Reevaluation of Factors Affecting Date Bunch Wilt and Dry Disorder (DBWD)

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Abstract

Agriculture and climate change are internally correlated with each other in various aspects, as climate change is the main cause of biotic and abiotic stresses The land and its agriculture are being affected by climate changes in different ways like Date palm bunch wilt and dry disorder (DBWD), the cause of which remains unknown, is among the most harmful disorders in recent years. No research has been done to identify the main factor of the physiology disorder affecting date production and quality. This research was conducted for duration of two years, 2020 and 2021 seasons on palm groves of "Saidy" afflicted with (DBWD). The experimental site was chosen to study the effect of essential nutrients application by addition of balanced amounts of macro and micro-nutrients (T1) were applied on the basis of soil and leaf analysis. as well as spraying potassium silicate at 10 mL /L water (T2) and salicylic acid at 100 ppm (T3) and the interactions between them on Date Bunch Wilt and Dry disorder (DBWD) Results declared that single and combined applications of the three treatments (T1, T2 andT3) were very effective, as it caused a decrease in the percentage of Date palm bunch Wilt and Dry disorder, and showed a remarkable promotion on bunch weight, yield as well as physical and chemical characteristics of the fruits in comparison with the control treatment (T0). The promote effects of these treatments on the investigated parameters could be arranged as follows in descending order T1, T3, and T2. The combined application of these treatments was superior than using each alone in this respect.

Keywords: Date bunch wilt, dry disorder, potassium silicate, yield, salicylic acid, Saidy date palm cultivar

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Introduction

Date palm (*Phoenix dactylifera* L.) cultivation is centered in a rainless belt of the deserts south of the Mediterranean Sea and in the southern fringes of the Middle East, from south Iran in the east to the Atlantic coast of North Africa in the west All over these hot deserts, a date palm oasis still is a welcome sight, where water and shade are available, (Jaradat and zaid 2004). Trees growth, nutritional status, and cropping in different date palm cvs are obviously affected by various biotic and abiotic stresses as well as nutritional factors and physiological changes. The yield redaction of "Saidy" date palms grown in the New Valley region in Egypt is considered a major problem that faces farmers. Date bunch wilt and dry disorder (DBWD) occurs in different places, causing extensive damages to palm groves. No pathogen has been recognized for this disease as yet, but it has become evident that it

appears most when there are seasonal hot winds and severe dry weather (Panahi, 2000). In affected trees, fruits are dried and crumpled during the process of change of Khelal (when fruits are physiologically mature, hard and, crisp, with moisture content about 50-58%, bright yellow or red in color) to Rutab (partially browned, reduced moisture content to about 30-45%, fibers softened). Also, in the junctions of strands to axis in the main bunch, brown spots and cracks are formed. Because of the sudden dry disorder of the unripe fruit, severe waste and damage is inflicted upon date production (Saleh, 2005) Finding out recent methods for promoting the yield of date palms under such regions is an important task for pomologists. Little research has been done on the suppression of DBWD, but suitable management of palms nutrition is thought to probably decrease the intensity of the disease and even control it. Studies show that the disease occurs most when the plant is exposed to abiotic stress, ie Inadequate mineral in the soil, water- logging, Drought , Soil Salinity, - High or low temperature, Too much or too little light, as well as Phytotoxic compounds (Ozone). Stress causes damage to the fruit which is the most sensitive part of the palms especially in the stage of changing from Khelal to Rutab when dates carry the highest moisture content. At this stage, an increase of salt concentration in the sap can reduce the vulnerability of plant cells. Calcium is an example, plays this role well among various nutrient elements in plants. Also, potassium additions would increase plant resistance by helping it to keep more moisture in its tissues (El- Hammady *et al*., 1991; Malakouti, 1995 and Panahi, 2000). Silicon plays an important role in increasing and enhancing with standing of fruit crops to biotic and abiotic stresses, photosynthesis, nutrient and water uptake, plant pigments and all cell division (Epstein, 1999 and Ma, 2004). The beneficial effects of silicon on forming double layers on plant tissues, as well as its roles as an antioxidant could explain its effect on protecting the trees from higher transpiration rates and the incidence of different disorders (Melo *et al*., 2003 Boukachabine *et al*., 2011). Application of a balanced fertilizer to palm trees, consisting of nitrogen, phosphorus, potassium, and magnesium in a 2:1:3:1 ratio produced the highest yields. Sulfur, copper-zinc and boron can also be effective in increasing date yield (Shahrokh, A. 1998; Timothy and Merow 1999). The above-mentioned reports indicate that using essential macro and micronutrient elements could improve date yield and fruit quality. Because DBWD disorder has a diverse effect on yield and fruit quality in date palm, Saleh, 2009). Plant growth and development are hampered by various biotic and abiotic stress factors. Detection of compounds capable of reducing these stresses is of great importance from both theoretical and practical points of view. Salicylic acid compounds play an important role in developmental processes and some of them have key roles in mechanism leading to acclimation for changing environments. Salicylic acid has long been known as a signal molecule in the induction of defense mechanisms in plants .It also participates in signaling during abiotic stresses (Raskin, 1992 and Shah, 2003, Harvath *et al*., 2007 and Szepesi *et al*., 2009). So the aim of the current study is to evaluate the effect of some nutrients as well as potassium silicate and salicylic acid spraying on Date palm bunch wilt and dry disorder and fruiting of saidy date palm under New valley conditions.

