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PROPHYLACTIC MEASURES FOR THE IMPROVMENT OF FLOWER PRODUCTION IN *Jasminum sambac* L. PLANTS

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ABSTRACT

One year old transplants of Arabian jasmine (*Jasminum sambac* L.) with a height of 15-20 cm were sprayed monthly with one of the following solutions:

1- A fungicide: Topsin M (thiophanate-methyl) at 2 g/l.
2- An insecticide: Rogor (Dimethoate) at 2 ml/l.
3- A nutritive solution: (MS basal salts described by Murashige and Skoog, 1962) at full strength.
4- Methanol (methyl alcohol) at 10% aqueous solution.
5- A combined treatment consisting of all the above-mentioned treatments.
6- A spray of water only for the control treatment.

The consistent trends along the two years of this study could be concluded in the following:

"The combined treatment" resulted in the highest values of flower number, plant height, number of leaves, branch number, and contents of carbohydrate, N, P and K. However, some of these highest values were not confined to "the combined treatment" only. The methanol treatment was responsible also for the highest records of flower number, flower fresh weight, plant height, number of leaves, chlorophyll a, b and carbohydrate contents. Highest value of carbohydrate content was a result of either one of the later two treatments or the insecticide treatment. The nutritive solution treatment resulted also in the highest N content. The control treatment was responsible for the lowest values of flower number, flower fresh weight, plant height, number of leaves, branch number, chlorophyll a, b and contents of carbohydrate, N, P and K. On the other hand, flower neck diameter and leaf content of carotene were not significantly affected by any of the treatments used.

It is recommended to pay more attention to Arabian jasmine (*Jasminum sambac*) plants through routine prophylactic programs of nutrition and pest control in order to get better vegetative growth and flowering of these plants of great importance in landscape as well as for export of concrete oil for perfumery purposes.

Keywords: Arabian jasmine, *Jasminum sambac*, fungicide, Topsin M, insecticide, Rogor, Dimethoate, nutritive solution, MS, methanol.

INTRODUCTION

The genus *Jasminum*, of the olive family "Oleaceae", comprises about 200 species, native of the Old World, mostly of warm-temperate, subtropical and tropical regions. *Jasminum sambac*, native of Southeast Asia, is an evergreen, more or less climbing shrub up to 150 cm tall. It has downy branches and broad elliptic to ovate or nearly round, nearly stalkless opposite leaves. The white fragrant flowers, mostly in three-branched clusters, are about 2.5 cm in diameter, have 4 to 9 or in some varieties more, oblong to rounded, blunt petals. Variety *J. s. multiplex* has semidouble flowers. The blooms of *J. s. flore-pleno* are extremely double and button-like that they resemble small roses. Arabian jasmine is attractive when trained as a standard with a single, branchless trunk 150-180 cm tall and a well-furnished head of branches. It can also be accommodated in ground beds or containers. In Hawaii, the flowers of *J. sambac* or pikake as it is called there, are used in leis, and perfume of local sale is made from these flowers (Everett, 1981).

It has been remarked in the last few years that Arabian jasmine plants have suffered a great deal of deterioration. This deterioration might be attributed to many factors such as diseases, insects, and lack of nutrition, or to all of these factors together. A number of researches were conducted in regard to nutrition of jasmine plants. Srinivasan *et al* (1989) observed that good vegetative growth and flower characteristics of *Jasminum sambac* cv. Gundumalli plants were obtained with the highest N (90 g/bush) and P (120 g/bush) rates.

It is almost impossible to find any group of plants that are not prone to be attacked by different kinds of viruses, diseases, insects or any other pests. Hilal *et al* (1987) stated that root and basal stem rots of jasmine cause 15-24% loss of cuttings and 5-13% loss of plants less than 1.5 years old in Egypt. Vyas (1998) stated that *Jasminum sambac* plants, were attacked by a large number of insect pests from the sapling to the flowering stage. This caused considerable damages. Dziedzicka and Karnkowski (2002) mentioned that of the many insect pests imported incidentally with plant material from warmer countries, is *Pseudaulacaspis pentagona* (Order Hemiptera) on jasmine plants from Egypt.

