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Evaluation Modified Integrated Management Program of Mango Powdery Mildew Disease

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Abstract

This study was done through four years from 2021 to 2024 under two agro-ecological zones, Mansoura (Dakahlia governorate) and Rashid (Beheira governorate) on Owes Mango variety. In the first season (2021), five different fungicides were repeated for 3 spraying, alone,(original farm fungicides applications), after symptoms appearance in 15 February. The period between the first spray and the next was tested as every 7 or 10 days. The best time between two applications was once every 7 days. Amistar-top fungicide revealed the most efficiency to decrease Mango powdery mildew (30 and 25%) at Rashid and Mansoura locations. In the second season (2022), combination between the best farm fungicides and the modified tested fungicides, eight fungicides were applied as modified chemical control (both of chemical fungicides original farm or tested chemical control programs). Both of Belize and Amisto 25% fungicides decreased powdery mildew disease severity (33%) on leaves and (49 and 48%) on flowers at Rashid. In the third season (2023) combination between systemic and contact fungicides modified chemical control was tested. At the end of modified chemical control program which gave (14 and 8 %), compared with control treatment which recoded (100 and 100%) disease severity on flower and fruit stage at both of Rashid and Mansoura locations. In the last, season, (2024) modified integrated pest management control was done at first of, November, as

combination between, systemic, contact and fertilizer. Finally results showed that modified integrated control program was the most effective on mango powdery mildew either on foliar or fruits and flowers at the two lections compared with control treatment. Finally, **modified tested integrated control** produced (60, and 68.60 compared with untreated control treatment which didn't produce yield (00 and 00Kg/tree), at both Rashid and Mansoura locations, respectively

Keywords: Evaluation, Modified Integrated Management Program, Mango Powdery Mildew Disease.

Introduction

Mango (*Mangifera indica L*) fruit crop belongs to the family Anacardiacae, it is one of the most important crops in Egypt, the agricultural area in Egypt is estimated at about 321, 000 Fedden at year 2024. But Mango is liable to infection with many fungal, bacterial diseases and insect pests, in addition to seed rot, which leads to significant crop loss and decreased productivity (Haggag, 2010; Ravikumar *et.al.,* 2017 and Iqbal, *et., al.*, 2024). Whatever, fungal diseases effect on mango fruit trees that cause huge losses, whether to the fruit crop produced or death of the trees, for example, dieback of the stem (Awad, *et., al.*, 2022), Mushroom diseases (El-Marzoky, 2014) and floral malformation disease Kamhawy,(2006) and (Freeman, *et.,al.,* 2014). In addition, flower blight and fruit rot diseases that lead to a direct reduction in yield, such as, Powdery mildew and anthracnose diseases (Iqbal *et.,al.,* 2024; Raut*, et.,al.,* 2020 and Nasir, *et.al.,* 2017), and fruit drop due to infection by *Fusarium moniliforme*, *Lasiodiplodia theobromae* Pat., and *Alternaria alternata*(Hassan*, et., al.,* 2024).

Powdery mildew is considered a dangerous disease for mango crops elsewhere because it is able to infect all parts of mango trees, leaves, new growing shoots or flowers, inflorescences and fruits, (Misra, 2001). Although the severity of this disease is depended on climatic change conditions especially during cool and dry weather conditions, Iqbal *et., al.*, (2024) and definitional among mango varieties, but it causes losses to the mango crop at almost mango growing regions, as well as to different varieties (Gupta, 1976).

Under Egyptian conditions, in most cases using the fungicides used for control of powdery mildew in mango crops strategies are often begin after symptoms appearance on the flowers. So, this leads to use the fungicides application, whether the number of sprays was too many or some other farms apply double concentrations to decrease the spread of the disease (Raheel, *et., al.*, 2008*).*

In the modern control strategies, it had become necessary to use different methods to combat powdery mildew, whether the use of resistant varieties (Maheedano, *et.al.,* 2021*)*. In this respect, use of some nutritional elements fertilizers to induce resistance within the plant beside their importance as fertilizers for the mango fruit trees (Zhu*, et.al.*,2008).

