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EFFECT OF YEAST AND HUMIC ACID FOLIAR SPRAY ON SEWY DATE PALM FRUITING UNDER NEW VALLEY CONDITIONS

BY

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ABSTRACT

An orchard experiment was carried out during 2015, 2016 and 2017 seasons on Sewy date palm grown in the Agricultural Research Station, El-Kharga, New Valley governorate, Egypt to evaluate the spraying effect of humic acid, yeast and their combinations at two times on the fruiting of Sewy date palm.

The results showed that all foliar applications of yeast, humic acid and their combination had a positive effect on the yield and fruit quality compared to the water foliar one (control). Spraying the mixture of yeast at 75 g/L and humic acid 75 ml/L was significantly superior in improving the fruit retention and bunch weight as well as enhanced fruit weight, flesh percentage and fruit dimensions. This treatment also enhanced the TSS% and sugar contents as well as nitrogen, phosphorus and potassium contents of the fruit. On the contrary, it decreased the fruit total acidity.

So, it could be advisable to spray yeast at 50 or 75 g/L combined with humic acid at 50 or 75 ml/L to increase the yield and improve the fruit quality and nutrient contents of Sewy date palm under El-Kharga conditions, New Valley governorate.

Keywords: *Phoenix dactylifera, humic acid, yeast extract, spraying, yield, fruit quality.*

INTRODUCTION

Date palm (Phoenix dactylifera) is one of the most important fruit crops grown in Egypt for its unique nutritional value. The number of fruitful female palms in Egypt is 14.96 million planted on approximately 115572 feddans producing 1.68 million metric tons of dates (AOAD, 2016). New Valley governorate is ranked in the fourth position of the date palm cultivated areas after Sharkia, Behaira and Aswan. Its area is about 19103 feddans containing about 1.41 million fruitful female palms. This area produces 112000 tons of dates (NVAD, 2016). In Egypt, many cultivars are grown in different regions according to the diversity of their climatic necessity. Sewy date is one of the most economically important semi dry dates. Sewy cultivar covers all the acreage of the total cultivated area in New Valley governorate.

One of the best tools for date palm reproductivity is the fertilization (Khayat et al., 2007; El-Salhy et al., 2017). Spraying fertilizers have the important role to reduce application rates, uniform distribution of fertilizer materials and quick responses to applied nutrients. Moreover, hidden hungers can easily be managed (Umar et al., 1999; Mengel, 2002).

Humic substances such as humic and fulvic acids are derived from organic matter decomposition. They are a source of some essential nutrients for plant growth and improve soil fertility (Yagodin, 1984; Diab, 2006).

Yeast it also considered as one of the promising bio-fertilizers for many crops. Yeast applications have positive effects in activating the photosynthesis process as well as its high own content of natural growth regulators, amino acids and B-vitamins. Moreover, yeast is responsible for stimulating the uptake of different nutrients (Barnett et al., 1990).

In this respect, many investigators emphasized the importance of humic acid and yeast applications to improve the fruiting of date palm (Osman, 2003; Gobara, 2004; Gobara and Ahmed, 2004; Gadalla et al., 2011; Osman et al., 2011; El-Khayat and El-Noam, 2013; Ahmed et al., 2014; Mostafa, 2015; El-Salhy et al., 2017).

So, this study aims investigate the effect of humic acid and yeast either alone or in combinations on fruiting the Sewy date palm cultivar under New Valley conditions.

MATERIALS AND METHODS

An orchard experiment was carried out to evaluate the effects of humic acid and yeast applications on the yield and quality of Sewy date palm grown on a sandy loam soil at the Agricultural Research Station, El-Kharga, New Valley governorate, Egypt (Latitude: N 25° 27' 88.48", Longitude: E 30° 32' 43.38 and Altitude: 73 m), during three seasons of 2015, 2016 and 2017. Five palms were selected under the flooding irrigation system and planted at 6x6 meter apart. They were uniform, free of insect, damage and diseases. The leaf/bunch ratio was adjusted at the end of the blooming seasons to meet their value of 7:1. Bunches were adjusted to be 10 per palm by removing the excess earliest, latest and smallest ones. An artificial pollination was uniformly performed in respect of source, date and method. The experiment was conducted as a randomized complete block design with five replications for each treatment. Each replication was represented by one bunch.