The aim of this study was to find out the effect of some prophylactic and nutritive measurements on the vegetative growth and flowering of Arabian jasmine (*Jasminum sambac*).

MATERIALS AND METHODS

This study was carried out in the nursery of the Ornamental Plant Research Department, Horticulture Research Institute, Giza, Egypt in the two seasons of 2002–2003 and 2003–2004. A randomized complete block design was adopted, with 6 treatments; each comprised 3 replicates, with 4 plants in each replicate.

In the first season, land was divided into 3 longitudinal strips (replicates, 120 cm wide x 690 cm long) with a 50 cm ridge between each 2 replicates. Six beds (120 x 90 cm) representing treatments were laid out longitudinally in each replicate, with a 25 cm ridge between each 2 beds. Each bed (treatment) contained 3 rows, 30 cm apart. On March 1st four 1 year old healthy and pest-free transplants of Arabian jasmine (*Jasminum sambac* (L.) Ait) with a height of 15-20 cm were planted in each row. In this way, each treatment comprised 12 plants, replicated 3 times. Each plant occupied an area of 30 x 30 cm^2.

One month later (April 1st) plants of each treatment were sprayed monthly with one of the following solutions:

1- A fungicide: Topsin M (thiophanate-methyl) at 2 g/l.
2- An insecticide: Rogor (Dimethoate) at 2 ml/l.

3- A nutritive solution: (MS basal salts described by Murashige and Skoog, 1962) at full strength.
4- Methanol (methyl alcohol) at 10% aqueous solution.
5- A combined treatment consisting of all the above mentioned treatments.
6- A spray of water only for the control treatment.

The two used pesticides were chosen for their systemic and wide spectrum effect. Plants started to flower in June and went on flowering till December. In winter, flowering decreased to a great extent and was resumed again in March, at which time a similar area of land were divided in the same way and new similar transplants were planted as a replication of the whole experiment (second season).

Data obtained in both seasons are:

1- Flower number
2- Flower fresh weight (g)
3- Flower diameter (cm)
4- Flower neck diameter (mm)
5- Plant height (cm)
6- Number of leaves
7- Branch number

Additional data, obtained in the second season only, are:

8- Chlorophyll a, b and carotenoids content (mg/100 g) according to Moran (1982)
9- Total carbohydrate % content according to O.A.C. (1995)
10- N, P and K % contents according to Jackson (1973)

These data were statistically analyzed using SAS 1995 computer program, and means were compared by L. S. D. method according to Snedecor and Cochran (1980).

Analysis of the nursery soil (mean of two seasons), carried out in the Horticulture Research Institute is shown in table (a).

Table (a): Analysis of the nursery soil (mean of two seasons)

Item	Unit	Mean values	Item	Unit	Mean values
Soil porosity	%	42.67	**soluble**	**cations**	
E. C.	(mmhos/cm)	1.42	N	%	0.65
pH		8.00	P	%	0.67
soluble	**anions**		K^+	meq/l	1.83
HCO_3^-	meq/l	4.24	Ca^{++}	meq/l	17.41
Cl^-	meq/l	10.70	Mg^{++}	meq/l	9.27
$SO_4^=$	meq/l	34.36	Na^+	meq/l	20.38

RESULTS

1 – Effect of treatments on flower number (table 1):

The effect of treatments on flower number was significant in both seasons as compared with the control. In the first season, flower number was significantly highest in plants treated with fungicide, methanol and "the combined treatment". The outcome of using the insecticide did not differ significantly from the previous results or from that of using the nutritive solution. Control plants gave the lowest significant flower number. In the second season, the highest significant record was achieved by applying "the combined treatment", followed without any significant difference by plants treated with methanol. Flower number of plants treated with the fungicide or insecticide were not significantly different from those produced by plants treated with methanol. Plants treated with the nutritive solution gave significantly lower number of flowers. However, control plants gave the significant lowest record.

In both seasons, plants treated with "the combined treatment" or methanol kept their rank in producing the significant highest number of flowers, while the control plants were the lowest.