The aim of this study is to clarify the optimal time to apply different effective fungicide, and the optimal time to spray nutrients to induce resistance within mango trees, which leads to reduce spraying fungicides, either in the number of sprays or the time between one spray application and the next. Besides, proposing an integrated control program for mango powdery mildew using spraying fungicides and alternated fertilizer to reduce the use of fungicides.

Materials and Methods

This study was carried out over four consecutive agricultural seasons2021 to 2024, under two different agro-ecological zones (Rashid and Mansoura), and on the Owais mango variety. The age of the trees was 15 years, the planting distances are 5 meters by 5 meters between one tree and the other. In addition to the designs of all experiments were completely randomized and the number of replicates was 5 trees duplicates / treatment.

In first season (2021, fungicides of original farm which were applied and the efficiency were evaluated for decrease mango powdery mildew disease severity (Pérez-Rodríguez ***et., al.***,**2017**). Moreover the best time between two applications, as once every 7 or 10 days were tested, according to **Ministry of Agriculture and Agriculture Pesticides Commit, 2020 and 2022 reports**. All fungicides were applied after the first appearance of symptoms on flowers stage at first of March, as original farm that was applied Awan (2014). The results were recorded, a month after the last application, in first season.

In the second season (2022), combination fungicides that were applied as farm chemical control and that modified tested fungicides chemical control were tested to decrease powdery mildew disease severity %on mango fruit trees as 3 sprays / fungicide as once every 10 days. All fungicides sprays started at the first of March until first, April. The results recorded at first May, a month after last application. (Raheel, *et., al.*, 2008), and Maheedano *et., al.*, (2021).

In third season (2023), the effect of modified chemical control program as, contact interval with systemic fungicides on disease severity% of mango powdery mildew disease, was evaluated. In this respect, the application of modified chemical program started through winter service at 15 November until the first of June, while the results were recorded at harvest time

(Bana *et.al.*, 2020)

In the Fourth season (2024), the efficacy of modified integrated control, as combination between ,contact, systemic fungicides and also fertilizers as alternative fungicides and inducer of resistance sprayers (Table, 2) was evaluated for its effect to decrease mango powdery mildew disease severity %. (Reuveni and Reuveni,1998) and Rajapakse *et., al.*, (2006).

Table (1): Trade name, rate /100 L and active ingredient of the tested used fungicides

Fungicides commercial Name	Rate g or cm/ 100 L	Active ingredient
Sulfur 80%	250	Sulfur (A preventive and curative contact fungicide)
Champion 77% Wp	180	77%copper hydroxide (protective and contact)
Vevando 50%Sc	20	Metrafenone (contact)
Topas 10%	10	Penconazole (protective, stageic and curative)
Score25%EC	50	Difinoconazole (systemic)
Amistar-top 32.5%SC	75	Azoxystrobin 20%Difenconazol 12.5% (systemic)
Amisto 25%Sc	50	Azoxystrobin(systemic)
Belize 38%Wp	50	Boscalid25.2% + pyraclostrobin 12.8% (systemic)
Hesta-70%Wp	65g	Thiophenate methyl (systemicstageic)

Table 2. Fertilizers treatments names and rate/ 100 L

Fertilizers treatments names	Rate/ 100 L
Chitosan ,**According to (Gad *et., al.*,2021)**	0.5 g / litter
Calcium nitrate **According to (Bitange *et.al.*,2023) and also Modified of (Singh *et.,al.*,2017)**	**1.5gm/ L**
Potassium monophosphate according to (. Hussein2023) and also,Modified of (Khalifa and Thabet., 2014)	1 gm./L
Potassium di phosphate	1gm/L
Potassium phosphide	1 ml
Micro elements +Mg **according to** Kumar ***et., al.*, (2023)** **(Fe, Mn, Me, Zn, and Bo)+ Mg**	0.1 gm/L

Assessment of Powdery Mildew Disease Severity%:

Disease severity on naturally infected mango powdery mildew mango was assessed according were carried to Elisis and Shams. (2019) scale 0−4, where 0 = healthy; 1.0 = 1−25% leaf area covered with lesions; 2.0 = 26−50%; 3.0 = 51−75%; and 4.0 = 76−100%.