Materials and methods

Plant materials

This study was conducted during 2020 and 2021 seasons in a private date palm orchard situated at El-Kharga Oasis, New Valley Governorate, Egypt, on 26 years old "Saidy" as semi dry dates 24 palms are uniform in vigour, healthy, good physical conditions, free from insects, diseases and damages were selected planted at 7x7 meters apart and irrigated with well water through surface irrigation system. The texture of the tested soil is sandy loam. Soil analysis done according to Wilde *et al*., (1985) and the obtained data are illustrated in Table (1).

Table (1): Mechanical, physical and chemical analysis of the tested orchard soil.

Characters	Values
Sand %	82
Silt %	11.5
Clay %	6.5
Texture	Sandy
grade	loam
pH (1: 2.5 extract)	8.31
E.C (1: 2.5 extract) (mmhos /1cm)	0.40
CaCO3 %	4.0
O. M. %	1.96
Total N %	0.13
Available p ppm (Olsen method)	2.92
Available K ppm (ammonium acetate)	91.00

All the selected palms received the common and usual horticultural practices that already applied in the orchard except those dealing as follows:

1. Control (common fertilization) (T0).
2. Addition of balanced amounts of macro and micro-nutrients (T1).
3. Spraying potassium silicate at 10 ml / L water (T2).
4. Spraying of salicylic acid at 100 ppm / L water (T3).
5. Addition of balanced amounts of macro and micro-nutrients plus spraying potassium silicate at 10 ml / L water (T4).
6. Addition of balanced amounts of macro and micro-nutrients plus spraying salicylic acid at 100 ppm /1 L water (T5).
7. Spraying potassium silicate at 10 ml /1 L water plus spraying salicylic acid at 100 ppm (T6).
8. Addition of balanced amounts of macro and micro-nutrients plus spraying potassium silicate at 10 ml /1 L water plus spraying salicylic acid at 100 ppm/1 L water (T7).

Common fertilizer it was done by adding 4 kg urea + 3 kg super phosphate + 1 kg potassium sulfate.