Table (1) - Effect of treatments on flower number/plant

Treatments	Season 1	Season 2
Fungicide	10.67 a	9.38 b
Insecticide	9.67 ab	9.19 b
Nutritive solution	7.00 b	6.60 c
Methanol	10.00 a	10.27 ab
Combined treatment	11.33 a	11.00 a
Control	2.67 c	3.36 d
L.S.D. at 5%	2.73	1.36

2 – Effect of treatments on flower fresh weight(g) (table2):

The effect of treatments on flower fresh weight was significant in the second season only. In the first season, though the response was insignificant, Heaviest flowers were those produced by plants treated with methanol while the lightest ones were produced by the control plants.

In the second season, methanol treatment resulted in the significant heaviest flowers, followed with a significant difference by flowers of plants treated with nutritive solution, insecticide or fungicide. The later was not significantly different from flowers of the "the combined treatment", which in turn was insignificantly different in weight from the lightest flowers of the control plants.

Although significancy was confined to the second season only, heaviest fresh flowers were those produced by plants treated with methanol, while the lightest were those produced on the control.

Table (2) - Effect of treatments on flower fresh weight (g)

Treatments	Season 1	Season 2
Fungicide	0.61 ab	0.74 bc
Insecticide	0.76 ab	0.79 b
Nutritive solution	0.64 ab	0.81 b
Methanol	1.16 a	1.30 a
Combined treatment	0.38 b	0.40 cd
Control	0.21 b	0.18 d
L.S.D. at 5%	N.S.	0.34

3 – Effect of treatments on flower diameter (cm) (table 3):

In the first season, there was no significant effects were observed for the different treatments. In the second one, significant widest flowers were a result of applying methanol, however, nutritive solution, insecticide and fungicide gave flowers that were not significantly different.

Table (3) - Effect of treatments on flower diameter (cm)

Treatments	Season 1	Season 2
Fungicide	1.72 a	1.67 abc
Insecticide	1.85 a	1.72 abc
Nutritive solution	2.00 a	1.84 ab
Methanol	1.96 a	2.08 a
Combined treatment	1.36 a	1.30 c
Control	1.49 a	1.63 bc
L.S.D. at 5%	N.S.	0.42

Applying all treatments resulted in the smallest flowers significantly, although they were not significantly different from those of insecticide, fungicide and control treatments. In both seasons, "the combined treatment" resulted in the smallest flowers.

4 – Effect of treatments on flower neck diameter (cm) (table 4):

In both seasons, the effect of treatments on flower neck diameter was insignificant.

Table (4) - Effect of treatments on flower neck diameter (mm)

Treatments	Season 1	Season 2
Fungicide	1.30 a	1.28 a
Insecticide	1.32 a	1.35 a
Nutritive solution	1.23 a	1.27 a
Methanol	1.40 a	1.43 a
Combined treatment	1.53 a	1.39 a
Control	1.15 a	1.28 a
L.S.D. at 5%	N.S.	N.S.

5 – Effect of treatments on plant height (cm) (table 5):

In both seasons, plants treated with methanol or "the combined treatment" were significantly the tallest, while the untreated plants were significantly the shortest.

Table (5) - Effect of treatments on plant height (cm)

Treatments	Season 1	Season 2
Fungicide	64.47 b	67.57 ab
Insecticide	64.50 b	65.13 ab
Nutritive solution	66.90 b	58.45 bc
Methanol	75.29 a	70.11 a
Combined treatment	74.77 a	71.87 a
Control	45.65 c	50.62 c
L.S.D. at 5%	7.34	9.83

In the first season, plants treated with fungicide, insecticide or nutritive solution were not significantly different, and their heights were intermediate between the above-mentioned groups.

In the second season, plants treated with either fungicide or insecticide were not significantly different in height from those treated with methanol or with "the combined treatment" from one side, and from those treated with nutritive solution from the other side. The later group was also not significantly different in height from the control plants.

6 – Effect of treatments on number of leaves (table 6):

Plants treated with methanol or "the combined treatment" produced the highest significant number of leaves in both seasons of this study, while the control ones produced the lowest number in this concern. In the first season, plants treated with either fungicide or insecticide came significantly in the second order while those receiving the nutritive solution were ranked as the third order significantly. In the second season, number of leaves of plants treated with fungicide, insecticide or nutritive solution came significantly in the second, third and fourth orders, respectively.