Disease severity % 100

$\Sigma = (nxv)/ 4Nx100$

Where:

n = Number of the infected inflorescences in each category.

v = Numerical values of each category.

N = Total number of the examined inflorescences.

Statistical analysis

This experiment was arranged as a complete randomized block design with five replicates, three mango trees per each one. Data were subjected to analysis of variance (ANOVA) using Costat Statistical Software (1986). Means of all data were compared by LSD method at 5% according to Snedecor and Cochran (1994).

Results

Generally, (original farm application), data in Table (3), show the most efficiency period between the application and that following one, once every 7 days, that decreased powdery mildew disease severity % more than the application once every 10 days. In addition, both of Amistar-Top and Belize fungicides were the most significantly effective against powdery mildew disease severity either every 7days treatment or every 10 days treatment. They recorded (30 and 31%) and (25 and 24%) every 7 days application, while that recorded (41 and 40%) and (36 and 34%) every 10 days application compared with untreated general control, being (100 and 100) percentage of Powdery mildew disease severity at the two locations, Rashid and Mansoura, respectively. However, data in Table (3) show that there were not significant differences between (application fungicides as one sprayer). Effect of fungicides treatment and the total yielded either at Rashid or Mansoura locations.

Table 3: Evaluation of different original farm fungicides and their efficiency on powdery mildew disease severity %, on Owes Mango and total yielded (Kg/Treatment) in Rashid and Mansoura locations , Frist season (2021),.

original farm Fungicides Farm treatments	Period between the application and the next one	Time of application (3 repeated Sprays)	Plant treated diseased organ	Rashid		Mansoura	
				Disease severity %	Total yielded /kg at harvest time	Disease severity %	Total yielded /kg at harvest time
Zero time				42	0	37	0
Score	Once /7 days	1 Mar.: 21 Mar. Results were recorded after a month from the last application , 21 /April	flowers and fruits stage	35	1.0	30	1.25
Topas				38	0.70	35	1.3
Hesta 70%Wp				40	0.5	34	0.75
Amestar-top (Aozxystrobune + difenoconazole				30	1.0	25	1.4
Belize				31	1.0	24	1.6
Control				80	00	70	00
Score	Once / 10 days	1 : 30 /Mar. Results were recorded after a month from the last application, 30/April		56	0.6	46	1
Topas				60	0.3	50	1
Hesta 70%Wp				55	0.7	45	1
Amestar-top(Aozxystrobune+ difinconazole				41	1.0	36	1.6
Belize				40	1.0	34	1.4
Control				**100**	**00**	**100**	**00**
L.S.D.5%				**4.68**	**N.S.**	**3.883**	**N.S.**

Data in Table (4) reveal that the most efficient original farm chemical control treatment was Belize fungicide treatment which gave 33 and 35 % powdery mildew disease severity on leaves and 49 and 46 %) powdery mildew disease severity on flowers and fruits stage at both locations (Rashid and Mansoura), respectively. While, the most efficient tested chemical fungicides, that treated with both of Amisto 25% which decreased disease severity % either on leaves or flowers and fruits being (33 and 34%) and (48.0 and 46%), compared to untreated control treatment, that gave (80 and 70 %) on foliar (100 and 100%) on flowers and fruits powdery mildew disease severity at both Rashid and Mansoura locations, respectively.

Table 4: Combination between original Mango farm chemical fungicides control program, and the tested chemical fungicides control, under the of locations (Rashid and Mansoura) locations, second season 2022.

