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Evaluating the effect of compatible pesticides spray against major pests and diseases of apple

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ABSTRACT

A two-year field trial was conducted at Shalimar campus, SKUAST-Kashmir, J&K 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 at five different phenological stages (pink bud, petal fall, fruit let and fruit development stage-I and -III). Standard controls comprising 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 (ALB), per cent mortality of European red mite (ERM) and San Jose scale (SJS) were recorded at petal fall, fruit let, fruit development stage-I, II and pre-harvest stages. The pesticidal combinations exhibiting physical incompatibility were discarded in the initial phase. No incidence of apple scab, ALB and ERM was observed at petal fall stage. However SJS was noticed at this stage. Combined spray of fungicides and insecticidse proved equally effective in controlling SJS. Myclobutanil 10 WP (30 g) + dimethoate 30 EC proved most effective (68.6% SJS mortality) which was at par with flusilozole 40 EC (30 ml) + dimethoate 30 EC (100 ml), funarimol 12 EC (40 ml) + dimethoate 30 EC (100 ml), dodine 65 WP (60 g) followed by dimethoate 30 EC (100 ml) and fenazaquine 10 EC (40 ml). At pre-harvest stage, all the treatments controlled scab, ALB, ERM and SJS in comparison to unsprayed check. Penconazole had least foliage scab incidence and dithionon + dimethoate showed lowest intensity (2.30%). Fruit scab incidence and intensity were lowest in penconazole + milbemectin and dithionon + milbemectin respectively. ALB incidence and intensity were least in dithionon 75 WP (75 g) + milbemectin 1 EC (100 ml) and dithionon 75 WP (75 g) + dimethoate 30 EC (100 ml) treatments (9.43 and 4.67 respectively). The mortality of ERM was high in abamectin treatment. Similarly SJS mortality was high in dimethoate sprayed alone. Thus compatible chemicals can effectively minimize labour, time and inputs.

Keywords: Pesticides; apple; compatibility; insecticides; fungicides

INTRODUCTION

Apple is the predominant temperate fruit crop in India which accounts for about 10 per cent of total fruit production of the country (Gautam et al 2004). 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 of 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 for 67 per cent of the total apple production and 50 per cent of its export in the country; hence a substantial foreign exchange earner and important for economic growth (Parrey and Hakim 2015).

Apple has been a main source of income of 2.85 lakhs farming communities of the valley which earns about 2,500 to 3,000 crore rupees annually to the state exchequer (Anon 2015). Although the agroclimatic conditions of the state are congenial for apple production yet the productivity of quality fruit is substantially low. Apple is cultivated in almost all the ten districts of Kashmir valley with an average area of 1,25,615.6 ha and production of about 1,13,4637 metric tonnes with a productivity of 10.85 MT/ha (Rather et al 2017). Although its annual production is higher than other states but from the last few years it is decreasing irrespective of the fact that average land under apple cultivation has explicitly increased without rapid increase in production. Many reasons are responsible for its decline in production 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 (Anon 2015, Baba et al 2015, Bilal et al 2015, Foster and Mourato 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, the effect of compatible pesticides against major diseases and pests of apple and the effect of compatibile spray mixture on fruit set, yield etc.

MATERIAL and METHODS

A field trial on compatibility of various pesticides was conducted at Shalimar campus, SKUAST-Kashmir, J&K where apple trees cv Red Delicious were sprayed with different pesticides and fungicides alone and in combination at five different phenological stages (pink bud, petal fall, fruitlet and fruit development stage-I and III).

Standard controls comprising 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, per cent mortality of European red mite (ERM) and San Jose scale (SJS) were recorded at petal fall, fruitlet, fruit development stage-I, -II and pre-harvest stages.

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 findings of the research would be helpful to boost the economic status of orchardists by using compatible pesticides for disease and insect pest control.

RESULTS and DISCUSSION

The pesticidal combinations 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 pink bud, petal fall, fruitlet, fruit development stage-I and fruit development stage-II with compatible pesticides (mixtures) at recommended concentrations and observations were recorded at petal fall, fruitlet, fruit development stage-I, fruit development stage-II and pre-harvest stages.