This study included ten treatments as follow:

- **Spraying with active dry yeast at a level of 25 g/L (T_1).**
- **Spraying with active dry yeast at a level of 50 g/L (T_2).**
- **Spraying with active dry yeast at a level of 75 g/L (T_3).**
- **Spraying with humic acid at a level of 25 ml/L (T_4).**
- **Spraying with humic acid at a level of 50 ml/L (T_5).**
- **Spraying with humic acid at a level of 75 ml/L (T_6).**
- **Spraying with active dry yeast at a level of 25 g/L + humic acid at a level of 25 ml/L (T_7).**
- **Spraying with active dry yeast at a level of 50 g/L + humic acid at a level of 50 ml/L (T_8).**
- **Spraying with active dry yeast at a level of 75 g/L + humic acid at a level of 75 ml/L (T_9).**
- **Control (spraying with distilled water) (T_{10})**

All treatments were applied as a foliar application on the bunches at two times. The 1st time was performed in April (immediately after fruit set) and the 2nd time was in May (45 days after fruit set).

The active dry yeast was dissolved in water before its use resulting in three concentrations of 25, 50 and 75 g/L per bunch. They dry yeast was activated before the application using 5% sugar solution in warm water (38°C) for 24 hours (Barnett et al., 1990).

The humic acid as Humex® which contains 13% humic acid, 3% fulvic acid and 5% K was also added as a foliar application at three concentrations (25, 50 and 75 ml/L) at the above mentioned times.

The studied treatments were applied on the same palm. Thus, each treatment represented of one bunch on each palm and repeated five times. The bunches were sprayed with the investigated treatments using a small hand sprayer until run-off. They were separated from each side with plastic sheets to avoid any overlap with others. Other horticultural practices such as irrigation, fertilization, pruning, and pest control were carried out as usual.

The following measurements were determined during the three investigated seasons:

Yield and its components

The fruit retention was calculated at the harvest using the following equation:

$$Fruit\ retention\ (\%) = \frac{Av.\ number of\ retained\ \ fruit}{Av.\ number of\ retained\ \ fruit + Av.\ number of\ \ flower\ scars} x100$$

The bunches of each palm were harvested when the fruits reached the tamer stage and then each bunch was weighed.

Fruit characteristics

At the maturity stage, a sample of 50 fruits was randomly taken from each bunch to determine some fruit physical properties such as fruit weight, flesh %, fruit dimensions and volume. The chemical characters including TSS% (using a hand refractometer), sugar percentages (reduced and total) and total acidity % (as a citric acid/100 g pulp) were determined according to A.O.A.C. (1995).

Fruit N, P and K contents

Fruit samples were washed with tap water and then distilled water. These fruits were evenly peeled and the seeds were removed. The fleshes of those fruits were cut into small pieces with a clean knife oven dried at 70°C to a constant weight and then ground using a mill. Then 0.5 g of the ground sample was accurately weighed and digested using a H2SO4-H2O2 mixture. The total N content in the digests was estimated using the micro Kjeldahl method (Page et al., 1982) both total phosphorus and potassium in date digests were also determined as it is described by Jackson (1973).

Statistical analysis

The statistical analysis was done according to Mead et al. (1993) using the new L.S.D. at 5% to compare the different treatment means.

RESULTS

1. Fruit Retention and Bunch Weight

Table 1 shows the effect of yeast, humic acid and their combinations on fruit retention and bunch weight of Sewy date palm yield components during 2015, 2016 and 2017 seasons. Fruit retention and bunch weight are used as an index for yield/palm. It is obvious that the results exhibit a similar trend during the three studied seasons.