Chemical Control Program	Fungicides	No. of sprayers	Rashid		Mansoura	
			stem up to leaves development	Flower up to fruit stage	stem up to leaves development	Flower up to fruit stage
Zero Time			38	53	25	40
Original farm chemical program	**Sulfur 80%**	3 times (one / 10 days) Started from 1 March Until 1 April.	65	100	60	100
	Champion 77% Wp		62	100	58	100
	Vevando 50%Sc		68	90	55	80
	Topas		62	75	53	64
	Belis		33	49	35	46
Tested chemical fungicides	**Amisto 25%**	**Results were recorded A month after the last application (1 / May)**	33	48.0	34	46
	Score		42	56	30	43
	Hesta		45	60	43	54
Control			80	100	70	100
L.S.D.5%			**6.602**		**5.605**	

Table (5, a): Effect of modified farm mango chemical fungicides control Program on Powdery mildew disease severity% on Owes mango verity, under two locations (Rashid and Mansoura).at the third season 2023.

Treatment	Time of application	Powdery mildew Disease severity % at,			
		Rashid		Mansoura	
		stem up to leaves development	Flower up to fruit stage	stem up to leaves development	Flower up to fruit stage
Sulfur 80% + Champion77%Wp +Vevando	15 : 30 / Nov. 1 Dec: 15/Dec 18: 2 Jan	00	00	00	00
Control	**Water only**	**00**	**00**	**00**	**00**
Topas Champion 77% Wp + Vavando	3: 18 Jan **(2, sprayers, once / 7 days)** 19 Jan : 2 Feb 3: 18 Feb	7	13	3	8
Control	**Water only**	**19**	**23**	**15**	**16**
Score Vevando	**19 / Feb: 5 Mar. (2, sprayers, once / 7 days)** 6 : 13 March	16	20	11	17
Control	**Water only**	**28**	**39**	**26**	**36**
Belize Vevando	**14/ Mar: 30 Mar (2, sprayers, once / 7 days)** 1/ Apr: 7/Apr	16	23	11	14
Control	**Water only**	**45**	**60**	**40**	**50**
Amisto Champion77%Wp	**8 : 23 /Apr. (2, sprayers, once / 7 days)** 24 Apr. : 7 May	12	20	10	11
Control	**Water only**	**75**	**90**	**60**	**80**
Hesta	8 May.: 23/May **(2, sprays, once / 7 days)**	9	17	6	9
champion 77% WG	24 May : 1 Jun	11	14	7	8
Control	**Water only**	**85**	**100**	**80**	**100**
Stop until harvest					

Table (5, b): Effect of modified farm mango chemical fungicides program on yielded of Owes mango (Kg/ tree), under two locations (Rashid and Mansoura).at the third season 2023.

Treatment	Rashid /Kg/ tree	Mansoura Kg/tree
Modified chemical program	34.00	40.00
Control	00.00	00.00

In general, data in Table (5,a) effect of modified farm mango chemical fungicides control Program on Powdery mildew disease severity% on Owes mango, under two locations (Rashid and Mansoura).at the third season 2023 resulted that application with contact and systemic fungicides together from the first of January decreased the percentage of powdery mildew disease severity either on leaves or flowers and fruits stage at the two locations and also decreased the number of systemic fungicides applications. In this respect, at the end of the season, modified original farm program showed (11 and 7 %) powdery mildew disease severity %, on leaves, (14 and 8) on flowers and fruits stage compared with untreated general control treatment that resulted (85 and 80%) powdery mildew disease severity %, on leaves and (100 and 100) on flowers and fruits stage at the two locations (Rashid and El- Mansoura) locations, respectively. Also data in table (5, b) the yield were effect of the modified fungicide control program produced (34.0 and 40.0) kg/tree compared with control untreated treatment which did not produce yield (00 and 00) Kg/tree, ay both Rashid and Mansoura locations, respectively.

