J. Agr. Sci. Tech. (2009) Vol. 11: 323-329

Decreasing the Intensity of Date Bunch Wilt and Dry Disorder (DBWD) by Using Balanced Proportions of Nutrient Elements

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ABSTRACT

There are more than 37,000 hectares of land cultivated with date palm in Hormozgan Province producing around 145,000 tons of date annually. Therefore, increasing date yield and quality can render positive effects, especially on farmers' income in the region. One of the most important agricultural practices is mineral nutrition and soil fertility management that can improve yield and fruit quality of date palm. This research was conducted for a duration of three years to study the effect of essential nutrients application on Date Bunch Wilt and Dry disordr (DBWD) which has caused large production reductions in recent years. Two palm groves of "*Mordasang*" cultivar were chosen as experimental sites. One was afflicted with DBWD and the other one healthy. Fertilizer treatments were applied on the basis of soil and leaf analysis as follows: 1- Control (with no use of fertilizers) 2- Addition of balanced amounts of macro-nutrients and 3-Addition of balanced amounts of macro as well as micro-nutrients. The experiment was arranged with a complete randomized block design of five replications. Maintenance operations consisted of pollination, weeding, disease and pest control. Such plant responses as fruit yield, bunch number and percentage of bunches afflicted by DBWD were determined and compared among treatments. There was no significant difference observed between bunch numbers per tree in the fertilizer treatments. Application of essential nutrient elements (treatments 2 and 3) resulted in a considerable increase in date yield and a decrease in dried bunches percentage.

Keywords : DBWD, Iran, Macro nutrient, micro nutrient.

INTRODUCTION

Hormozgan Province with 37,252 hectares of land under date cultivation and producing 145,542 tons of date annually [12] is an especially suitable place for the production of this valuable fruit. "*Mordasang*" cultivar that is mainly produced in eastern parts of Hormozgan, especially in Minab and Roudan areas, is one of the best varieties grown because of it's good marketing value, desirable taste and proper fruit moisture content.

Date Bunch Wilt and Dry disorder (DBWD) occurs in such southern parts of Iran as: Boushehr, Hormozgan and Jiroft, causing extensive damages to palm groves and gardens. 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 [9].

In affected trees, fruits are dried and crumpled during the process of change of Khalal (when fruits are physiologically mature, hard and crisp, moisture content about 50-58%, bright yellow or red in color) to Rutab (partially browned, reduced moisture content to about 30-45%, fibres softened). Also, in the junctions of strands to axis the main bunch, brown spots and cracks

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are formed. Because of the sudden dry disorder of the unripe fruit, severe waste and damage is inflicted upon date production [11].

Little research has been done on suppression of DBWD, but suitable management of plant nutrition is thought to probably decrease the intensity of the disease and even control it. Studies show that the disease occurs most when plant is exposed to a severe stress, often hot weather [9]. Stress causes damage to the fruit which is the most sensitive part of the plant expecially in the stage of changing from Khalal 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 as an example plays this role well among various nutrient elements in plant [7, 9]. Also, potassium additions would increase plant resistance by helping it to keep more moisture in its tissues [4, 7].

Research in Jiroft in 1999 showed that foliar spray of $Ca(NO_3)_2$ and $CaCl_2$, induced desirable effects on fruit firmness. Research on *Shahani* cultivar in Jahrom (Fars Province) showed that the highest date yield was obtained when applying 50 g of nitrogen and 30 g of phosphorus (for every year of tree's age) to each tree and through drop irrigation [13]. Furthermore, in Bam (Kerman Province), applying 150 kg of nitrogen per hectare in the form of urea produced the highest yields in *Mozafati* cultivar [3]. Research in Kerman, Hormozgan and Fars Provinces indicated that applying $CuSO_4$ caused yield increase, even though the effect of the use of micronutrients on yield was shown to be not statistically significant [3, 8, 11, 13]. Also, studies in Egypt, show that by adding 500 g of nitrogen every year at 3 stages along with potassium, increased date yield [6]. In Florida, United States of America, 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 [14].

The above mentioned reports indicate that using essential macro and micro nutrient elements could improve date yield and fruit quality. Because DBWD disorder has a diverse effect on yield and fruit quality in date palm, therefore, this research was conducted to study the suppressing effect of proper fertilization on this disorder.

MATERIALS AND METHODS

Two palm-groves were chosen for the research. One of them was healthy and without any DBWD disorder, but the other grove had shown the symptoms of the disease in the recent three years. Other characteristics of the groves were alike.

Ten-year-old palm trees of *Mordasang* cultivar were employed. Distance between trees was six meters. This cultivar was chosen because it is highly sensitive to DBWD. The experiment followed a randomized complete block design with three treatments (two trees in each treatment) and five replications for a duration of three years. Treatments were :

Treatment 1: No fertilizer application.

Treatment 2: Balanced and optimum amounts of macronutrients as dictated by to soil and leaf analysis.

Treatment 3: Balanced and optimum amounts of macro and micro nutrients application based upon results obtained from soil and leaf analysis.

Treatments Carried out in the Afflicted Grove

Treatment 1: No fertilizer.