Both fruit retention percentage and bunch weight significantly increased due to the spray application of yeast, humic acid and their combinations compared to the control. The combined

application of yeast and humic acid was more effective in improving the fruit retention percentage and bunch weight compared to using yeast or humic acid alone. The foliar application of yeast had rather lower results than that of humic acid without significant differences. Spraying yeast at a level of 75 g/L combined with humic acid at a level of 75 ml/L (T9) gave the highest values of fruit retention (59.42, 61.87 and 62.58%) and bunch weight (10.24, 10.07 and 10.15 kg) in 2015, 2016 and 2017 seasons, respectively. Meanwhile, the control treatment (T10) showed the lowest values of fruit retention (51.19, 50.74 and 53.17%) and bunch weight (7.38, 7.94 and 7.76 kg) during these respective seasons.

The recorded mean fruit retention of these studied seasons was 54.70, 55.97, 58.16, 56.97, 58.00, 59.14, 59.44, 60.30, 61.29 and 51.70% due to T1, T2, T3, T4, T5, T6, T7, T8, T9 and T10 treatments, respectively. The mean bunch weight of these respective treatments during these seasons was 8.04, 8.25, 8.61, 8.22, 8.53, 8.78, 9.30, 9.76, 10.15 and 7.69 kg. Hence, the mean obtained increment percentage of bunch weight over these seasons of T1, T2, T3, T4, T5, T6, T7, T8 and T9 treatments was 4.55, 7.28, 11.96, 6.89, 10.92, 14.17, 20.94, 28.22 and 31.99%, respectively, compared to the control treatments (T10).

It is clear that an increase in both fruit retention and bunch weight is obtained as the concentration of the spray solution increases. No significant differences of fruit retention and bunch weight were recorded due to using the two higher concentrations of the spray solution. Therefore, on the economic view, it is preferable to use the mixture of yeast and humic acid at a concentration of 50 ml/L for each one (T_8).

Table (1): **Effect of humic acid (H) and yeast (Y) foliar applications on fruit retention and bunch weight of Sewy date palm during 2015, 2016 and 2017 seasons.**

Treatment		Fruit retention (%)				Bunch weight (kg)			
		2015	2016	2017	Mean	2015	2016	2017	Mean
Yeast (25 g/L)	T_1	54.52	53.77	56.08	54.70	7.77	8.23	8.12	8.04
Yeast (50 g/L)	T_2	56.12	55.51	56.28	55.97	7.94	8.39	8.42	8.25
Yeast (75 g/L)	T_3	57.48	55.96	61.04	58.16	8.29	8.53	9.01	8.61
Humic (25 ml/L)	T_4	56.87	55.42	58.61	56.97	7.96	8.30	8.39	8.22
Humic (50 ml/L)	T_5	56.95	58.08	58.97	58.00	8.32	8.71	8.55	8.53
Humic (75 ml/L)	T_6	58.53	58.24	60.66	59.14	8.86	8.99	8.50	8.78
Y. + H. (25/25)	T_7	58.75	58.32	61.25	59.44	9.46	9.27	9.16	9.30
Y. + H. (50/50)	T_8	59.27	60.24	61.39	60.30	9.86	9.81	9.61	9.76
Y. + H. (75/75)	T_9	59.42	61.87	62.58	61.29	10.24	10.07	10.15	10.15
Control	T_{10}	51.19	50.74	53.17	51.70	7.38	7.94	7.76	7.69
New LS.D. $_{0.05}$		3.08	2.84	2.98		0.44	0.39	0.48	

2- Fruit Quality

2.1- Physical properties

Tables 2, 3 and 4 display that the fruit weight, flesh percentage, fruit dimensions and volume of Sewy dates significantly increased due to the studied treatments compared to the control during 2015, 2016 and 2017 seasons. The highest values of fruit weight, flesh percentage and size were observed on palms that were sprayed with yeast at 75 g/L + humic acid at 75 ml/L (T_9) followed by those sprayed with yeast at 50 g/L + humic acid at 50 ml/L (T_8) compared to the other investigated treatments. The lowest values of these physical fruit traits were recorded on the fruits that were picked from the water sprayed bunches (control, T_{10}).