Table (6) - Effect of treatments on leaf number

Treatments	Season 1	Season 2
Fungicide	247.11 b	259.94 b
Insecticide	244.00 b	221.23 c
Nutritive solution	192.36 c	186.70 d
Methanol	288.78 a	287.17 a
Combined treatment	278.00 a	294.39 a
Control	129.00 d	117.53 e
L.S.D. at 5%	18.84	12.05

7 – Effect of treatments on branch number (table 7):

The effect of treatments on branch number was significant in both seasons. Compared to the control plants, which had the significant lowest number of branches in both seasons, plants received "the combined treatment" produced the significant highest number in this concern. Branches of plants treated with methanol were significantly lower than those of the "the combined treatment" plants and higher than those of the control ones. Branch number of plants treated with either fungicide or insecticide was significantly lower than that of the previous group in the first season, followed with no significant difference by the corresponding record of plants received the nutritive solution. The later was also not significantly different from that of the lowest result of the control treatment. In the second season, next to the branch number resulted by the methanol treatment; the same character obtained by the fungicide treatment was significantly lower. The later was followed with no significant difference by outcome of the insecticide treatment. Branch number resulted by applying the nutritive solution was neither significantly different from that of the insecticide treatment nor from that of the control one.

Table (7) - Effect of treatments on branch number

Treatments	Season 1	Season 2
Fungicide	9.44 c	11.18 c
Insecticide	9.50 c	9.92 cd
Nutritive solution	8.41 cd	8.24 de
Methanol	15.83 b	14.17 b
Combined treatment	20.78 a	20.33 a
Control	6.50 d	7.27 e
L.S.D. at 5%	2.32	2.04

8- Effect of treatments on chlorophyll a and b leaf contents in the second season (mg/100 g) (table 8):

For both chlorophyll a and b the significant highest contents were found in plants treated with methanol. Exposing plants to "the combined treatment" resulted in the significant second highest contents of the two pigments. Plants of the control group and those treated with fungicide for chlorophyll b only, scored the lowest significant content, while those treated with insecticide or nutritive solution in addition to those treated with fungicide for chlorophyll a only were not significantly different from the later group or the second one.

Table (8): Effect of treatments on chlorophyll a and b leaf contents (mg/100 g) in the second season.

Treatments	Chlorophyll a (mg/100 g)	Chlorophyll b (mg/100 g)	Carotene (mg/100 g)
Fungicide	46.28 bc	2.85 c	1.46 a
Insecticide	38.11 bc	4.91 bc	1.36 a
Nutritive solution	40.83 bc	6.60 bc	1.69 a
Methanol	78.30 a	16.14 a	2.96 a
Combined treatment	53.95 b	9.40 b	1.97 a
Control	28.58 c	1.92 c	0.99 a
L.S.D. at 5%	19.67	5.80	N.S.

9- Effect of treatments on carotenoids content in the second season (mg/100 g) (table 8):

No significant effect was detected for the treatments on the carotenoids content. Despite this fact, the highest content was induced by the methanol treatment, while the lowest was a found in the control plants.

10- Effect of treatments on total carbohydrate % in the second season (table 9):

Percentage of total carbohydrate was significantly influenced by the treatments used in this study. Compared to the control plants, other treatments resulted in significant higher contents, with no significant difference in between.

Table (9): Effect of treatments on total carbohydrate % and N % in the second season

Treatments	total carbohydrate%	N%
Fungicide	25.65 a	1.15 cd
Insecticide	26.57 a	1.51 bc
Nutritive solution	29.36 a	2.21 a
Methanol	27.97 a	1.76 ab
Combined treatment	32.63 a	2.12 a
Control	15.84 b	0.94 d
L.S.D. at 5%	7.13	0.51

11- Effect of treatments on N % in the second season (table 9):

Differences between the nitrogen content of plants belonging to different treatments were statistically significant. The highest content was a result of using either the nutritive solution or "the combined treatment", while the lowest one was found in the control plants.

12- Effect of treatments on P and K % in the second season (table 10):

Percentages of both P and K were significantly different among the different treatments. Plants received "the combined treatment" had the highest content of both nutrients, while those of the control treatment (for both nutrients) and the fungicide treatment (for P only) achieved the lowest values.

