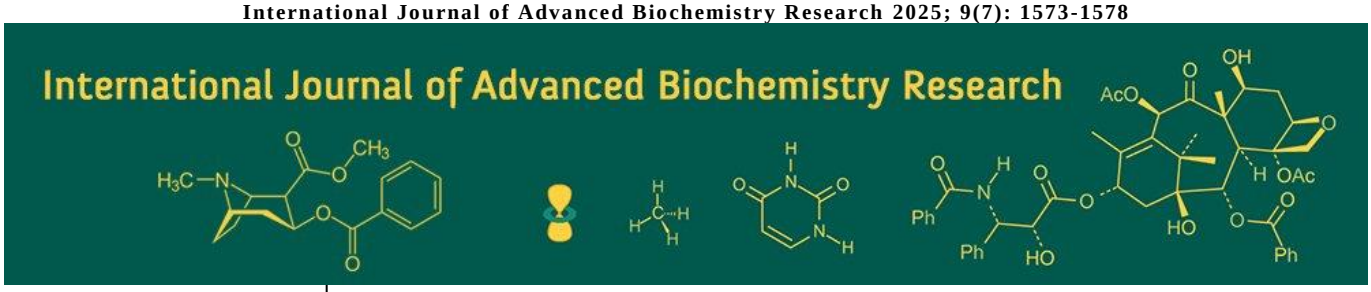

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Aditi Yadav
PG Scholar, Agricultural Economics and Statistics Section, college of Agriculture, Nagpur, Maharashtra, India

Dr. NT Bagde
Assistant Professor, Agricultural Economics and Statistics Section, College of Agriculture, Nagpur, Maharashtra, India

Dr. VJ Rathod
Associate Professor, Agricultural Economics and Statistics Section, College of Agriculture, Nagpur, Maharashtra, India

Dr. Sunita N Suryawanshi
Assistant Professor, Agricultural Economics and Statistics Section, College of Agriculture, Nagpur, Maharashtra, India

Dr. MK Rathod
Professor, Agricultural Extension Education Section, College of Agriculture, Nagpur, Maharashtra, India

Dr. VU Raut
Professor, Horticulture Section, College of Agriculture, Nagpur, Maharashtra, India

Dr. RS Waghmare
Associate Professor Agricultural Extension Education Section, College of Agriculture, Nagpur, Maharashtra, India

Ashwini A Nagwe
PG Scholar, Agricultural Economics and Statistics Section, College of Agriculture, Nagpur, Maharashtra, India

Corresponding Author:
Aditi Yadav
PG Scholar, Agricultural Economics and Statistics Section, college of Agriculture, Nagpur, Maharashtra, India

A comparative study of fruit drop losses and adoption barriers in mandarin

Aditi Yadav, NT Bagde, VJ Rathod, Sunita N Suryawanshi, MK Rathod, VU Raut, RS Waghmare and Ashwini A Nagwe

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Abstract
Nagpur mandarin (*Citrus reticulata* Blanco) holds a prominent place among citrus fruits cultivated in India, especially in the Nagpur district of Maharashtra. Despite its economic importance, the crop suffers substantial yield and income losses due to fruit drop, which occurs as a result of various biotic, abiotic, and management-related factors. This study aims to identify the major causes of fruit drop, estimate associated production and economic losses, and analyze the impact of adopting recommended practices to control fruit drop given by the Dr. P.D.K.V, Akola in Mandarin on reducing these losses.
The research was conducted in three major mandarin-growing tehsils of Nagpur district Katol, Narkhed, and Kalmeshwar using primary data collected from 120 growers, equally divided into adopters and non-adopters. The dropping of fruits was calculated from collected data and the analyzed data is presented in tabular form with the help of averages, percentages etc. Results revealed that adopters experienced lower production losses (35.41 q/ha) and economic losses (₹74,391.09/ha) compared to non-adopters, who faced higher production losses (51.24 q/ha) and economic losses (₹1, 22,360.09/ha). Adoption led to a 30.89 percent decrease in fruit drop and a 44.90 percent decrease in economic losses, with a 42.10 percent increase in productivity over non-adopters. The key constraints to adoption of fruit drop practices included lack of awareness about the practices (93.33 percent), limited access to advisory services (86.66 percent), and high cost of implementation (75.00 percent). Growers expressed the need for regular technical guidance, compensation for losses, and processing avenues for dropped fruits. It is observed from the findings that the minimization of fruit drop and enhancing profitability in mandarin cultivation, highlighting the need for focused extension efforts, financial support mechanisms, and better dissemination of recommended practices.

