (11.24)	18.33 (25.18)	4.20 (11.66)	18.62 (24.45)	9.99 (16.65)	75.53 (60.33)	44.26 (41.67)
T_{12}	Check (water spray)	70.77 (57.44)	18.71 (24.80)	72.27 (58.32)	40.90 (39.65)	66.07 (59.62)	42.06 (38.40)	16.56 (23.96)	16.1 (23.65)
T_{13}	Dimethoate 30EC (100 ml)	40.94 (39.68)	9.69 (18.05)	58.67 (49.99)	30.40 (32.97)	50.09 (44.68)	36.57 (34.22)	44.43 (41.78)	75.6 (60.39)
T_{14}	Propargite 57EC (88 ml)	44.15 (41.61)	11.52 (19.71)	49.20 (44.52)	31.57 (34.13)	46.78 (42.89)	31.82 (32.27)	79.56 (63.07)	57.01 (49.02)
T_{15}	Summer spray oil (750 ml)	50.24 (45.15)	14.02 (21.54)	50.63 (45.53)	22.07 (27.78)	37.87 (37.54)	15.07 (20.34)	78.52 (62.37)	65.13 (53.79)
T_{16}	Flusilozole 40EC	13.20 (20.88)	4.41 (12.10)	17.00 (23.90)	6.50 (14.62)	15.09 (21.43)	4.13 (10.90)	32.93 (35)	38.96 (38.58)
T_{17}	Bitertinol 25WP (50g)	12.67 (20.13)	3.33 (10.25)	15.40 (23.07)	6.57 (14.76)	21.18 (26.11)	5.64 (12.95)	34 (35.66)	43.16 (41.03)
T_{18}	Difenconazole 25EC (30 ml)	10.97 (19.28)	4.47 (12.18)	13.83 (21.41)	5.03 (12.81)	20.27 (25.66)	7.07 (13.47)	33.93 (35.61)	41.86 (40.28)
	CD (P = 0.05)	7.35	6.10	8.26	6.23	13.67	12.58	5.22	8.29

Note: g* = grams per 100 liters of water, ml** = milliliters per 100 liters of water, Spray conducted at fruit development stage-I

Recommended spray schedule was at par with most of the combined spray treatments in controlling diseases and pests. Treatment T_5 (difenconazole + phosalone) proved superior in minimizing foliar scab incidence and intensity. T_3 (difenconazole + chlorpyriphos) and T_{16} (difenconazole) had minimum incidence (0.80%) and intensity (0.30%) of fruit scab. The trees sprayed with hexaconazole followed by chlorpyriphos (T_9) lowest disease incidence (0.23) of ALB and lowest intensity (0.17) was found in Haxaconozol followed by Milbactin (T_{10}). T_4 (Difenconazole + Milbactin) proved most effective in inflicting maximum ERM mortality (68.6%) and was at par with T_7 (65.6%) followed by T_{14}.

Treatment T_1 (Haxaconozole + Milbectin) shows 57 per cent mortality of SJS and was at par with T_3 (Difenconazole + Chlorphriphos) and T_{12} (Chlorpyriphos) treatments. At fruit development stage-I, all the treatments controlled apple scab, ALB, ERM and SSJ significantly as compared to unsprayed check (table 2). T_5 (Zineb + Chlorpyriphos) had least foliage scab incidence (2.63%) and T_{13} (Mancozeb) showed lowset intensity (0.70%), whereas T_5 (Zineb + Chlorpyriphos) exhibited least fruit scab incidence (6.50%) followed by T_8 (Mancozeb followed by Chlorphriphos) and lowest intensity were recorded in T_2 (Mancozeb + Chlorpyriphos) and T_8 (Mancozeb followed by Chlorphriphos) (02.03%). ALB incidence was significantly controlled by T_3 (Mancozeb + Dicofol) and intensity was significantly controlled by T_1 (Mancozeb + Quinalphos) followed by T_2.

Percent mortility of ERM was highest by T_{12} (Dicofol) (80.4 %) followed by treatment T_5 (Zineb + Chlorpyriphos) (75.9) per cent. In case of SJS, treatment T_{10} (Quinalphos) and T_7 (mancozeb + Quinalfos) was most promising with 79.3 and 78.3% mortality, respectively. At fruit development II, all the treatments significantly controlled apple scab, ALB, ERM and SJS in comparison to unsprayed check (table 3). Least leaf scab incidence and intensity was showed by treatment T_5 Bitertinol+ Propargite (8.63 and 2.41 %, respectively).

However, least fruit scab incidence was observed in trees sprayed with T_3 (Flusilozole + Summer spray oil) while treatment T_2 (Flusilozole + Propargite) showed lowest fruit scab intensity of 3.27 per cent. Bitertinol + summer spray oil (T_6) sprayed trees had least ALB incidence (5.97%) while T_7 (Difenconazole + Dimethoate) had least ALB intensity (2.65%). Percent mortility of ERM was highest by T_{14} Propargite effectively controlled ERM and was at par with treatment T_{15} and T_8. Similarly in case of SJS treatment T_7 (Difenconazole with Dimethoate) and T_1, T_4, T_6, T_9, T_{10} and T_{13} showed statistically similar performance. Thus, compatible chemicals can effectively minimize labour, time and inputs.

Significant Findings

The studies conducted on compatibility pesticides revealed as under:

- Single combined spray of compatible insecticides and fungicides at fruit-let, fruit development stage-I and fruit development stage-II were almost equally effective in controlling apple scab, ALB, SJS and ERM as compared with two spray schedule i.e. first spray of fungicides followed by insecticide/ acaricide spray 3-4 days later.

- Spray of compatible chemicals had no adverse effects on fruit set and yield. Such a schedule may be helpful in reducing the number of sprays and save time, labour and energy.

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