Table (10) - Effect of treatments on P % and K% in the second season

Treatments	P%	K%
Fungicide	0.18 d	1.04 b
Insecticide	0.30 bc	0.95 bc
Nutritive solution	0.25 c	1.03 b
Methanol	0.33 b	0.91 c
Combined treatment	0.40 a	1.13 a
Control	0.15 d	0.81 d
L.S.D. at 5%	0.05	0.08

DISCUSSION

The highest N content achieved by the nutritive solution treatment might be explained by the effect of foliar fertilization on the chemical composition and nutrient content that was proven by many workers. Ishag (1992) stated that applying foliar trace element fertilizers, Wuxal, Polymicra and Bayfolan 11-8-6, each containing Fe, Zn, Mn, B, Cu, Mo and Co on cotton (*Gossypium barbadense* cv. Barakat and *G. hirsutum* cv. Shambat-B) increased leaf N concentration. Alan and Padem (1994) applied the foliar fertilizers Nutri-leaf, Polarosate, Nitrozyme, Bayfolan, Vitaminate, Phosamco 4, Nutramin and urea to spinach cv. Matador leaves. They remarked that the highest mean N concentration occurred with urea, the highest mean P and K concentrations with Nutri-leaf.

Fertilization of ornamental plants in generaal and *Jasminum sambac* in particular proved beneficial for plant growth and development. Mousa (1979) mentioned that flower numbers of rose plants were markedly increased by foliar applications of liquid fertilizers, the best results being obtained with Bayfolan or Foli-Fertil. Flower fresh weights were increased by Nutrin. Shalaby *et al* (1989) found that the total flower yield of *Jasminum sambac* in Egypt was highest on plots receiving 450 kg N/ha as ammonium sulphate. Hugar and Nalawadi (1994) reported that applying 60 g N + 120 g P + 120 g K/*Jasminum auriculatum* plant resulted in maximum number of sprouts/plant, longer primary shoots, a moderate number of leaves/primary shoot, maximum number of productive shoots, higher length and diameter of the flower bud at peak harvest, higher test weight, maximum number of flowers/plant and flower yield. Qasim *et al* (2003) reported that leaf N content, number and fresh weight of flowers/ *Jasminum sambac* plant and flower yield were maximum with 20 g N/plant, whereas vegetative growth (number of leaves per plant, leaf area and plant height) was maximum with 30 g N/plant.

In spite of the importance of *Jasminum sambac* as an ornamental plant much sought of in the gardens for its beloved fragrant flowers and its participation in introducing hard currency as a return for exporting its concrete oil yields, problems encountered in producing this plant or other species of the genus *Jasminum* on a large scale due to pests were rarely studied in Egypt and no prophylactic or curative programs were adopted routinely. Consequently, it is not astonishing for Arabian jasmine plants to suffer deterioration. Our approach of this study postulates that this deterioration might be attributed to nutrition, diseases, pests or a combination of them. Thus, a prophylactic measure of monthly spraying with the above-mentioned substances was adopted.

Although the fungicide treatment did not achieve a characteristic result, its participation in the combined treatment might add to the superiority of the last treatment. The impact of fungal diseases on plants in general and Arabian jasmine in particular was ascertained by a lot of researchers. Hilal *et al* (1987) stated that root and basal stem rots of jasmine cause 15-24% loss of cuttings and 5-13% loss of plants less than 1.5 years old in Egypt. The most commonly isolated fungi associated with infected plants and cuttings were *Botryodiplodia spp.*, *Fusarium solani* and *Macrophomina phaseolina*. The most virulent pathogens on the cuttings were *Fusarium moniliforme* (*Gibberella fujikuroi*), *Fusarium oxysporum* and *Pythium sp.*, followed by *Rhizoctonia solani*. These rots were most effectively controlled by Benlate (benomyl), Rovral (iprodione), Thiram or Topsin M (thiophanate-methyl). Planting cuttings in nursery soil treated with Benlate, Botran (dicloran), Rovral or Topsin M increased healthy survival.