Moreover, data in Table (6a) show the, effect of modified tested integrated control on powdery mildew under, Rashid and Mansoura locations, at the fourth season (2024). The results indicate that after the last application on the leaves stage was decreased powdery mildew disease severity, being 6 and 4 % and 5 and 2% flowers and fruits compared with control , being (100 and 100%) on leaves and (100 and100%) on flowers and fruits at both of Rashid and Mansoura locations, respectively. On the other hand, the application of modified tested integrated control program, combination of systemic fungicides and alternative fungicides as fertilizers decreased the number of systemic fungicides, and also, the period between the systemic fungicides, the flowers application was once every 10 days, generally, around once systemic application every 3 weeks or month. Also, starting spraying from the first of November during winter service protected the mango trees from early infection with powdery mildew that was more efficiency to decease the mango powdery mildew disease severity at the end of the season.

Table (6, a): Effect of modified tested integrated control on powdery mildew disease severity% under, Rashid and Mansoura locations, at the fourth season 2024.

Treatment	Time of application	Powdery mildew disease severity%, at			
		Rashid		Mansoura	
		leaves	**Flowers**	leaves	**Flowers**
Sulfur 80% + Champion 77% Wp +Calcium nitrate	**1/: 15/Nov.** **15: 29 Nov.** **1 Dec: 14 Dec.**	00	00	00	00
control		00	00	00	00
Sulfur 80% + Champion 77% Wp +Potassoum di- phosphate	**15: 30 Dec** **1 : 15 Jan** **16::31 Jan**	00	00	00	00
control		8	5	7	3
Topas Chitosan Vevando+	**1/: 10 Feb(once /10 days)** **11 : 21 Feb.** **22Feb : 2Mar**	6	4	3	1
control		17	20	13	18
Belize +Champion 77% Wp +Potassium Phosphide	**3/: 13 Mar (once /10 days)** **14/: 24/Mar** **25/: 31 Mar.**	10	5	6	3
control		45	39	35	40
Score Micro elements Vevando	**1 : 10/Apr. (once/ 10 days)** **11 : 18Apr.** **19: 29 Apr.**	13	8	7	5
control		70	85	60	75
Hesta Potassium mono phoshate +	**30Apr.: 15/May (once /15 days)** **16 May: 1 Jun**	6	5	4	2
control		**100**	**100**	**100**	**100**
Stop until Harvest					

Table(6,b): Effect of modified tested integrated control on yield Owes mango variety (Kg/ tree),under two locations (Rashid and Mansoura).at the third season (2024)

Treatment	Rashid /Kg/ tree	Mansoura Kg/tree
Modified chemical program	60,00	68.60
Control	00.00	00.00

In addition, data in Table (6, b) indicate that using the **modified tested integrated control** increased the yield of fruits /tree, being (60,0 and 68.60 kg/ tree) compared with control untreated treatment which did not produce yield (00 and 00)Kg/tree, at both Rashid and El. Mansoura locations, respectively.

Discussion

Generally, data in Table (3), show that ,(as original farm fungicides),the most efficiency period between the application and the flowing one was once every 7 days, that decreased powdery mildew disease severity % more than the application once every 10 days. In addition, both of Amistar-Top and **Belize** fungicides significantly decreased the powdery mildew disease severity either after one spray every 7days or every 10 days intervals. This result is in harmony with Nasir, *et.al*, (2017) who reported that Anthracnose and powdery mildew are the two common maladies that attack mango at flowering and inflict heavy loss to fruit production. One organic and seven inorganic fungicides were evaluated for their effectiveness against these diseases. In all, three bloom sprays were made, first at 25% flowering and two later sprays at 15-day intervals. Best results were achieved with Nativo 75% WDG (Tebuconazol+ Trifloxystrobin) which controlled anthracnose by 92.03% and powdery mildew by 90.19%. It was followed by Cabriotop 60% WDG (Metiram + Pyraclostrobin) which reduced incidence of these diseases by 89.08 and 88.04%, respectively, whereas Topsin-M 72% WP (Thiophanate methyl), Score 25% EC (Difenoconazol) and Shincar 50% SC (Carbendazim) provided less than 80% control. Topas 100% EC (Penconazole) and Vangard 25% EC (Tridamenol) were effective against powdery mildew (89.96 and 91.87%) and Champion 77% WP (Copper hydroxide) was effective against anthracnose only (82.64% disease control). In general, all the fungicide treatments significantly reduced incidence of the diseases and produced higher yield of quality fruits than control in both years. Also, Nasir, *et.al*.,(2014) mentioned that Prakash is an *Strobilurins* group contains the newest and most important fungicides against powdery mildew of mango, such as Axosystrobin (Abound, Amistar,Bankit, Ortiva, Priori, Heritage, Quadris), Fluoxastrobin, Pyraclostrobin(Insignia), Trifloxystrobin (Flint, Compass, Gem, Twist),Kresoxym-methyl (Alliage, Candit, Cygnus, Discus, Stroby, Sovran).In addition, Ravikumar, *el., al*., (2017) carried out experiment at humid tropical regions of Karnataka,