Treatment 2: (2000 g Ammonium sulfate +700 g Triple super phosphate+950 g Potassium sulfate) per tree.

Treatment 3: Treatment 2+100 g Fe-EDDHA +170 g Manganese sulfate+300 g Zinc sulfate+200 g Copper sulfate) per tree.

Treatments Carried out in the Non-afflicted Grove

Treatment 1: No fertilizer

Treatment 2: (2700 g Ammonium sulfate +800 g Triple super phosphate+1350 g Potassium sulfate) per tree.

Treatment 3: (Treatment 2+100 g Fe-EDD HA +200 g Manganese sulfate+150 g Zinc sulfate +300 g Copper sulfate) per tree.

All of the triple super phosphate, potassium sulfate, Fe-EDDHA, manganese sulfate, zinc sulfate, copper sulfate as well as one half of ammonium sulfate were applied, through localized placement method (Chalkood), in February every year. The remaining one half of ammonium sulfate was applied in subsequent year's month of May.

The trees were irrigated, through surface method and immediately following fertilizer applications. After that, irrigation was applied once a week. Trees in all treatments received the same pollination, weeding, plant disease and pest control practices. Each tree yield was annually assessed. Also, number of bunches as well as percentage bunches per tree afflicted by DBWD were determined. All data were subjected to the analysis of variance and *F* test through MSTATC program. Meanwhile, normality and equality of variances were tested in SPSS statistical program. Also, mean comparisons were performed by Duncan's multiple range test through MSTATC software. Finally, the effects of fertilizer treatments on yield, number of bunches and percentage of bunches afflicted by DBWD in both healthy and infected groves were discussed.

RESULTS AND DISCUSSION

Statistical analysis of data obtained from either of the experiments are shown in Table 1. The comparison of means are presented in Tables 2, 3 and 4.

Yield was affected by time factor (year) as well as by fertilization application in either healthy or afflicted groves (Tables 1 and 2). A comparison between means indicated that in either of the groves and for a duration of the three years, in total, applying either macro and micro nutrients (treatment 3) or just macro nutrients (treatment 2) caused significant increase in date yield, whilst treatment 2 being statistically similar to treatment 3. Also, significant differnces among date yields were observed in the three years of experimentation. Furthermore,

Table 1. Analysis of variance of some plant responses.

	Variation source	df	Mean squares		
			Yield	Bunch numbers	Dried bunches%
Non infected grove	Year	2	48836144 **	11.820 n.s.[a]	-
	Treatments	2	9153160 **	0.089 n.s.	-
	Year×Treatment	4	1564053 n.s.	1.489 n.s.	-
Infected grove	Year	2	19614629 **	11.022 *	272.87 **
	Treatment	2	996998 **	2.956 n.s.	834.87 **
	Year×Treatment	4	377996 **	2.489 n.s.	159.43 **

* and ** Significant at the 5% and 1% probability level, respectively.
[a] non significant.

Table 2. The effect of fertilization treatments on date yield (kg ha^{-1}).

		Treatment 1	Traetment 2	Treatmennt 3	Mean
Non infected grove	First year	1657 c [a]	3100 a	2306 b	2354 C
	Second year	2840 b	3750 ab	4240 a	3610 B
	Third year	4726 b	5894 ab	7117 a	5912A
	Mean	3074 B	4248 A	4554 A	
nfected grove	First year	3142 b	3480 a	3336 ab	3319 B
	Second year	2675 a	2820 a	2971 a	2822 C
	Third year	4559 b	4837 ab	5616 a	5004 A
	Mean	3459 B	3712 AB	3974 A	

[a] Values followed by the same small or capital letter in each row or column, indicate non-significant difference (Duncan 5%).

it was found out that (Year×Treatments) interaction increased the yield. That is, fertilizer treatments caused yield increase in each year. The increasing effect of macro nutrient elements on yield, in *Piarom* and other date varieties, has been shown by others from Iran [3, 10, 11, 13] as well as from other countries [2, 4, 5, 6]. Other research works have [1, 2] shown that applying micro nutrient elements too, especially Fe, increases date yield. The mentioned research works reported that using similar proportions of essential macro and micronutrient elements caused significant increases in date yield. Since yield decrease is one of the symptoms of DBWD, it can probably be said that fertilizer treatments were somehow able to overcome this disoredr.

There was no significant difference observed between date yield in treatment 2 (just macronutrientsapplied) and treatment 3 (applying macro and micronutrients), meaning that application of micronutrients didn't cause any significant increase in the yield. But, an application of both macro and micro nutrient elements (treatment 3) can be the most recommended treatment, due to the considerable positive effect of micro nutrients such as Fe and Zn on fruit quality [1, 2, 8].

Fertilizer treatments caused no changes in the number of bunches in any of the trees, however, significant differences in this parameter were observed in the three years of experimentation. Meanwhile, interactive effect of (Treatments×Year) didn't change number of bunches in each tree, excluding infected grove in second year (Tables 1 and 3).