No incidence of apple scab, *Alternaria* leaf blotch (ALB) and European red mite (ERM) was observed at petal fall stage. However San Jose scale (SJS) was noticed at this stage (Table 1). Combined spray of fungicides and insecticides proved equally effective in controlling SJS. T6 (Myclobutanil 10 WP + dimethoate 30 EC) proved most effective (68.6% SJS mortality) which was at par with T1, T4, T8 and T11.

The first appearance of foliar diseases was observed at fruitlet stage (Table 2). The experimental plants sprayed at petal fall with mixtures of fungicides and insecticides at recommended concentrations and observed at fruitlet stage exhibited significant reduction in apple scab, ALB, EMR and SJS in comparison to unsprayed check. Recommended spray schedule was at par with most of the combined spray treatments in controlling diseases. Treatment T5 (Difenconazole + phosalone) proved superior in minimizing foliar scab incidence and intensity. T3 (Difenconazole + chlorpyriphos) and T16 (Difenconazole) had minimum incidence (0.80%) and T5 (Difenconazole + phosalone) the minimum intensity (0.17%) of fruit scab. The trees sprayed with hexaconazole followed by chlorpyriphos (T9) recorded lowest disease incidence (0.23) of ALB and lowest intensity (0.17) was found in haxaconozole followed by milbactin (T10). T4 (Difenconazole + milbactin) proved most effective in inflicting maximum ERM mortality (68.6%) and was at par with T7 (65.6%) followed by T14. Treatment T1 (Hexaconozole + milbectin) showed 57 per cent mortality of SJS and was at par with T3 (Difenconazole + chlorphriphos) and T12 (Chlorpyriphos) treatments.

At fruit development stage-I, all the treatments controlled apple scab, ALB, ERM and SSJ significantly

Table 1. Effect of combined sprays of fungicides and insecticides on apple scab, *Alternaria* leaf blotch, European red mite (ERM) and San Jose scale (SJS) of apple at petal fall stage at Shalimar, J&K

Treatment	Scab disease incidence (%)		*Alternaria* leaf blotch incidence (%)	Incidence of ERM (%)	San Jose scale mortality (%)
	Foliage	Fruit			
T1	Free	Free	Free	Free	60.6 (51.12)
T2	Free	Free	Free	Free	41.5 (40.10)
T3	Free	Free	Free	Free	50.3 (45.17)
T4	Free	Free	Free	Free	66.5 (54.63)
T5	Free	Free	Free	Free	52.6 (46.49)
T6	Free	Free	Free	Free	68.6 (56.10)
T7	Free	Free	Free	Free	49.0 (44.42)
T8	Free	Free	Free	Free	66.3 (54.51)
T9	Free	Free	Free	Free	44.0 (41.55)
T10	Free	Free	Free	Free	17.0 (24.35)
T11	Free	Free	Free	Free	63.6 (52.89)
T12	Free	Free	Free	Free	38.6 (38.58)
T13	Free	Free	Free	Free	50.6 (45.34)
T14	Free	Free	Free	Free	19.3 (26.06)
T15	Free	Free	Free	Free	22.6 (28.38)
T16	Free	Free	Free	Free	22.0 (27.97)
$CD_{0.05}$	-	-	-	-	9.04

T1: Flusilozole 40 EC (30 ml) + dimethoate 30 EC (100 ml), T2: Flusilozole 40 EC (30 ml) + fenzaquine 10 EC (40 ml), T3: Flusilozole 40 EC (30 ml) + propargite 57 EC (88 ml), T4: Funarimol 12 EC (40 ml) + dimethoate 30 EC (100 ml), T5: Funarimol 12 EC (40 ml) + propargite 57 EC (88 ml), T6: Myclobutanil 10 WP (30 g) + dimethoate 30 EC (100 ml), T7: Myclobutanil 10 WP (30 g) + propergite 57 EC (88 ml), T8: Dodine 65 WP (60 g) followed by dimethoate 30 EC (100 ml), T9: Dodine 65 WP (60 g) followed by fenazaquine 10 EC (40 ml), T10: Check (water spray), T11: Dimethoate 30 EC (100 ml), T12: Fenazaquine 10 EC (40 ml), T13: Propergite 57 EC (88 ml), T14: Flusilozole 40 EC (30 ml), T15: Funarimol 12 EC (40 ml), T16: Myclobutanil 10 WP (30 g); Dose g or ml/100 l of water; Application done at pink bud stage; Myclobutanil 10 WP being incompatible with fenazaquine 10 EC and funarimol 12 EC being incompatible with fenazaquine 10 EC were discarded for spray; Figures in parentheses are angular transformed values