India during 2012-14 with six treatments of different fungicides, *viz*., Azoxystrobin 23% SC 1ml/L of water, Azoxystrobin 23% SC 2ml/L of water, Standard Azoxystrobin 250 SC (market Sample) 1ml/L of water, Standard Hexaconazole 5% SC 2ml/L of water, Standard Copper oxy chloride 50% WG 2.4g/ L of water along with one untreated control and they found that ,two sprays were taken up at 20 days interval during flowering stage. Among the different treatments, Azoxystrobin 23% SC 2ml/L of water recorded significantly lower per cent disease index of powdery mildew on leaves, inflorescences and fruits (17.75, 17.24 and 16.64, respectively) than control (53.53, 51.94 and 50.10 % , disease index on leaves, inflorescences and fruits, respectively).

Data of the present study, Table (4) indicate that the most efficiency original farm chemical control treatment was Belize fungicide treatment which gave (33 and 35 %) on leaves and (49 and 50%) powdery mildew disease severity on flowers and fruits at the two locations (Rashid and Mansoura), respectively. While, the most efficiency tested chemical fungicides that tested with Amisto 25% significantly decreased disease severity % on foliar (33 and 34%) and on flowers and fruits (48.0 and 46%), compared with untreated control treatment, that gave (80 and 70 %) on foliar stage and (100 and 100%) on flowers and fruits powdery mildew disease severity at both Rashid and Mansoura locations, respectively. These results are in agreement with those reported by Nasir *et., al.*,(2014). In addition, Hassan,*et.al.,* (2024) reported that, generally, the linear growth of any of the isolated fungi was inhibited with 0.5ml/L of Score, 0.5g/L of Belize and 1ml/L of Tekto, respectively. *In vivo*, the treatment with Score (50ml/100L) significantly decreased early fruit drop during the two experimental seasons on Montakhab El-Qanater and Owais mango cultivars.

However, data in Table (5), showed that application with contact and systemic fungicides together from the first of January decreased the percentage of powdery mildew disease severity either leaves or on flowers and fruits at the two locations (Rashid and Mansoura), also decreased the number of systemic fungicides applications. In this respect, at the end of the season, modified original farm program gave (11 and 7 %) Powdery mildew disease severity % on leaves and (14 and 8%) on flowers r and fruits, compared with untreated control treatment , being 85 and 80% on leaves and 100 and 100% on flowers and fruits powdery mildew disease severity %, at the two locations, Rashid and Mansoura, respectively. These results are in line with those reported by Raut, *et.,al.,(* 2020) who found among the different treatments, newer molecule Pydiflumetofen 7.5% + difenoconazole 12.5% w/v (200 SC) 0.6 ml/L of water that recorded significantly lower percent powdery mildew and anthracnose diseases of mango . In respect of powdery

mildew, significantly minimum percent (8.88) disease index values and highest per cent disease control (82.88) were recorded in treatment T4 where Pydiflumetofen 7.5% + difenoconazole 12.5% w/v (200 SC) 0.6 ml/L of water were applied as foliar spray. Raheel, *et., al.,* (2008) evaluated four foliar spray fungicides for the management of powdery mildew (*Oidium mangiferae* Barth) of mango found that Score 250EC (Difenoconazole) and Anpower 5ME (Hexaconazole) were the most and statistically equally effective fungicides in reducing disease incidence by 93.28 and 86.87 percent, respectively, over the non-sprayed control. Precure combi (Thiophanate methyl +Diethofencarb) and Thionill (Thiophenate methyl) were comparatively less effective but statistically equally effective in reducing powdery mildew by 83.38 and 79.83 %, respectively, over the non-sprayed control.