Zhuang (1993) and Jite and Tressa (1999) mentioned that the presence of *Uromyces hobsoni* (Basidiomycotina) was reported on *Jasminum seguinii* and *Jasminum grandiflorum*, respectively. Alice *et al* (1996) observed that jasmine root rot caused by *Macrophomina phaseolina* (Eumycota) could be controlled by carbendazim. Parameswaran *et al* (1996), Thammaiah *et al* (1997) and Narayan *et al* (2001) reported the presence of *Cercospora jasminicola* (*Cercospora jasminae*, *Pseudocercospora jasminicola*), Order: Ascomycotina in diseased jasmine (*Jasminum sp.*) plants. *Jasminum* *grandiflorum* and *J. multiflorum* were highly susceptible to this leaf spot disease They found that carbendazim (Bavistin), Benomyl (Benlate), captafol (Foltaf 80 WP) and zineb (Dithane Z-78 75 WP) also resulted in significant disease control.

Parameswaran *et al* (1996) and Korade *et al* (2001) stated that *Colletotrichum gloeosporioides* (*Glomerella cingulata*), Order: Ascomycotina, caused anthracnose disease in jasmine (*Jasminum sp.*) plants. *Jasminum sambac* was among the host range of this pathogen. Infection predominantly developed on leaves resulting in their premature drying. They stated that Bordeaux mixture, copper oxychloride and triadimefon were the most effective fungicides. Carbendazim (Bavistin), Benomyl (Benlate), captafol (Foltaf 80 WP), mancozeb, zineb (Dithane Z-78 75 WP), ziram and chlorothalonil resulted also in significant disease control.

Thammaiah *et al* (1997), Ramamoorthy *et al* (2000), Meena *et al* (2001), Maheswari *et al* (2002) and Meena and Muthusamy (2002) declared that sclerotial wilt of jasmine (*Jasminum sambac*) incited by *Sclerotium rolfsii* (*Corticium rolfsii*), Class: Basidiomycetes is a serious menace causing complete death of seedlings and grownup plants.

Meenu *et al* (1998) collected a new species of *Corynespora* (Deuteromycotina), i.e. *C. jasminiicola* occurring on *Jasminum arborescens*. Ann *et al* (1999) reported that brown root rot caused by *Phellinus noxius* (Basidiomycotina) is one of the most important root diseases of woody trees. They ascertained that Arabian jasmine (*Jasminum sambac*) was highly susceptible to the pathogen. Lechat (2002) stated that *Jasminum* was found to be a host plant for *Nectria aurigera* (Ascomycotina). Abbasi (2003) and Ale-Agha *et al* (2003) remarked that the rust fungus *Puccinia jasmini* (Teliomycetes) was detected on *Jasminum sp.*

Applying a routine prophylactic insecticide spray was one of the treatments that resulted in the highest value of carbohydrate content. Early protection of jasmine plants may explain this finding, as insects are undoubtedly the most common pests of all plants. In addition, it worth mentioning that insects act as the vector for transmitting most of the viral diseases. Shukla and Sandhu (1988), Amutha and David (1997) and Vanitha and Dhandapani (2004) reported that *Nausinoe geometralis* (Order: Lepidoptera) was found to be a destructive pest, causing a heavy damage to the foliage of 4 species of jasmine, i.e. *Jasminum sambac*, *J. grandiflorum*, *J. pubescens* and *J. auriculatum*.

Dhandapani *et al* (1989), Chandramohan and Manoharan (1990), Amutha and David (1995) and Vanitha and Dhandapani (2004) reported that the budworm (*Hendecasis duplifascialis*, Order: Lepidoptera) caused damages to plants of jasmine (*Jasminum sambac*). Cypermethrin was the most efficacious, followed by deltamethrin and diflubenzuron in reducing infestation. FMC 35001 (carbosulfan) and monocrotophos were effective. Endosulfan alone or alternated with fenvalerate were also recommended.

El-Borollosy *et al* (1990), Sundararaj and David (1990) and Medina-Gaud *et al* (1991) stated that *Jasminum sambac* and *J. multiflorum* plants were the most preferred plants for the whitefly *Dialeurodes kirkaldyi* and *D. vulgaris* (Order: Homoptera). Liu and Sengonca (1997 and 1998), Sengonca and Liu (1997 and 1998) and KangMei *et al* (1998) observed that another whitefly *Aleurotuberculatus takahashi* (Order: Homoptera) is one of the major pests of jasmine (*Jasminum*) plantations.