Keywords: Mandarin, fruit drop, economic losses, production losses, adopters, non-adopters

Introduction
Mandarin orange (*Citrus reticulata* Blanco) is one of the most widely cultivated citrus fruits in India. The Nagpur mandarin, in particular, holds a prominent position in the Nagpur district, where it is regarded as a major fruit crop of economic importance. In India total area under Mandarin in 2024-25 is 477.24 thousand hectares with production 6300.16 thousand metric tonnes and productivity 13.20 thousand metric tonnes. (Ministry of Agriculture and Farmers Welfare, Govt. of India, Second Advance estimate, 2024-25). In the year 2024-25 area under Mandarin cultivation in Maharashtra State is 145.85 thousand hectares with annual production 1396.62 thousand metric tonnes with productivity of 9.58 thousand metric tonnes. (Ministry of Agriculture and Farmers Welfare, Govt. of India, Second Advance estimate, 2024-25). Total area under orange of Katol is 5443 hectares and area affected by fruit drop is 1524 hectares, Kalmeshwar has area of 3749 hectares and area affected by fruit drop is 694 hectares and Narkhed has area of 7680 hectares and area affected by fruit drop is 2302 hectares (Fruit drop preliminary report, SAO, Nagpur 2024-25). Hence, the study of fruit drop in mandarin is crucial for improving yield, quality, and profitability in citrus production. Fruit drop, which occurs at different growth stages due to environmental, physiological, and pathological factors, can lead to significant economic losses. Many practices have been recommended by Agricultural Universities for control of fruit drop but it is very important to know the effect of adoption of these practices on economics and production also need to be investigated.

With the following Objectives

1. To identify the major biotic and abiotic factors of fruit drop in mandarin
2. To estimate the production and economic losses due to fruit drop faced by adopters and non-adopters
3. To identify constraints faced for non-adoption of fruit drop control practices

Material and Methods

Nagpur district has favorable climate to grow mandarin; therefore, production of mandarin is concentrated in Nagpur district was the reason for purposive selection of the area for the study. From Nagpur district, the three tehsils viz Katol, Narkhed and Kalmeshwar were selected on the basis of potential area under Mandarin cultivation. From each tehsil, three villages were selected hence in total nine villages were selected.

For the study, 60 growers who adopted and 60 growers who did not adopt the recommended fruit drop control Practices provided by the university were selected. Thus, a total of 120 growers were included in the study. The primary data was collected from Ambia Bahar mandarin growers during the season using a specially designed schedule. Information on fruit drop due to abiotic and biotic factors, as well as the adoption of Practices to reduce fruit drop, was gathered through the personal interview method. The data pertained to Ambia Bahar of Nagpur mandarin for the year 2024.The dropping of fruits was calculated from collected data and the analysed data is presented in tabular form with the help of averages, percentage, etc. Identification of constraints frequency distribution, percentile and simple ranking method was used.