Table 2. Effect of combined sprays of fungicides and insecticides on apple scab, *Alternaria* leaf blight and European red mite (ERM) of apple at fruitlet stage at Shalimar, J&K

Treatment	Foliage scab		Fruit scab		*Alternaria* blight		Per cent mortality	
	Inc (%)	Int (%)	Inc (%)	Int (%)	Inc (%)	Int (%)	ERM	SJS
T1	2.00	0.70	3.47	0.73	0.47	0.43	54.00	57.00
	(6.62)	(3.90)	(10.62)	(4.63)	(3.80)	(3.76)	(47.29)	(49.02)
T2	2.33	0.97	1.70	0.33	0.80	0.43	26.00	36.00
	(8.56)	(5.17)	(7.39)	(3.16)	(4.52)	(3.56)	(30.85)	(36.87)
T3	1.70	0.87	0.80	0.30	0.33	0.20	45.30	52.00
	(7.45)	(4.90)	(5.10)	(2.52)	(2.68)	(1.48)	(42.86)	(46.14)
T4	1.37	0.53	1.37	0.20	0.30	0.23	68.60	11.00
	(6.63)	(3.89)	(6.60)	(2.41)	(2.80)	(2.08)	(55.91)	(19.37)
T5	0.23	0.33	1.07	0.17	0.37	0.43	32.60	38.00
	(1.59)	(2.68)	(5.89)	(2.25)	(2.51)	(3.06)	(34.81)	(38.05)
T6	1.70	2.03	3.27	0.80	0.47	0.50	38.20	48.00
	(7.44)	(7.49)	(10.06)	(4.86)	(3.62)	(3.93)	(38.25)	(43.85)
T7	2.07	1.13	6.73	1.07	1.07	0.40	65.60	9.30
	(8.02)	(5.79)	(14.72)	(5.51)	(5.47)	(2.91)	(54.00)	(17.75)
T8	2.50	1.03	2.87	0.67	1.78	0.57	33.00	47.30
	(8.86)	(5.55)	(9.73)	(4.32)	(6.58)	(4.28)	(35.06)	(43.45)
T9	3.20	1.03	2.83	0.70	0.23	0.53	22.60	45.30
	(9.81)	(5.59)	(9.58)	(4.42)	(2.55)	(4.05)	(28.38)	(42.86)
T10	2.30	0.80	0.87	0.37	0.30	0.17	50.00	38.00
	(8.56)	(5.10)	(4.90)	(2.51)	(2.52)	(2.25)	(45.00)	(38.05)

T11	18.37 (24.76)	5.17 (12.83)	10.60 (18.96)	6.13 (14.21)	6.03 (13.14)	3.40 (10.60)	7.30 (15.67)	11.00 (19.37)
T12	10.70 (18.48)	4.40 (11.58)	6.67 (14.88)	3.37 (10.47)	4.90 (11.94)	0.73 (4.83)	54.30 (47.46)	50.60 (45.34)
T13	14.10 (21.48)	3.57 (10.22)	6.83 (15.12)	3.53 (10.75)	3.27 (10.20)	1.07 (5.86)	36.00 (37.22)	7.00 (15.34)
T14	14.53 (21.63)	3.10 (10.09)	7.53 (15.90)	4.10 (11.63)	4.17 (10.72)	0.77 (4.92)	58.60 (49.95)	49.00 (44.42)
T15	3.07 (10.01)	1.33 (5.74)	2.80 (9.19)	3.17 (8.34)	0.90 (4.93)	0.53 (4.16)	2.60 (9.28)	5.00 (12.92)
T16	0.53 (3.97)	0.53 (3.89)	0.80 (5.12)	0.30 (4.62)	1.43 (5.65)	0.47 (3.89)	3.00 (9.97)	3.30 (10.46)
T17	0.77 (4.09)	1.07 (4.78)	1.33 (6.60)	0.83 (4.83)	0.63 (4.24)	0.47 (3.71)	1.60 (7.26)	2.00 (8.13)
$CD_{0.05}$	6.50	2.78	3.19	3.78	4.08	2.54	9.19	7.67