The mean values of fruit weight of 13.62, 14.42, 14.99, 13.61, 14.72, 15.10, 14.73, 15.44, 15.81 and 10.64 g were recorded for the palms sprayed with T_1, T_2, T_3, T_4, T_5, T_6, T_7, T_8, T_9 and T_{10} treatments during the studied seasons, respectively. So, the corresponding increment percentage of the fruit weight

was 28.00, 35.53, 40.88, 27.91, 38.35, 41.92, 38.45, 45.11 and 48.59% due to the use of T_1, T_2, T_3, T_4, T_5, T_6, T_7, T_8 and T_9 treatments, respectively, compared to T_{10} (control).

These results revealed that the examined treatments had significant effects on fruit physical properties compared to the control treatment. At the same time no significant differences of the studied traits were found due to the use of yeast at 75 g/L

Table (2): Effect of humic acid (H) and yeast (Y) foliar applications on fruit weight and flesh percentage of Sewy date palm during 2015, 2016 and 2017 seasons.

Treatment		Fruit weight (g)				Flesh (%)			
		2015	2016	2017	Mean	2015	2016	2017	Mean
Yeast (25 g/L)	T_1	13.45	13.81	13.60	13.62	85.57	86.18	84.98	85.58
Yeast (50 g/L)	T_2	14.58	14.55	14.15	14.42	86.16	85.84	85.40	85.80
Yeast (75 g/L)	T_3	14.99	15.07	14.92	14.99	85.91	86.11	85.57	85.86
Humic (25 ml/L)	T_4	13.78	13.60	13.44	13.61	85.88	85.90	84.82	85.53
Humic (50 ml/L)	T_5	14.89	14.72	14.55	14.72	86.56	85.96	85.41	85.98
Humic (75 ml/L)	T_6	15.23	15.13	14.95	15.10	86.28	86.42	85.58	86.09
Y. + H. (25/25)	T_7	14.70	14.83	14.66	14.73	86.63	86.21	85.37	86.07
Y. + H. (50/50)	T_8	15.77	15.50	15.05	15.44	86.98	86.72	85.80	86.50
Y. + H. (75/75)	T_9	16.32	15.74	15.36	15.81	86.83	86.70	85.49	86.34
Control	T_{10}	11.01	10.34	10.57	10.64	83.11	82.96	82.38	82.82
New LS.D. $_{0.05}$		0.83	0.79	0.86		2.12	2.57	2.32	

Table (3): Effect of humic acid (H) and yeast (Y) foliar applications on fruit dimension of Sewy date palm during 2015, 2016 and 2017 seasons.

Treatment		Fruit diameter (cm)				Fruit length (cm)			
		2015	2016	2017	Mean	2015	2016	2017	Mean
Yeast (25 g/L)	T_1	2.39	2.50	2.41	2.43	4.08	4.12	4.13	4.05
Yeast (50 g/L)	T_2	2.41	2.53	2.44	2.46	4.23	4.27	4.18	4.23
Yeast (75 g/L)	T_3	2.45	2.62	2.47	2.51	4.31	4.44	4.31	4.35
Humic (25 ml/L)	T_4	2.39	2.59	2.51	2.50	4.26	4.31	4.21	4.26
Humic (50 ml/L)	T_5	2.50	2.66	2.56	2.57	4.45	4.44	4.39	4.43
Humic (75 ml/L)	T_6	2.55	2.72	2.61	2.63	4.54	4.57	4.50	4.54
Y. + H. (25/25)	T_7	2.50	2.62	2.54	2.55	4.37	4.34	4.28	4.33
Y. + H. (50/50)	T_8	2.57	2.74	2.62	2.65	4.43	4.47	4.42	4.44
Y. + H. (75/75)	T_9	2.61	2.83	2.68	2.71	4.67	4.65	4.54	4.62
Control	T_{10}	2.27	2.29	2.27	2.27	3.90	3.96	3.90	3.92
New LS.D. $_{0.05}$		0.11	0.16	0.12		0.16	0.18	0.13	