Analysis of variance shows that time factor (year), fertilizer treatments as well as their interactive effects, have caused significant changes in percentage of dried bunches in any of trees, during the three years of research (Table 1). It can be found from means' comparison (Table 4), that using essential macro nutrient elements (treatment 2) has decreased the percentage of dried bunches. Using both macro and micro nutrients (treatment 3) reduced the dried bunch parameter, too, so that percentage of dried bunches declined from 62.8 in control treatment to 54.3 in treatment 2 and to 47.9 in treatment 3. Moreover, interaction of treatments and year, caused a considerable reduction in percentage of dried bunches. The author didn't find any

Table 3. The effect of fertilization treatments on bunch number per tree.

		Treatment 1	Traetment 2	Treatmennt 3	Mean
Non-infected grove	First year	5.6 a [a]	6.6 a	6.4 a	6.2 B
	Second year	8.0 a	7.0 a	7.2 a	7.4 A
	Third year	8.2 a	7.8 a	7.8 a	7.9 A
	Mean	7.3 A	7.1 A	7.1 A	
Infected grove	First year	7.4 a	7.2 a	7.6 a	7.4 A
	Second year	7.4 a	5.6 ab	5.2 b	6.1 B
	Third year	7.8 a	7.2 a	8.0 a	7.7 A
	Mean	7.5 A	6.7 A	6.9 A	

[a] Values followed by the same small or capital letter in each row or column indicate non-significant difference (Duncan 5%).

Table 4. The effect of fertilization treatments on dried bunches percentage per tree in infected grove.

	Treatment 1	Traetment 2	Treatmennt 3	Mean
First year	63.2 a[a]	55.0 ab	48.6 b	55.6 AB
Second year	64.6 a	48.2 b	38.6 b	50.5 B
Third year	60.6 a	59.6 a	56.6 a	58.9 A
Mean	62.8 A	54.3 B	47.9 C	

[a] Values followed by the same small or capital letter in each row or column, indicate non-significant difference (Duncan 5%).

additional information about the effects of fertilizer treatments on reduction of this parameter in date palm.

In total, treatment 3 was demonstrated to be the most effective on suppression of DBWD. So, based upon the obtained results, one can recommend the application of balanced proportions of nitrogen, phosphorus, potassium, iron, manganese, zinc, copper and Cu (on the basis of prior soil and leaf analyses), and while employing the method of localized placing (chalkood) as the best control method. Some other researchers [2, 3, 4, 5, 6, 10, 11, 13] have also reported that optimum and balanced use of essential nutrient elements has increased the yield and suppressed the intensity of the disease in date palm. Therefore, it can more surely be concluded that in the case of palm groves affected with DBWD, using balanced proportions of essential nutrient elements will reduce the suppressing effect of the mentioned disorder.

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کاهش شدت عارضه خشکیدگی خوشه خرما با مصرف نسبتهای متعادل عناصر غذایی

ج. صالح

چکیده

سطح زیر کشت خرما در استان هرمزگان بیش از ۳۷۰۰۰ هکتار با تولیدی حدود ۱۴۵۰۰۰ تن می باشد. بنابراین بالابردن عملکرد و بهبود کیفیت خرما می‌تواند آثار مثبتی به ویژه بر درامد کشاورزان منطقه بر جای گذارد. یکی از مهمترین عملیات کشاورزی، که می‌تواند باعث ارتقای عملکرد و کیفیت خرما شود، مدیریت حاصلخیزی خاک و تغذیه معدنی گیاه می‌باشد. این تحقیق در مدت سه سال، به منظور بررسی اثر مصرف عناصر غذایی ضروری بر عارضه خشکیدگی خوشه خرما که در سالهای اخیر افت فراوانی در عملکرد این محصول ایجاد کرده، انجام شد. در این آزمایش، دو باغ خرما رقم مرداسنگ انتخاب شدند. یکی از این باغها مبتلا به عارضه خشکیدگی خوشه و دیگری سالم بود. تیمارهای کودی بر مبنای تجزیه خاک وبرگ به شرح زیراعمال شدند : ۱- تیمار شاهد (بدون مصرف کود)، ۲- مصرف نسبتهای متعادل عناصر غذایی پرمصرف بر مبنای تجزیه خاک و برگ و ۳- مصرف نسبتهای متعادل عناصر غذایی پرمصرف و کم مصرف بر مبنای تجزیه خاک و برگ. آزمایش به صورت طرح بلوکهای کامل تصادفی و با پنج تکرار انجام شد. عملیات داشت عبارت بود از گرده‌افشانی، وجین علفهای هرز و کنترل آفات و بیماریهای گیاهی. پاسخهای گیاهی نظیر عملکرد خرما، تعداد خوشه‌ها و درصد خوشه‌های آلوده به عارضه خشکیدگی خوشه در تیمارهای مختلف تعیین و مقایسه شدند. در تیمارهای کودی، اختلاف معنی‌داری بین تعداد خوشه‌های هر درخت وجود نداشت. کاربرد عناصر غذایی ضروری پرمصرف وکم مصرف (تیمارهای ۲ و ۳) موجب افزایش معنی‌دار عملکرد خرما شد و همچنین درصد خوشه‌های خشکیده را کاهش داد.