T1: Hexaconazole 5 EC (30 ml) + milbectin 1 EC (100 ml), T2: Hexaconazole 5 EC (30 ml) + phosalone 35 EC (100 ml), T3: Difenconazole 25 WP (30 ml) + chlorphriphos 20 EC (100 ml), T4: Difenconazole 25 WP (30 ml) + milbectin 1 EC (100 ml), T5: Difenconazole 25 WP (30 ml) + phosalone 35 EC (100 ml), T6: Triadimefon 25 WP (50 g) + chlorpyriphos 20 EC (100 ml), T7: Triadimefon 25 WP (50 g) + milbectin1 EC (100 ml), T8: Triadimefon 25 WP (50 g) + phosalone 35 EC (100 ml), T9: Hexaconazole 5 EC (30 ml) followed by chlorphriphos 20 EC (100 ml), T10: Hexaconazole 5 EC (30 ml) followed by milbectin 1 EC (100 ml), T11: Check (water spray), T12: Chlorpyriphos 20 EC (100 ml), T13: Milbectin 1 EC (100 ml), T14: Phosalone 35 EC (100 ml), T15: Hexaconazole 5 EC (30 ml), T16: Difenconazole 25 WP (30 ml), T17: Triadimefon 25 WP (50 g); Dose g or ml/100 l of water; Application done at pink bud stage; Application done at petal fall stage; Observations recorded at fruitlet stage; Hexaconazole 5 EC being incompatible with chlorpyriphos 20 EC, discarded for spray; Figures in parentheses are angular transformed values

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

Treatment	Foliage scab		Fruit scab		*Alternaria* blight		Per cent mortality	
	Inc (%)	Int (%)	Inc (%)	Int (%)	Inc (%)	Int (%)	ERM	SJS
T1	4.93 (12.76)	1.43 (6.68)	14.73 (22.48)	2.17 (8.45)	10.20 (17.54)	0.90 (5.12)	40.60 (39.58)	75.50 (62.37)
T2	3.73 (10.93)	1.13 (5.85)	11.40 (19.54)	2.03 (8.19)	8.10 (16.08)	2.53 (8.58)	63.30 (52.71)	74.30 (59.54)
T3	3.13 (10.12)	1.53 (7.03)	10.40 (18.33)	3.03 (9.99)	6.47 (13.70)	4.60 (10.11)	75.60 (60.39)	32.00 (34.45)
T4	2.97 (8.74)	1.83 (7.70)	12.13 (19.51)	2.93 (9.67)	9.00 (17.19)	4.17 (11.53)	64.00 (53.13)	73.30 (58.88)
T5	2.63 (8.44)	2.43 (8.69)	6.50 (14.67)	3.13 (10.06)	12.53 (20.19)	2.88 (9.31)	75.90 (60.59)	37.20 (37.58)
T6	5.87 (11.52)	1.10 (5.61)	13.33 (20.62)	4.13 (11.65)	7.37 (14.92)	3.60 (10.36)	80.40 (63.72)	70.50 (57.10)
T7	4.27 (10.08)	1.60 (7.22)	15.53 (23.15)	4.47 (12.17)	15.17 (22.02)	7.60 (15.12)	35.20 (36.39)	78.30 (62.23)
T8	4.77 (11.75)	0.80 (4.70)	8.63 (16.22)	2.03 (7.95)	14.73 (20.22)	7.87 (14.03)	68.60 (55.92)	70.60 (57.16)
T9	33.57 (35.14)	14.60 (20.64)	51.03 (45.66)	25.90 (29.00)	46.83 (43.11)	33.27 (32.82)	16.60 (24.04)	17.10 (24.42)
T10	27.73 (31.11)	10.03 (18.11)	35.00 (36.16)	12.90 (18.04)	40.13 (38.98)	15.17 (22.25)	40.70 (39.64)	79.30 (62.93)
T11	24.00 (29.26)	9.23 (17.17)	39.80 (38.91)	13.00 (20.78)	30.13 (32.07)	10.77 (18.64)	69.60 (56.54)	78.00 (62.03)
T12	21.27 (27.06)	9.80 (18.17)	22.00 (27.91)	7.83 (16.07)	14.53 (21.33)	6.13 (13.84)	80.40 (50.94)	40.70 (39.64)
T13	5.40 (12.81)	0.70 (4.76)	10.43 (18.76)	3.57 (10.87)	9.03 (17.00)	3.03 (8.53)	-	-
T14	3.60 (10.60)	1.50 (6.88)	18.33 (25.30)	4.07 (11.19)	14.23 (20.02)	4.64 (11.88)	-	-