Table (4): Effect of humic acid (H) and yeast (Y) foliar applications on fruit volume and total soluble solids (TSS) of Sewy date palm during 2015, 2016 and 2017 seasons.

Treatment		Fruit volume				TSS (%)			
		2015	2016	2017	Mean	2015	2016	2017	Mean
Yeast (25 g/L)	T_1	10.99	11.29	11.01	11.09	74.75	75.77	75.39	75.30
Yeast (50 g/L)	T_2	11.29	11.75	11.14	11.39	75.19	75.83	75.60	75.54
Yeast (75 g/L)	T_3	11.44	12.12	11.50	11.69	75.24	76.65	76.29	76.06
Humic (25 ml/L)	T_4	11.19	11.92	11.53	11.55	73.51	73.61	73.68	73.60
Humic (50 ml/L)	T_5	11.76	12.51	11.96	12.07	74.73	73.78	74.38	74.30
Humic (75 ml/L)	T_6	11.90	12.51	12.03	12.15	75.67	76.33	75.65	75.88
Y. + H. (25/25)	T_7	11.52	12.15	11.54	11.73	76.12	76.66	76.52	76.43
Y. + H. (50/50)	T_8	12.09	12.53	12.05	12.22	77.01	77.17	77.01	77.06
Y. + H. (75/75)	T_9	12.38	12.93	12.32	12.55	78.79	78.62	78.55	78.65
Control	T_{10}	10.36	10.64	10.37	10.46	70.07	70.13	70.40	70.20
New LS.D. $_{0.05}$		0.56	0.50	0.59		2.53	2.55	2.54	

(T_3), humic acid at 75 g/L (T_6), combined yeast and humic acid at 50 and 75 g/L (T_8 and T_9). Economically, a good marketable yield is an important target of date palm production. So, it could be concluded that spraying the bunches of Sewy date palm with yeast at 50 or 75 g/L combined with humic acid at 50 or 75 g/L (T_8 and T_9) may be used to enhance the fruit weight, flesh percentage and fruit size.

2.2- Chemical properties

The effects of yeast, humic acid and their combination treatments on some chemical properties of Sewy dates are summarized in Tables 4, 5 and 6.

It is apparent that all investigated chemical fruit characteristics significantly increased with spraying Sewy date bunches with yeast and humic acid either alone or in combinations over the control (water sprayed bunches). The total soluble solids (TSS) and sugar content tended to be gradually increased through increasing the concentration of yeast or humic acid in the spraying solution. Moreover, the yeast surpassed the humic acid in its effect on these examined traits. The highest values of these traits were obtained by the foliar application of yeast at 75 g/L combined with humic acid at 75 ml/L (T_9). The highest average values of TSS, total sugar and reducing sugar were 78.65, 70.17 and 61.97%, respectively, during the studied seasons. However, yeast at 50 g/L combined with humic acid at 50 ml/L (T_8) gave the second higher values (77.06, 69.96 and 61.76%), of TSS, total sugar and reducing sugar, respectively. On the other hand, the lowest values of TSS, total sugar and reducing sugar 70.20, 63.03 and 55.32%, respectively were recorded for water sprayed fruits.

On the opposite, the lowest mean total acidity (0.197%) value was found with spraying the fruits with yeast at 75 g/L combined with humic acid at 75 ml/L (T_9) during the investigated seasons.

Therefore, the highest average increase percentages of the total soluble solids (12.04%) and total sugars (12.18%) during the studied seasons were obtained when the bunches were sprayed with T_9 treatments compared to that of the control treatment.