Balanced fertilizer it was done by addition of balanced amounts of macro and micro-nutrients were applied on the basis of soil and leaf analysis, consisting of nitrogen, phosphorus, potassium, and magnesium in a 2:1:3:1 ratio. As well as Sulfur, copper, manganese, zinc, iron and boron

Each treatment was replicated three times, one palm per each. Spraying times was in mid-May until the first of July. An average of every fifteen days (4 spraying) It is worth to mention that salicylic acid didn't dissolve in water but it dissolved easily in ethyl alcohol. Triton B as a wetting agent was added at 0.05 % to all salicylic acid solutions. The experiment was arranged in a randomized completely block design including eight treatments with three replications,

1. **Date palm bunch Wilt and Dry disorder (DBWD) (%)**
   In order to calculate date bunch Wilt and Dry disorder, 50 fruits were picked randomly from four bunches in four direction of each palm.
2. **Bunch weight and yield / palm:** All bunches were harvested at tamer stage. The bunch weight (kg) was determined then the average yield/palm (kg) for each treatment was recorded
3. **Fruit characteristics:** At harvest time, sample of 30 fruits were picked at random from each bunch for determination of some physical and chemical fruit properties.
   a. **Physical properties included:** Fruit weight (in g), Fruit moisture content (expressed on the fresh weight basis),
   b. **Chemical properties included:** total soluble solids (T.S.S. %): it was determined by using hand refractometer according to A.O.A.C. (2000).

Statistical analysis

Data were subjected to statistical analysis according to the procedure reported by Gomez and Gomez (1984) and Snedecor and Cochran (1990). Treatments means were compared by the least significant difference test (L.S.D.) at the 5% level of probability in the two experimental seasons.

RESULTS and discussion

1. Bunch Wilt and Dry disorder percentage

Data in Table (2) clearly show that single applications of the three treatments (fertilization balanced amounts of macro and micro-nutrients (T1) , spraying potassium silicate at 10 ml / L water (T2) and salicylic acid at 100 ppm (T3) as well as combined applications as double form (T4,5,6) and thrice form (T7)significantly decrease in Bunch Wilt and Dry disorder percentage compared with the check treatment T0 The decreasing effects of these treatments with disorder percentage on could be arranged as follows in descending order T1, T3, and T2. The combined application of these treatments was superior them using each alone in this respect. The minimum values in bunch wilt and dry disorder percentage

Was recorded on the palms that received thrice form (T7).The maximum values in Bunch Wilt and Dry disorder percentage were recorded on untreated palms (T0) A similar trend was observed during both seasons These results are in agreement with those obtained by (Saleh, 2009; Izadi and Shahsavar, 2015; Epstein, 1999; Izadi and Aslmoshtaghi, 2015; Ma, 2004; El- Hammady, *et al*., 1991; Malakouti, 1995; Raskin, 1992 and Panahi, 2000).

Table (2): The effect of fertilization balanced amounts of macro and micro-nutrients, spraying potassium silicate and salicylic acid on DBWD percentage during 2020 and 2021 seasons.

Treatments	DBWD %			
	2020	2021	Mean	Decrement %
Control (T_0)	51,33	45.72	48.53	0.00
(T_1)	7.26	6,44	6.85	85.89
(T_2)	23.00	21.83	22.42	53.80
(T3)	9.46	8,55	9.01	81.43
(T_4)	6.00	5.36	5.68	88.30
(T_5)	5.22	4.91	5.07	89.55
(T_6)	9.11	8.37	8.71	82.05
(T_7)	3.50	3.00	3.25	93.30
L.S.D. 5%	5.15	4.37		

2. Fruit weight, Bunch weight and yield per palm

Data in Table (3) show the effect of fertilization balanced amounts of macro and micro-nutrients and spraying potassium silicate as well as spraying salicylic acid on yield Component of Saidy cv. date palm during 2020 and 2021 seasons. Results declared that all single or twice or thrice form applications were very effective caused a remarkable promotion in Fruit weight, Bunch weight and yield per palm compared with the control treatment (T0) The maximum values in yield were recorded on the palms that received thrice form (T7). The minimum values were recorded on untreated palms (T0) was accompanied with improving fruit quality in terms of increasing fruit weight, relative to the check treatment. The stimulation on quality of the fruits was associated with using T1, T3 and T2 in ascending order. Combined applications of these treatments were favorable than single ones in enhancing fruit quality. Significant differences on these parameters were observed among all treatments. The best results with regard to quality of the fruits were obtained with using all treatments (T1, T2 and T3) together. Untreated palms with these treatments gave unfavorable effects on fruit quality at is above from the data that results took a similar trend true during both seasons. The profit of these treatments on the growth and nutritional status of the plants surely reflected on improving yield per palm. These results are in harmony with those obtained by (Ahmed, 2011; Abdel-Galil *et al*., 2014, El-Salhy *et al*., 2021, Ahmed *et al*., 2003; Gobara, 2004; and Ahmed *et al*., 2007).