Estimation of economic and production losses due to fruit drop

Following tools were used (Ashraf *et al*., 2012) [1]

1. Economic losses = Production losses × Mean price per tonnes
2. 2)Production loss per ha = [Total fruit drop (in Qts)/Total area (in ha)
3. Fruit drop percent = [(Total quantity of fruit per hectare-Total quantity of fruit drop per hectare)/Total quantity of fruit per hectare]x 100

Results and Discussions

I) Identification of major factors of losses of fruit drop in mandarin

It is revealed from the study that the factors responsible for fruit drop were abiotic, biotic, & management factors. In abiotic factors, rainfall, high temperature, windstorm, water stress and droughts and cold and fog were found. In biotic factors were categorized into entomological & pathological causes, whereas, in management factors were categorized into nutrient deficiency, type of irrigation, time of application of pesticides, fungicides, FYM, NPK and over mature fruits. Similar findings have been reported by Kumar *et al*. (2020), Bishnoi *et al*. (2023), and Datir *et al*. (2023) [4, 7, 9].

Table 1: Identification of major factor of losses of fruit drop in mandarin

Abiotic Factors	Biotic Factors	Management Factors
1. High Rainfall and High humidity	**Entomological factors**	1. Nutrient deficiency
2. High temperature/Sudden change in temperature	1. Fruit Fly	2. Type of irrigation
3. Windstorm	2. Fruit Sucking Moth	3. Time of application of pesticides, fungicides
4. Water Stress and Drought condition	3. Citrus Psylla	4. Time of application of FYM and NPK
5. Cold and Fog	4. Citrus mite	5. Over ripening of fruits
	5. Black Fly	
	B. Pathological factors	
	1. Brown rot	
	2. Stem end rot	
	3. Fruit Rot	
	4. Gummosis	
	5. Bacterial Infection	

The primary data collected from 120 mandarin growers revealed that abiotic factors were the most widely reported causes of fruit drop, with 100 percent of respondents identifying high rainfall, high humidity, and sudden temperature fluctuations as major contributors. Other notable abiotic causes included water stress (60 percent) and windstorms (39.17 percent). Among biotic factors, citrus psylla (55 percent), fruit fly (53.33 percent), and fruit sucking moth (45 percent) were frequently observed pests, while brown rot (48.33 percent) and fruit rot (44.17 percent) were the most common diseases. In terms of management-related issues, nutrient deficiency (56.67 percent), over-ripening of fruits (49.17 percent), and untimely application of pesticides and fertilizers were reported as significant contributors to fruit drop. The result highlights the need for improved pest and disease management, along with timely and balanced cultural practices. Similar results have been reported by Chandrakant *et al*. (2019) [5].

II) Estimate the production losses and economic losses due to fruit drop faced by adopters and non-adopters.

Production and Economic losses due to fruit drop for adopters

The results provided a comprehensive overview of the production and economic losses in mandarin cultivation due to fruit drop by adopters, categorized into abiotic, biotic, and management-related factors. The total fruit drop per hectare was observed to be 35.41 quintals, accounting for 26.81 percent of the expected yield (132.03 q/ha), resulting in an actual yield of 93.38 q/ha. This fruit drop led to a substantial economic loss of ₹74391.09per hectare.

Among the three major categories, abiotic factors contributed the most to fruit drop, accounting for 36.23 percent of the total loss, which corresponds to 12.83 q/ha and an economic loss of ₹26953.90/ha. The most prominent abiotic causes were heavy rainfall (15.39 percent), high temperature fluctuations (8.95 percent), and water stress conditions. These factors are primarily climatic and often beyond the control of the farmers, yet they have a significant impact on fruit retention.

Table 2: Category-Wise distribution of factors responsible for fruit drop faced by Mandarin growers

Category	Factors	No. of Growers
Abiotic Factors	1. High Rainfall and High Humidity	120
	2. High Temperature/Sudden Change in Temperature	120
	3. Windstorm	47
	4. Water Stress and Drought Condition	72
	5. Cold and Fog	39
Biotic Factors	**A. Entomological Factors**	
	1. Fruit Fly	64
	2. Fruit Sucking Moth	54
	3. Citrus Psylla	66
	4. Citrus Mite	37
	5. Black Fly	45
	B. Pathological Factors	
	1. Brown Rot	58
	2. Stem End Rot	49
	3. Fruit Rot	53
	4. Gummosis	42
	5. Bacterial Infection	36
Management Factors	1. Nutrient Deficiency	68
	2. Type of Irrigation	51
	3. Time of Application of Pesticides/Fungicides	56
	4. Time of Application of FYM and NPK	47
	5. Over Ripening of Fruits	59