Vasundhara *et al* (1990) and Dhandapani *et al* (1992) stated that the mealy bugs *Rastrococcus iceryoides* and *Planococcus lilacinus* (Order: Homoptera) was observed infesting leaves of *Jasminum auriculatum* and *J. rigidum*. They remarked that the lowest populations of these pseudococcids were recorded with the use of monocrotophos.

David *et al* (1992) declared that an unidentified species of jasmine blossom midge (*Contarinia sp.*, Order: Diptera) causes purple discoloration and drying of flower buds in *Jasminum sambac*. The lowest percentage of discoloured buds was observed on bushes treated with monocrotophos, followed by bushes treated with cypermethrin.

Yuan (1992) observed that *Caloptilia cuculipennella* (Order: Lepidoptera) was found on *Jasminum spp.* ChunCai *et al* (1996) reported the presence of *Ceroplates japonicus* (*Ceroplastes japonicus*) (Order: Homoptera) on jasmine.

Pinto and Salerno (1998) reported that there was a crop damage caused by *Metcalfa pruinosa* (Order: Homoptera) on jasmine. Gargani (1999) stated that *Palpita unionalis* (Order: Lepidoptera) caused damage to *Jasminum sp.* SanAn (2000) stated that *Jasminum nudiflorum* is among the host plants of *Phenacoccus perillustris* (Order: Homoptera). Nikolashvili (2001) observed the presence of citrus mining moth *Phyllocnistis citrella* on jasmine. Dziedzicka and Karnkowski (2002) mentioned that of the many insect pests imported incidentally with plant material from warmer countries, is *Pseudaulacaspis pentagona* (Order Hemiptera) on jasmine plants imported from Egypt. Conti *et al* (2003) remarked that *Jasminum frutificans* (*J. fruticans*) is one of the most alternative host plants for citrus thrips species such as *Pezothrips kellyanus*, *Thrips flavus*, *Thrips tabaci* and *Frankliniella occidentalis*. Kamel *et al* (2003) mentioned that in Egypt, plants of *Jasminum sp.* were infested with eleven armored scale insect species (diaspidids), e.g. *Chrysomphalus aonidum*, *Aonidiella aurantii* and *Parlatoria oleae*.

Mites and red spiders also can represent a serious problem to jasmine plants. Fortunately, Rogor (Dimethoate) used in this study can be used against them. Mallikarjunappa *et al* (1991), Mallapur and Kubsad (2000) and Umapathy and Rajendran (2000) found that *Jasminum auriculatum* was infested with the eriophyid *Aceria jasminae* (*A. jasmini*) mites throughout the year. Treatments with ethion, fenpropathrin, dicofol, ethion + dimethoate, carbofuran, phorate or endosulfan were effective. Rajkumar *et al* (2005) observed the presence of the red spider mite, *Tetranychus urticae*, on jasmine (*Jasminum sambac*).

The highest records of flower number, flower fresh weight, plant height, number of leaves, chlorophyll a, b and carbohydrate contents achieved by the methanol treatment were on par with the findings of some workers. When Swaminathan *et al* (1999) sprayed *Jasminum sambac* bushes with methanol at 10, 20 and 30% (25 days after pruning and 20 days later), they found that methanol at 10% gave the highest number of flowers/plant, total weight of flowers/plant and total yield/hectare. Petridou et al. (2001) studied the effect of methanol and ethanol on retarding senescence of the leaves of cut chrysanthemum (*Dendranthema grandiflora*) [*Dendranthema morifolium*] cv. Reagan White cut flowers. They stated that the two substances tested extended the vase life, limited fresh weight loss and increased chlorophyll content. Methanol applied continuously increased quantum yield of photosynthesis in the leaves. The effect of methanol could be explained in the light of the findings of Gout *et al* (2000) who used ^{13}C-NMR to demonstrate that [^{13}C]methanol readily entered sycamore (*Acer pseudoplatanus* L.) cells to be slowly metabolized to [3-^{13}C]serine, [$^{13}CH_3$]methionine, and [$^{13}CH_3$]phosphatidylcholine. They conclude that the assimilation of [^{13}C]methanol occurs through the formation of $^{13}CH_3H_4$Pte-glutamate (Glu)$_n$ and *S*-adenosyl-methionine, because feeding plant cells with [3-$^{13}CH_3$]serine, the direct precursor of $^{13}CH_2H_4$Pte-Glu$_n$, can perfectly mimic [$^{13}CH_3$]methanol for folate-mediated single-carbon metabolism. On the other hand, the metabolism of [^{13}C]methanol in plant cells revealed assimilation of label into a new cellular product that was identified as [$^{13}CH_3$]methyl-β-D-glucopyranoside. The de novo synthesis of methyl-β-D-glucopyranoside induced by methanol did not require the formation of $^{13}CH_3H_4$Pte-Glu$_n$ and was very likely catalyzed by a "transglycosylation" process.