T15	6.47 (13.92)	1.40 (6.78)	13.63 (21.09)	4.57 (12.30)	20.17 (25.82)	6.77 (13.13)	-	-
$CD_{0.05}$	7.89	6.02	9.35	8.99	14.85	10.66	4.31	3.62

T1: Mancozeb 75 WP (300 g) + quinalphos 25 EC (100 ml), T2: Mancozeb 75 WP (300 g) + chlorpyriphos 20 EC (100 ml), T3: Mancozeb 75 WP (300 g) + dicofol 18.5 EC (108 ml), T4: Zineb 80 WP (200 g) + quinalphos 25 EC (100 ml), T5: Zineb 80 WP (200 g) + chlorpyriphos 20 EC (100 ml), T6: Zineb 80 WP (200 g) + dicofol 18.5 EC (108 ml), T7: Mancozeb 75 WP (300 g) followed by quinalfos 25 EC (100 ml), T8: Mancozeb 75 WP (300 g) followed by chlorphriphos 20 EC (100 ml), T9: Check (water spray), T10: Quinalphos 25 EC (100 ml), T11: Chlorphriphos 20 EC (100 ml), T12: Dicofol 18.5 EC (108 ml), T13: Mancozeb 75 WP (300 g), T14: Captan (300 g), T15: Zineb 80 WP (200 g); Dose g or ml/100 l of water; Application done at fruitlet stage; Captan 80 WP being incompatible with quinalphos 25 EC, chlorpyriphos 20 EC the spray was discarded; Figures in parentheses are angular transformed values

as compared to unsprayed check (Table 3). T5 (Zineb + chlorpyriphos) had least foliage scab incidence (2.63%) and T13 (Mancozeb) showed lowest intensity (0.70%) whereas T5 (Zineb + chlorpyriphos) exhibited least fruit scab incidence (6.50%) followed by T8 (Mancozeb followed by chlorphriphos) and lowest intensity was recorded in T2 (Mancozeb + chlorpyriphos) and T8 (Mancozeb followed by chlorphriphos) (2.03%).

ALB incidence was significantly lowest in T3 (Mancozeb + dicofol) and intensity was significantly lowest in T1 (Mancozeb + quinalphos) followed by T2. Per cent mortality of ERM was highest in T12 (Dicofol) (80.4%) followed by T5 (Zineb + chlorpyriphos) (75.9%). In case of SJS, treatments T10 (Quinalphos) and T7 (Mancozeb + quinalfos) were most promising with 79.3 and 78.3 per cent mortality respectively.