Biotic factors were the second major contributor, causing 40.72 percent of the total fruit drop, with a yield loss of 14.42 q/ha and an economic impact of ₹30294.25/ha. Biotic losses were further classified into entomological and pathological causes. Among entomological factors, citrus psylla, fruit sucking moth, and fruit fly were the most damaging pests, while among the pathological causes, gummosis, brown rot, and fruit rot were found to be the most significant.

Management-related factors contributed to 23.04 percent of the total loss, amounting to 8.16 q/ha and ₹171742.93/ha in economic terms. Ineffective water management, nutrient deficiency, improper timing of pesticide/fertilizer application, and failure to harvest fruits at the right maturity stage were key reasons under this category.

Table 3: Production and Economic losses due to fruit drop for adopters

Sr. No.	Particulars	Production losses Qts/ha	Percent	Economic losses Rs/ha
A	**Abiotic losses**			
1	Heavy Rainfall	5.45	15.39	11449.63
2	High temperature/sudden change in temperature	3.17	8.95	6659.69
3	Strong wind	1.10	3.10	2310.93
4	Water stress and drought condition	1.96	5.53	4117.66
5	Cold and fog	1.15	3.24	2415.97
	Subtotal	12.83	36.23	26953.90
B	**Biotic losses**			
I	**Entomological causes**			
1	Fruit fly	1.60	4.51	3361.36
2	Fruit sucking Moth	1.40	3.95	2941.19
3	Citrus psylla	2.17	6.12	4558.84
4	Citrus Mite	1.12	3.16	2352.95
5	Black fly	1.06	2.99	2226.90
	Subtotal	7.32	20.67	15378.22
II	**Pathological causes**			
1	Stem end rot	1.10	3.10	2310.93
2	Fruit rot	1.17	3.30	2457.99
3	Brown rot	1.60	4.51	3361.36
4	Gummosis	2.13	6.01	4474.81
5	Bacterial infection	1.10	3.10	2310.93
	Subtotal	7.10	20.05	14916.03
	Total Biotic losses	14.42	40.72	30294.25
C	**Management Factors**			
1	Nutrient Deficiency	1.60	4.51	3361.36
2	Type of irrigation (Ineffective water management)	2.31	6.52	4852.96
3	Time of application of pesticides/fungicides	1.21	3.41	2542.02
4	Time of application of FYM and NPK	1.27	3.58	2668.07
5	Over mature fruits	1.77	4.99	3718.50
	Subtotal	8.16	23.04	171742.93
	Grand Total of Production Losses (quintals)	35.41	100.00	74391.09
	Actual Yield per hectare (quintals)	93.38		
	Expected Yield per hectare (quintals)	132.03		
	Percentage fruit drop (percent)		26.81	

Production and Economic losses due to fruit drop for non-adopters

The results show that the extent of fruit drop losses in mandarin cultivation by non-adopters, which resulted in a significant reduction of 51.24 quintals per hectare, accounting for 48.66 percent of the expected yield (105.30 q/ha). The actual yield realized was only 54.06 q/ha, with a total economic loss of ₹1, 22,360.09 per hectare. These losses were classified into abiotic, biotic, and management-related factors.

Among the three major categories, biotic factors contributed the highest loss, accounting for 39.04 percent of the total fruit drop (20.01 q/ha), with an economic loss of ₹47,783.47/ha. Within this, entomological causes such as citrus psylla, fruit fly, and fruit sucking moth were the most damaging pests, collectively responsible for 21.19 percent of the losses. Pathological causes like gummosis, brown rot, and bacterial infections were also significant, contributing to 17.85 percent of the fruit drop and an economic loss of ₹21,850.01/ha.