Data presented in Table (6) show that at the end of application program, Hesta +Potassium mono-phosphate, gave the highest decrease of powdery mildew disease severity % on foliar (6 and 4) and (5 and 2%) on flowers and fruits, compared with control which gave (100 and 100%) on leaves (100 and10 0 %) and on flowers and fruits powdery mildew disease severity % at both of (Rashid and Mansoura) locations, respectively. On the other hand, the application of modified tested integrated control program, combined of systemic fungicides and alternative fungicides as fertilizers that decreased the number of systemic fungicides, and also, the period between the systemic fungicides, the flowers application was once every 10 days, generally, around once systemic application every 3 weeks or month. Also, starting the application program from the first of November during winter service protected the mango trees from early infection with powdery mildew that was more efficiency to decrease the mango powdery mildew disease severity at the end of the season, that was in harmony with Iqbal, *et.al.,* (2024) who found that, the most severe losses occur when flowering and growth flushes become infected, especially during cool and dry weather conditions. Optimal disease development typically happens within a temperature range of 11–14 °C minimum and 27–31 °C maximum, coupled with relative humidity levels of 64–72%. Despite the widespread impact, and influence of climate change, losses are increasing day by day. There is a lack of comprehensive research on the symptoms, biology, and control measures. Control is difficult due to the emergence of resistant strains and the varying levels of susceptibility of mango varieties. Therefore, it is crucial to implement integrated management techniques to control powdery mildew. To address this issue, various approaches, such as chemical control, biological control, and Nanotechnology are being employed as management strategies. On the other hand, Nasir *et., al.*, (2014) found that the fungicidal treatment must start before flowering, or when 20%

or maximum of 30% inflorescence appears to be the most critical for infection, otherwise secondary infections and disease epidemics cannot be controlled. However, Reuveni and Reuveni (1995) recorded that application of phosphate solutions is a new approach in the control strategies of powdery mildews in vegetables and fruit trees. The role and effect of phosphates and systemic fungicides, alone or in combination, was investigated by **Reuveni and Reuveni (1995)** reported that foliar sprays of 0.025 M and 0.04 M solutions of K2HPO4 (DKP) and KH2PO4 (MKP) þ KOH (plus Triton X -100) and commercial systemic fungicides difniconazole (Marit 12.5% WP), myclobutanil Sisthane 12Ec%) and penconazole (Ophir) inhibited the development of powdery mildew fungi on leaves, fruits and flowers and fruit clusters of field-grown mango. The systemic fungicides were more effective in controlling the disease on inflorescences of mango than either phosphate. Alternating treatments of phosphate salt with each of these fungicides, however, enhanced the inhibitory effect against the fungus in each crop. Also, Reuveni *et al.* (1998) in another study revealed that tank-mix treatments of 1% KH2PO4 solution with half the recommended quantity of sterol inhibitor fungicide applied at 14-day intervals provided a protection against powdery mildew comparable with or superior to that given by the standard fungicides-based treatment applied at 7-day intervals. Tank-mix treatments of MKP (1%) with sterol inhibitor at the recommended rate or with the new strobilurin Kresoxym-methyl (BAS 490F, strobi), or the BAS 490F alone, were the most effective, and provided >95% protection against *O. mangiferae*, compared with the control. Reuveni *et al.* (1998) concluded that the phosphate solutions and biocompatible fungicides are non-phytotoxic, have a remarkable role in disease control and yield increase, serve as ideal foliage fertilizers for field application and constitute potentially a major component of an integrated pest management program.