At fruit development stage-II, all the treatments significantly controlled apple scab, ALB, ERM and SJS in comparison to unsprayed check (Table 4). Least leaf scab incidence and intensity were reported in treatment T5 (Bitertinol + propargite) (8.63 and 2.41% respectively) However least fruit scab incidence was observed in trees sprayed with T3 (Flusilozole + summer spray oil) while treatment T2 (Flusilozole + propargite) showed lowest fruit scab intensity of 3.27 per cent. Bitertinol + summer spray oil (T6) sprayed trees had least ALB incidence (5.97%) while T7 (Difenconazole + dimethoate) had least ALB intensity (2.65%).

Per cent mortility of ERM was highest in T14 (Propargite) which effectively controlled ERM and was at par with treatment T15 and T11. Similarly, in case of SJS, treatment T7 (Difenconazole with dimethoate), T1, T4, T6, T9, T10 and T13 showed statistically similar performance.

At pre-harvest stage, all the treatments controlled scab, ALB, ERM and SJS in comparison to unsprayed check (Table 5). Treatment T18 (Penconazole) had least foliage scab incidence and T4 (Dithionon + dimethoate) showed lowest intensity (2.30%). Fruit scab incidence and intensity were lowest in treatment T8 (Penconazole + milbemectin) and T5 (Dithionon + milbemectin) respectively. ALB incidence and intensity were least in T5 and T4 treatments (9.43 and 4.68 respectively). The mortality of ERM was high in abamectin treatment. Similarly, SJS mortality was high in dimethoate sprayed alone. Thus compatible chemicals can effectively minimize labour, time and inputs.

CONCLUSION

It was concluded that single combined spray of compatible insecticides and fungicides at pink bud, petal fall, fruitlet and fruit development stage-I and -III were almost equally effective in controlling apple scab, ALB, SJS and ERM as compared to two spray schedules viz first spray of fungicides followed by insecticide/acaricide spray 3-4 days later. Spray of compatible chemicals had no adverse effect on fruit set and yield. Such a schedule may be helpful in reducing the number of sprays and save time, labour and energy.

REFERENCES

Anonymous 2015. Pesticide surveillance report. Standing Committee Meeting, February 2015, SKUAST-K, Shalimar, Jammu & Kashmir, India.

Baba SH, Wani MH and Wani SA 2015. Pesticide application on apple: issues of marketing and ecological implications. Policy Paper, Kashmir and Ladakh Agriculture Watch Centre, Directorate of Research, Policy Research Series DR-SKUASTK/2015-10, SKUAST-Kashmir, Jammu and Kashmir, India.

Table 4. Effect of combined sprays of fungicides and insecticides on apple scab, *Alternaria* blotch, European red mite (ERM) and San Jose scale of apple at fruit development stage–II at Shalimar, J&K

Treatment	Foliage scab		Fruit scab		*Alternaria* leaf blotch		Per cent mortality	
	Inc (%)	Int (%)	Inc (%)	Int (%)	Inc (%)	Int (%)	ERM	SJS
T1	12.57 (19.37)	3.73 (11.04)	14.00 (21.62)	3.73 (10.93)	16.60 (23.76)	3.21 (10.07)	41.60 (40.16)	77.70 (61.82)
T2	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)	51.40 (45.80)
T3	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)	68.80 (56.04)
T4	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)	76.80 (61.20)
T5	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)	45.10 (42.18)
T6	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)	70.90 (57.35)
T7	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)	78.80 (62.62)
T8	12.33 (20.01)	3.64 (10.95)	13.57 (21.07)	4.17 (11.64)	18.31 (24.72)	4.90 (12.07)	72.80 (58.56)	38.00 (38.05)
T9	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)	71.90 (57.98)
T10	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)	71.80 (57.92)
T11	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)
T12	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)
T13	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)	75.60 (60.39)
T14	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)
T15	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)
T16	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 (35.00)	38.96 (38.58)
T17	12.67 (20.13)	3.33 (10.25)	15.40 (23.07)	6.57 (14.76)	21.18 (26.11)	5.64 (12.95)	34.00 (35.66)	43.16 (41.03)
T18	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)
$CD_{0.05}$	7.35	6.10	8.26	6.23	13.67	12.58	5.22	8.29