Abiotic factors were the second-largest contributor to fruit drop, causing 37.91 percent of the total loss (19.43 q/ha) and economic damages of ₹46,398.45/ha. The most critical abiotic stressors identified were heavy rainfall and high humidity (13.56 percent), sudden changes in temperature (9.97 percent), and drought-like water stress conditions (9.32 percent). These factors often stem from erratic climate conditions, which directly affect fruit set and retention.

Management-related factors accounted for 23.05 percent of the total fruit drop (11.80 q/ha), resulting in a financial loss of ₹28,178.16/ha. Improper or untimely practices, such as ineffective irrigation, nutrient deficiency, and late application of fertilizers, were major contributors. In addition, over-ripening of fruits due to delayed harvesting also led to a noticeable portion of the losses. The similar findings were found by Birthal *et al*. (2015) and Sharma *et al*. (2018) [2, 14].

Table 4: Production and Economic losses due to fruit drop for non-adopters

Sr. No.	Particulars	Production losses Qts/ha	Percent	Economic losses Rs/ha
A	**Abiotic losses**			
1	Heavy rainfall and high humidity	6.95	13.56	16596.46
2	High temperature/Sudden change in temperature.	5.11	9.97	12202.57
3	Windstorm	1.31	2.50	3128.25
4	Water stress and drought condition	4.78	9.32	11414.54
5	Cold and fog	1.28	2.49	3056.61
	Subtotal	19.43	37.91	46398.45
B	**Biotic losses**			
I	**Entomological causes**			
1	Fruit fly	2.38	4.64	5683.39
2	Fruit sucking Moth	2.24	4.37	5349.07
3	Citrus psylla	3.54	6.90	8453.44
4	Citrus Mite	1.60	3.12	3820.76
5	Black fly	1.10	2.14	2626.77
	Subtotal	10.86	21.19	25933.46
II	**Pathological causes**			
	Stem end rot	1.30	2.53	3104.37
2	Fruit rot	1.60	3.12	3820.76
3	Brown rot	2.20	4.29	5253.55
4	Gummosis	2.49	4.85	5946.07
5	Bacterial infection	1.56	3.04	3725.24
	Subtotal	9.15	17.85	21850.01
	Total	20.01	39.04	47783.47
C	**Management Factors**			
1	Nutrient Deficiency	2.20	4.29	5253.55
2	Type of irrigation (Ineffective water management)	3.00	5.85	7163.94
3	Insufficient application of nutrient and fertilizer	2.10	4.09	5014.75
4	Time of application of FYM and NPK	2.30	4.48	5492.35
5	Over ripening of fruits	2.20	4.29	5253.55
	Subtotal	11.80	23.05	28178.16
	Grand Total of Production Losses (quintals)	51.24	100.00	122360.09
	Actual Yield per hectare (quintals)	54.06		
	Expected Yield per hectare (quintals)	105.30		
	Percentage fruit drop (percent)		48.66	

Comparison of production and economic losses between adopters and non-adopters

The comparison represents analysis of production and economic losses between growers who adopted the recommend practices and those who did not. Adopters achieved an actual production of 93.38 quintals per hectare, experiencing production losses of 35.41 q/ha, which amounts to 26.81 percent of expected yield. In contrast, non-adopters recorded significantly lower actual production at 54.06 q/ha, with higher production losses of 51.24 q/ha, representing 48.66 percent of expected yield.

The economic impact of fruit drops also followed a similar pattern. Adopters incurred a loss of ₹74391.09/ha, whereas non-adopters suffered a much higher loss of ₹1, 22,360.09/ha.

This indicates a 30.98 percent reduction in production and economic losses among adopters compared to non-adopters, showcasing the effectiveness of recommended practices and

their adoption in mitigating fruit drop. Moreover, the productivity of non-adopters declined by 42.10 percent compared to adopters, emphasizing the significant role of fruit drop control practices in enhancing yield and reducing losses. Assessment of the role of recommended agricultural practices on the productivity and profitability of mandarin orchards, with a comparison between adopters and non-adopters was similarly done by Khandekar *et al*. (2017) [15].