At the end of each season, plants receiving the combined treatment were healthier and apparently free of pests.

It is recommended to pay more attention to Arabian jasmine (*Jasminum sambac*) plants through routine prophylactic programs of nutrition and pest control in order to get better vegetative growth and flowering of these plants of great importance in landscape as well as for use as a supreme fragrant cut flower.

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إجراءات وقائية لتحسين إنتاج الأزهار فى نباتات الفل

فيصل محمد عبد العليم سعداوى ، سميرة صالح ، صلاح عبد العزيز جمعة
قسم بحوث نباتات الزينة ، معهد بحوث البساتين ، مركز البحوث الزراعية ، الجيزة ، مصر

تم رش نباتات فل عمر سنة وإرتفاع ١٥-٢٠ سم شهريا بأحد المحاليل التالية :

١ – مبيد فطرى: توبسين بتركيز ٢ جم/لتر.
٢ – مبيد حشرى: روجور (دايمثويت) بتركيز ٢ ملل/لتر.
٣ – محلول مغذى: أملاح بيئة موراشيج وسكوج بالقوة الكاملة .
٤ – ميثانول بتركيز ١٠% (محلول مائى)
٥ – معاملة مشتركة (بجميع المعاملات السابقة) .
٦ – الرش بالماء فقط لنباتات الكنترول .

يمكن تلخيص الإتجاه الثابت على مدى سنتى الدراسة لنتائج هذه التجربة ما يلى :

كان تعريض النباتات للمعاملة المشتركة سببا فى التوصل لأعلى قيمة من حيث عدد الأزهار ، إرتفاع النبات ، عدد الأوراق ، عدد الأفرع ، محتوى النبات من الكربوهيدرات والنيتروجين والفوسفور والبوتاسيوم . ومع ذلك فان بعض هذه النتائج العالية لم يكن مقصورا على " المعاملة المشتركة " فقط . فقد كانت المعاملة بالميثانول مسئولة أيضا عن أعلى النتائج من حيث عدد الأزهار ، وزن الأزهار الرطب ، إرتفاع النبات ، عدد الأوراق ، محتوى النبات من كلوروفيل " أ " و"ب" والكربوهيدرات . ونتج أعلى محتوى من الكربوهيدرات من المبيد الفطرى أو المحلول المغذى أو من المعاملة بالمبيد الحشرى . وتسببت معاملة المحلول المغذى أيضا فى إنتاج أعلى محتوى من النيتروجين .

تسببا معاملة الكنترول فى أقل قيمة لعدد الأزهار ، الوزن الطازج للأزهار ، إرتفاع النبات ، عدد الأوراق ، عدد الأفرع ، محتوى كلوروفيل " أ " و"ب" والكربوهيدرات والنيتروجين والفوسفور والبوتاسيوم .

ومن ناحية أخرى ، فإن قطر عنق الزهرة ومحتوى النبات من الكاروتين لم تتأثر بدرجة معنوية بأى من المعاملات المذكورة .

ويوصى هذا البحث بأن نولى المزيد من الإهتمام لنباتات الفل عن طريق عمل برامج وقائية منتظمة للتغذية ومقاومة الآفات وذلك حتى نحصل على أفضل نمو خضرى وزهرى لهذه النباتات ذات الأهمية الكبيرة فى تنسيق الحدائق وكذلك لتصدير الزيوت العطرية التى تدخل فى صناعة العطور .