Table (3): The effect of fertilization balanced amounts of macro and micro-nutrients, spraying potassium silicate and salicylic acid on fruit weight (g), bunch weight (kg.) and Yield (kg) during 2020 and 2021 seasons.

Treatments	Fruit weight (g)		Bunch weight (Kg)		Yield (Kg)		
	2020	2021	2020	2021	2020	2021	Increment %
Control (T_0)	8.78	8.72	5.71	6.35	72.22	80.50	0.00
(T_1)	10.12	9.64	8.32	8.88	92.73	107.48	31.10
(T_2)	9.16	9.16	7.60	7.39	81.14	88.32	10.96
(T3)	9.23	9.22	7.12	7.65	84.65	88.00	13.06
(T_4)	10.05	9.81	8.40	8.63	98.33	104.07	32.53
(T_5)	10.41	9.98	8.38	8.80	98.82	107.26	34.94
(T_6)	9.51	9.24	7.45	7.85	84.37	90.32	14.39
(T_7)	10.44	10.18	8.33	9.46	103.45	111.18	40.54
L.S.D. 5%	0.40	0.36	0.72	0.93	11.81	8.4	

3. Date of harvesting

Data in Table (4) show the effect of fertilization balanced amounts of macro and micro-nutrients (T1) as well as spraying potassium silicate at 10 ml / L water (T2) and salicylic acid at 100 ppm (T3) that single and combined applications on date of "Saidy" dates harvesting during 2020, and 2021 seasons. It is worth to mention that the results reacted almost similarly during two studied seasons. The obtained data clearly show that there was a wide variation on harvest date start as response to used fertilization balanced treatment spraying potassium silicate at 10 ml/L water and salicylic acid at 100 ppm. The fruits started to harvest at second week of September and continued up end of it. As a general view it can be noticed that all fertilization treatments (T1, T4, T5 and T7) as well as spraying potassium silicate (T2) were materially advanced the harvest date compared to control (farmer treatment) (T0). So, it can be said that the treatments were able to activate the process of fruit ripening and induce markedly early harvesting On the other hand, spraying salicylic acid (T3 and T6) caused late the harvest date The effect of the plant hormone salicylic acid (SA) is attributed to the low levels of production of ethylene, which is the plant hormone responsible for the ripening of Climacteric fruits, which is known as the ripening hormone (Ecker, 1995 and Babalar, 2007)**.** Most researches indicated that treating fruits with salicylic acid reduced respiration by inhibiting ethylene and increasing antioxidant activity in fruits (Muntaha *et al*., 2012)

Table (4): The effect of fertilization balanced amounts of macro and micro-nutrients, spraying potassium silicate and salicylic acid on ripening date**,** fruit moisture % and T.S.S %, of Saidy date palm cultivar during 2020 and 2021 seasons.