Table 5: Comparison of production and economic losses between adopters and non-adopters

Sr. No.	Category of Growers	Actual Production (Qtl/ha)	Total Production losses (Qtl/ha)	Total Economic losses (Rs./ha)	Production losses in percentage (%)
1	Adopters	93.38	35.41	74391.09	26.81
2	Non-Adopters	54.06	51.24	122360.09	48.66
3	Percentage decrease in losses of adopters over non-adopters due to high adoption of recommended practices to reduce fruit drop.		-30.89	-39.20	-44.90
4	Percentage decrease in productivity of non-adopters over adopters.	-42.10			

Identification of constraints faced for non-adoption of fruit drop control practices

The survey results key constraints limiting the adoption of recommended practices among non-adopter mandarin growers. The most prominent issue was lack of awareness about recommended practices to control fruit drop and their benefits, reported by 93.33 percent of respondents. This was followed by the absence of regular advisory services (86.66 percent) and the high cost of adoption (75 percent). Other notable barriers included climatic challenges (70 percent), input and market access issues (58.33 percent), and difficulty in pest and disease identification (46.66 percent). These findings highlight the need for improved extension services, awareness programs, and financial support to enhance practices adoption. Similar constraints were found by Ghadge *et al*. (2014) and Rathod *et al*. (2016) [13, 8].

Table 6. Constraints faced by non-adopters for non-adoption of practices

Sr. No.	Constraints	Frequency (N = 60)	Percentage	Rank
1	Growers are not fully aware of all the fruit drop control practices and its benefits	56	93.33	I
2	Non availability of regular advisory services	52	86.66	II
3	The cost of adopting new recommended practices may be prohibitively expensive for orange growers.	45	75.00	III
4	Problem in identification of disease and pest	28	46.66	VI
5	Input and Market access issues	35	58.33	V
6	Climatic and environmental Challenges	42	70.00	IV

Expectations of orange growers to reduce fruit drop

The expectation of orange growers who suffered from production and economic losses has been surveyed. The expectations of growers for reducing fruit drop revealed that a majority (77.50 percent) emphasized the need for regular and timely advisory services, ranking it as the top priority. This was followed by 60.83 percent of respondents suggesting the utilization of dropped fruits in processing industries, and 51.67 percent expressing the need for compensation to offset fruit drop losses. These findings indicate that farmers seek both preventive support through advisory services and post-loss mitigation strategies to manage the impact of fruit drop effectively.

Table 7: Expectations of orange growers to reduce fruit drop

Sr. No.	Expectations of farmers to reduce fruit drop	Frequency (N = 120)	Percentage	Rank
1	Requirement of regular and timely advisory services	93	77.50	I
2	Demanded compensation to mitigate the fruit drop losses.	62	51.67	III
3	Use of dropped orange fruits in processing industries	73	60.83	II

Conclusion

Based on results obtained from the study, following conclusions are drawn.

The major abiotic and biotic factors causing fruit drop in mandarin are, rainfall, high temperature, windstorm, water stress and droughts and cold and fog were found. In biotic factors were categorized into entomological & pathological causes, whereas, in management factors were categorized into nutrient deficiency, type of irrigation, time of application of pesticides, fungicides, FYM, NPK and over mature fruits.

The production losses occur maximum in adopters 35.41 qts/ha with economic losses of Rs. 74391.09 per hectare followed by non-adopters, production losses were 51.24 qts/ha with economic loss of Rs. 122360.09 per hectare.

The percentage of fruit drop were found to be 26.81 percent, for adopters and 48.66 percent fruit drop in non-adopters.

The adopters have more biotic losses with 14.42 qtl/ha, followed by abiotic and management losses were 12.83 qtl/ha and 8.16qtl/ha respectively.