T1: Flusilozole 40 EC (30 ml) + dimethoate 30 EC (100 ml), T2: Flusilozole 40 EC (30 ml) + propargite 57 EC (88 ml), T3: Flusilozole 40 EC (30 ml) + summer spray oil (750 ml), T4: Bitertinol 25 WP (50 g) + dimethoate 30 EC (100 ml), T5: Bitertinol 25 WP (50 g) + propargite 57 EC (88 ml), T6: Bitertinol 25 WP (50 g) + summer spray oil (750 ml), T7: Difenconazole 25 EC (30 ml) + dimethoate 30 EC (100 ml), T8: Difenconazole 25 EC (30 ml) + propargite 57 EC (88 ml), T9: Difenconazole 25 EC (30 ml) + summer spray oil (750 ml), T10: Bitertinol 25 WP (50 g) followed by dimethoate 30 EC (100 ml), T11: Bitertinol 25 WP (50 g) followed by propargite 57 EC (88 ml), T12: Check (water spray), T13: Dimethoate 30 EC (100 ml), T14: Propargite 57 EC (88 ml), T15: Summer spray oil (750 ml), T16: Flusilozole 40 EC (30 ml) , T17: Bitertinol 25 WP (50 g), T18: Difenconazole 25 EC (30 ml); Dose g or ml/100 l of water; Application done at fruit development stage-I; Figures in parentheses are angular transformed values

Bilal AS, Malik M, Alam A and Bashir S 2015. Pesticide residues: Kashmir apples- findings of valley-wide survey in 2013-14. Policy Paper, Kashmir and Ladakh Agriculture Watch Centre, Directorate of Research, Policy Research Series/DRSKUAST-K/2015-16, SKUAST-Kashmir, Jammu and Kashmir, India.

Foster V and Mourato S 2000. Valuing the multiple impacts of pesticides use in the UK: a contingent ranking approach. Journal of Agricultural Economics **51(1):** 1-21.

Gautam DR, Sharma G and Jindal KK 2004. Fruit setting problems of apples under changing climatic scenario

Table 5. Effect of combined sprays of fungicides and insecticides on apple scab, *Alternaria* blotch and European red mite (ERM) and San Jose scale of apple at pre-harvest stage at Shalimar, J&K