In addition, Zhu*,et., al., (2008)* mentioned that The effects of chitosan coating on delaying ripening and reducing decay of mango fruits (*Mangifera indica L.* cv. Tainong) were investigated . The fruits were treated with 0.5, 1.0 or 2.0% chitosan solution, respectively, and were stored at 15C, 85–90% relative humidity. Results showed that the ripening of mango fruits was significantly delayed by the treatment of chitosan coating in a concentration-dependent manner. Among them, 2.0% chitosan coating was the most effective. Anjali, *et.,al.,* (2021) found that copper based fungicides and bactericides are widely used in crop management globally. However, copper fungicides had their limitations because of their non- systemic interaction with the plants. In mid-1970's a systemic group of fungicides called phosphonates emerged in the area of disease management, which were

unique in their ability to reduce some diseases by direct action as well as indirect action as a systemic acquired resistance initiator.

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تقييم برنامج الإدارة المتكاملة المعدل لمرض البياض الدقيقي في المانجو

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المستخلص

اجريت هذه الدراسة خلال اربعة مواسم زراعيه متتاليه من ٢٠٢١ الى ٢٠٢٤ في المنصورة ورشيد على صنف المانجو عويس. في الموسم الأول (٢٠٢١) تم المعاملة بالرش لخمسه مبيدات على ان يكرر الرش ثلاث مرات متتاليه لكل/ مبيد منفردا. وقد تم بدء المعاملات بعد ظهور الأعراض في ١٥ فبراير. وقد تم اخذ النتائج للتجربة الاولى بعد الرشة الثالثة ب ٧ و ١٠ أيام ، كان الغرض من التجربة هو تحديد افضل فترة بين الرشة والتالية لها. اشارت النتائج ان أفضل وقت بين تطبيقين كان مرة واحدة كل ٧ أيام. واظهر المبيد الفطري اميستار توب أعلى كفاءة في تقليل البياض الدقيقي على المانجو (٣٠ و ٢٥%) في موقعي رشيد والمنصورة. وفي الموسم الثاني (٢٠٢٢) تم اختبار ثمانية مبيدات فطرية مختلفة للمقارنة بين المبيدات الفطرية في المزرعة الأصلية، أو المبيدات المقترح استخدامها لتعديل برامج المكافحة الكيميائية. اظهرت النتائج ان: كلا من المبيدين البيليز والاميستار– توب قد خفضا من شدة الاصابة بمرض البياض الدقيقي (٣٣%) على الأوراق و(٤٩ و٤٨%) وعلى الازهار في منطقة رشيد. وفي الموسم الثالث (٢٠٢٣) تم اختبار عمل البرنامج المعدل الاولى وهو يجمع بين المبيدات الفطرية الجهازية والملامسة المعدلة بالمكافحة الكيميائية. في نهاية برنامج المكافحة الكيميائية المعدل الذي أعطى (١٤ و ٨%)، بالمقارنة مع معاملة الاشجار التي لم ترش (الكنترول) والتي سجلت ١٠٠ و ١٠٠% لشدة المرض على الأزهار والثمار في موقعي رشيد والمنصورة.

وفي الموسم الاخير الرابع (٢٠٢٤) تم تنفيذ برنامج المكافحة المتكاملة في أول نوفمبر، حيث تم الجمع بين النظامي والملامس والسماد (غير مفهوم) .

أظهرت النتائج أن:

برنامج المكافحة المتكاملة المعدل قد حقق انخفاض في البياض الدقيقي على المانجو سواء على الأوراق أو على الثمار والأزهار في مرحلتين مقارنة بمعاملة المقارنة. كما اظهر برنامج المكافحة المتكامل تأثير شديد على الانتاج العام للمحصول فص صنف المانجو عويس في كلا من موقعي التجربة برشيد والمنصورة.

الكلمات المفتاحية: التقييم، برنامج الإدارة المتكاملة المعدل، مرض البياض الدقيقي في المانجو.