Adoption of recommended practices to control fruit drop reduces production losses by 30.89 percent and economic losses by 39.20 percent, while increasing productivity by 42.10 percent in mandarin cultivation. These improvements highlight the critical role of recommended practices in minimizing fruit drop and enhancing growers yield and income.

The major constraints limiting the adoption of recommended practices among mandarin growers are lack of full awareness (93.33 percent), unavailability of regular

advisory services (86.66 percent), and high adoption costs (75 percent), followed by climatic challenges (70 percent).

Growers, primarily expect regular and timely advisory services (77.50 percent) to reduce fruit drop, followed by the use of dropped fruits in processing industries (60.83 percent) and compensation to mitigate losses (51.67 percent).

Recommendation:

The total economic losses due to fruit drop in adopters were estimated to Rs. 74391.09, and Rs. 122360.09 for non-adopters per hectare respectively. Similarly, per hectare production losses for adopters and non-adopters were 35.41 and 51.24 qtl/ha respectively. Hence, it is noticed that the adoption of recommended practices causes less economic and production losses. Therefore, it is recommended to conduct regular advisory services to disseminate the awareness about fruit drop practices recommended by university.

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References

1. Asharf YM, Yaquab M, Javed A. Control of excessive fruit drop and improvement in yield and juice quality in kinnow mandarin. Pak J Bot. 2012 Mar;44:259-265.
2. Birthal PS, Jha AK, Singh H. Improved management practices and technology adoption in Indian agriculture: A farm-level analysis. Policy Paper No. 30. New Delhi: National Centre for Agricultural Economics and Policy Research (NCAP); 2015.
3. Bhatnagar P, Jain MC, Singh J. Physiological fruit drop in Ambe bahar of Nagpur mandarin (*Citrus reticulata* Blanco). Int J Sci Environ Technol. 2016 Aug;5(5):2885-2890.
4. Bishnoi M, Prakash J, Khan A. Citrus fruit drop: Causes and management. Just Agric. 2023 Jun;3(10):115-120.
5. Chandrakant M, Waghmare RB. Effectiveness of recommended practices on fruit drop management in citrus. J Citrus Sci. 2019;17(2):112-118.
6. Das AK, Sonkar RK, Thirujnanavel A, Meshram NM, Bhattacharya S, Ghosh D. Management of citrus fruit drop: A complex problem in central India. Indian Citriculture. 2023;1(1):3-7.
7. Datir P, Tekale VS, Bharad SG. Reasons behind the fruit drop in oranges and removal of orchards. Pharma Innov J. 2023 Jun;12(5):387-390.
8. Ghadge RM. Constraints in adoption of improved production technology of mandarin. Indian Soc Ext Educ. 2014;50(1-2):90-92.
9. Kumar R. Various causes of fruit drop in kinnow (*Citrus reticulata*) and its control with growth regulators. Just Agric. 2020 Sep;1(1):121-124.
10. Khade SD, Roy TN. Economic analysis of impact assessment of production technology of paddy cultivation in Nasik region of Maharashtra in India. Econ Aff. 2020;65(1):63-68.
11. Rathod MK, Rathod V. Technology adoption, its gap and constraints in orange cultivation in Nagpur district. Indian Res J Ext Educ. 2016 Sep;16(3):60-66.
12. Meena RR, Singh J, Verma AK, Singh B. Adoption level of practices in growing and trading of mandarin orange in Jhalawar, Rajasthan. Int J Agric Stat Sci. 2012;8(1):177-183.
13. Rattanpal HS, Singh G, Arora A, Singh S. Management of fruit drop in citrus. Ludhiana: Punjab Agricultural University, Additional Director; 2019. p. 1-22.
14. Sharma R, Singh A. Economic impact of technology adoption in horticultural crops: A case of citrus growers in India. Agric Econ Res Rev. 2018;31(2):215-222.
15. Punetha M, Khandekar S. A CFD based modelling approach for predicting steam condensation in the presence of non-condensable gases. Nuclear Engineering and Design. 2017 Dec 1;324:280-296.