Treatments	Ripening date				Fruit moisture (%)		T.S.S (%)	
	2020	2021	Mean	Earliest	2020	2021	2020	2021
Control (T_0)	25 \ 9	23	24	0.0	14.37	14.82	77.95	78.15
T_1	13	9	11	13.0	12.70	12.83	80.35	80.1
T_2	20	18	19	5.0	13.32	13.69	78.85	78.95
T_3	30	26	28	- 4.0	13.15	13.80	80.8	79.9
T_4	14	8	11	13.0	12.81	13.26	81.1	80.4
T_5	20	16	18	6.00	12.43	13.36	81.55	80.55
T_6	28	26	27	- 3.0	13.32	13.55	81.5	80.4
T_7	11	9	10	12.00	12.57	12.74	81.95	81.65
L.S.D. 5%					0.66	0.51	1.35	1.18

4. Fruit moisture and total soluble solids

Data in Table (4) show the effect of fertilization balanced amounts of macro and micro-nutrients (T1) as well as spraying potassium silicate at 10 ml/L water (T2) and salicylic acid at 100 ppm (T3) that single and combined applications on the percentage of moisture and total soluble solids in pulp of Saidy cv. date during 2020, and 2021 seasons. As a general view it can noticed that using balance fertilization as well as spraying potassium silicate at 10 ml/L water (T2) and salicylic acid were accompanied by improving the fruit quality in terms of increasing total soluble solids and decreasing the moisture contents compared to control (T0).

Conclusions

The following conclusions can be drawn from the study

Single and combined applications of the three treatments (essential nutrients application by addition of balanced amounts of macro and micro-nutrients T_1, Spraying potassium silicate at 10 ml /L water T_2 and Spraying of salicylic acid at 100 ppm/L water T_3) were very effective as they caused a decrease in Date palm bunch Wilt and Dry disorder percentage and a remarkable promotion on bunch weight, yield as well as physical and chemical characteristics of the fruits.

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إعادة تقييم العوامل المؤثرة على اضطراب ذبول وجفاف سوباطات التمر (DBWD)

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الملخص العربي

ترتبط الزراعة وتغير المناخ ارتباطًا وثيقًا ببعضهما البعض في جوانب مختلفة، حيث أن تغير المناخ هو السبب الرئيسي للضغوط الحيوية وغير الحيوية. وتتأثر الأرض وزراعتها بالتغيرات المناخية بطرق مختلفة مثل ذبول سوباطات النخيل واضطراب الجفاف (DBWD)، والذي لا يزال سببه مجهولاً، وهو من بين أكثر الاضطرابات ضرراً في السنوات الأخيرة. لم يتم إجراء أي بحث لتحديد العامل الرئيسي للاضطراب الفسيولوجي الذي يؤثر على إنتاج التمور وجودته. أجري هذا البحث لمدة عامين، موسمي ٢٠٢٠ و ٢٠٢١ على بساتين النخيل صنف الصعيدي المصابة بمرض (DBWD). تم اختيار الموقع التجريبي لدراسة تأثير إضافة العناصر الغذائية الأساسية عن طريق إضافة كميات متوازنة من العناصر الغذائية الكبرى والصغرى (T1) على أساس تحليل التربة والأوراق. وكذلك رش سيليكات البوتاسيوم بتركيز ١٠ مل / لتر ماء (T2) وحامض الساليسيليك بتركيز ١٠٠ جزء في المليون (T3) والتفاعلات بينهما في مرض ذبول وجفاف سوباطات التمر (DBWD) بينت النتائج أن التطبيقات المفردة والمركبة للمعاملات الثلاث وكانت (T1 وT2 وT3) فعالة جداً، إذ تسببت في إنخفاض نسبة مرض ذبول وجفاف سوباطات النخيل، كما أظهرت ارتفاعاً ملحوظاً في وزن السوباطة والمحصول وكذلك الصفات الفيزيائية والكيميائية للثمار مقارنة مع معاملة المقارنة (T0) يمكن ترتيب التأثيرات المعززة لهذه المعالجات على المعاملات التي تم فحصها على النحو التالي بالترتيب التنازلي T1 وT3 وT2. وكان التطبيق المشترك لهذه العلاجات أفضل من استخدام كل منها على حدة في هذا الصدد.

الكلمات الدالة: ذبول سوباطات التمر، اضطراب الجفاف، سيليكات البوتاسيوم، حمض الساليسيليك، المحصول، صنف نخيل التمر الصعيدي