Treatment	Foliage scab (%)		Fruit scab (%)		*Alternaria* leaf blotch (%)		Mortality (%)	
	Incidence	Intensity	Incidence	Intensity	Incidence	Intensity	ERM	SSJ
T1	19.98 (26.01)	3.97 (11.32)	15.12 (22.76)	5.60 (13.49)	19.53 (25.22)	6.17 (14.19)	46.3 (42.87)	76.3 (60.86)
T2	13.83 (21.81)	3.31 (10.24)	21.70 (27.63)	5.17 (12.93)	19.45 (26.15)	7.50 (15.35)	69.2 (56.29)	70.0 (56.79)
T3	17.94 (24.70)	3.47 (10.42)	20.50 (26.81)	4.57 (12.18)	19.36 (25.94)	8.73 (17.17)	68.4 (55.79)	41.7 (40.22)
T4	11.27 (19.59)	2.30 (8.38)	13.48 (21.52)	7.77 (15.90)	11.75 (19.89)	4.67 (12.46)	37.2 (37.58)	73.2 (58.82)
T5	12.82 (20.95)	2.57 (8.88)	19.68 (25.88)	3.73 (11.07)	9.43 (17.26)	5.37 (13.03)	78.6 (62.44)	73.0 (58.69)
T6	14.93 (22.53)	2.50 (8.73)	21.83 (27.77)	6.17 (14.33)	10.88 (18.60)	5.63 (13.29)	71.7 (57.86)	45.3 (42.30)
T7	16.47 (23.87)	3.49 (10.40)	15.20 (22.78)	6.27 (14.42)	19.29 (25.75)	5.73 (13.80)	42.2 (40.51)	79.6 (63.15)
T8	18.20 (25.21)	3.10 (9.90)	13.09 (21.09)	5.87 (13.95)	23.52 (28.91)	10.53 (18.64)	65.3 (53.91)	72.2 (58.18)
T9	17.69 (24.82)	3.37 (10.23)	18.26 (24.95)	5.03 (12.69)	29.53 (32.89)	8.83 (16.69)	67.3 (55.12)	38.4 (38.29)
T10	19.28 (25.57)	4.03 (11.11)	21.32 (27.47)	7.63 (15.98)	29.54 (32.65)	13.27 (21.32)	38.7 (38.47)	77.3 (61.54)
T11	12.15 (20.38)	4.20 (10.88)	20.69 (26.96)	6.73 (14.97)	28.10 (31.95)	14.10 (21.98)	63.2 (52.65)	69.6 (56.54)
T12	70.50 (58.23)	39.55 (38.75)	86.64 (72.36)	44.73 (41.62)	78.46 (62.37)	40.10 (39.22)	15.0 (22.78)	13.5 (21.55)
T13	49.37 (44.58)	27.91 (30.97)	66.72 (54.86)	41.24 (39.57)	75.77 (60.66)	30.60 (33.53)	39.6 (38.99)	80.6 (63.86)
T14	39.67 (39.02)	24.87 (29.07)	49.14 (44.40)	39.47 (38.82)	77.87 (62.04)	32.53 (34.66)	63.7 (52.95)	79.9 (63.36)
T15	37.44 (37.68)	24.84 (29.73)	48.62 (44.18)	30.24 (33.34)	65.50 (54.00)	31.83 (34.15)	80.4 (63.72)	42.4 (40.63)
T16	7.75 (13.90)	3.06 (9.71)	18.86 (25.51)	11.77 (19.76)	30.79 (33.63)	7.00 (15.28)	-	-
T17	14.97 (22.49)	4.27 (11.72)	22.1 (27.96)	21.44 (26.83)	32.34 (34.21)	9.03 (17.46)	-	-
T18	7.50 (13.30)	3.40 (9.71)	23.13 (28.60)	13.23 (20.96)	21.00 (27.23)	13.13 (21.20)	-	-
$CD_{0.05}$	10.62	8.91	10.19	9.32	8.47	5.51	3.39	3.66

T1: Difenconazole 25 EC (30 ml) + dimethoate 30 EC (100 ml), T2: Difenconazole 25 EC (30 ml) + milbemectin 1 EC (100 ml), T3: Difenconazole 25 EC (30 ml) + abamectin 1 EC (100 ml), T4: Dithionon 75 WP (75 g) + dimethoate 30 EC (100 ml), T5: Dithionon 75 WP (75 g) + millbemectin 1 EC (100 ml), T6: Dithionon 75WP (75 g) + abamectin 1 EC (100 ml), T7: Penconazole 10 EC (100 ml) + dimethoate 30 EC (100 ml), T8: Penconazole 0 EC (100 ml) + milbemectin 1 EC (100 ml), T9: Penconazole 10 EC (100 ml) + abamectin 1 EC (100 ml), T10: Difenconazole 25 EC (30 ml) followed by dimethoate 30 EC (100 ml), T11: Difenconazole 25 EC (30 ml) followed by milbemectin 1 EC (100 ml), T12: Check (water spray), T13: Dimethoate 30 EC (100 ml), T14: Milbemectin 1 EC (ml), T15: Abamectin, T16: Difenconazole 25 EC (30 ml), T17: Dithionon 75 WP (75 g), T18: Penconazole 10 EC (100 ml); Dose g or ml/100 l of water; Application done at fruit development stage-III; Figures in parentheses are angular transformed values

of northwestern Himalayas of India. Acta Horticulturae **662:** doi: 10.17660/ActaHortic.2004.662.66

Parrey SH and Hakim IA 2015. Exploring marketing activities of apple growers: empirical evidence from Kashmir. Pacific Business Review International **7(12):** 73-80.

Rather GH, Paray MA, Javid R, Khursheed R, Yaqoob M, Rehman MU and Farhana Majid F 2017. Pollination problems in apple of Kashmir Himalaya. International Journal of Pure and Applied Bioscience **5(6):** 817-823.