On the contrary, the highest mean decrease percentage (28.11%) of the total acidity was recorded for T_9 treatment compared to that of the control one.

Table (5): **Effect of humic acid (H) and yeast (Y) foliar applications on total and reducing sugars of Sewy date palm during 2015, 2016 and 2017 seasons.**

Treatment		Total sugars (%)				Reducing sugar (%)			
		2015	2016	2017	Mean	2015	2016	2017	Mean
Yeast (25 g/L)	T_1	70.10	69.15	69.41	69.55	61.12	60.92	61.59	61.21
Yeast (50 g/L)	T_2	67.88	67.06	67.40	67.45	59.38	58.23	59.23	58.95
Yeast (75 g/L)	T_3	69.80	69.42	69.69	69.64	61.97	60.26	61.76	61.32
Humic (25 ml/L)	T_4	66.97	66.40	66.72	66.70	58.28	59.49	58.46	58.08
Humic (50 ml/L)	T_5	69.50	67.98	68.60	68.69	60.52	59.56	60.64	60.24
Humic (75 ml/L)	T_6	70.40	69.50	69.47	69.79	62.10	59.95	61.00	61.02
Y. + H. (25/25)	T_7	68.94	68.66	69.06	68.89	61.14	60.06	60.82	60.67
Y. + H. (50/50)	T_8	69.92	69.89	70.08	69.96	61.87	61.69	61.73	61.76
Y. + H. (75/75)	T_9	71.73	70.05	70.36	70.71	62.09	61.98	61.85	61.97
Control	T_{10}	64.55	64.03	60.52	63.03	55.36	55.18	55.42	55.32
New LS.D. $_{0.05}$		3.14	2.95	3.11		2.93	2.78	2.83	

Table (6): **Effect of humic acid (H) and yeast (Y) foliar applications on the total acidity and N content of Sewy date palm during 2015, 2016 and 2017 seasons.**

Treatment		Total acidity (g)				N (%)			
		2015	2016	2017	Mean	2015	2016	2017	Mean
Yeast (25 g/L)	T_1	0.207	0.214	0.197	0.206	0.583	0.598	0.611	0.605
Yeast (50 g/L)	T_2	0.214	0.209	0.200	0.208	0.615	0.650	0.637	0.634
Yeast (75 g/L)	T_3	0.201	0.207	0.183	0.197	0.622	0.670	0.643	0.645
Humic (25 ml/L)	T_4	0.220	0.227	0.217	0.221	0.622	0.671	0.648	0.647
Humic (50 ml/L)	T_5	0.220	0.227	0.213	0.220	0.674	0.691	0.669	0.678
Humic (75 ml/L)	T_6	0.201	0.224	0.203	0.209	0.638	0.721	0.685	0.681
Y. + H. (25/25)	T_7	0.206	0.214	0.203	0.208	0.643	0.730	0.700	0.691
Y. + H. (50/50)	T_8	0.200	0.208	0.190	0.199	0.662	0.738	0.713	0.704
Y. + H. (75/75)	T_9	0.193	0.202	0.197	0.197	0.685	0.740	0.723	0.716
Control	T_{10}	0.249	0.256	0.243	0.249	0.556	0.578	0.574	0.576
New LS.D. $_{0.05}$		0.015	0.016	0.017		0.018	0.017	0.020	

Table (7): **Effect of humic acid (H) and yeast (Y) foliar applications on P and K contents of Sewy date palm during 2015, 2016 and 2017 seasons.**

Treatment		P (%)				K (%)			
		2015	2016	2017	Mean	2015	2016	2017	Mean
Yeast (25 g/L)	T_1	0.100	0.105	0.095	0.100	0.791	0.799	0.791	0.794
Yeast (50 g/L)	T_2	0.102	0.108	0.097	0.102	0.797	0.805	0.796	0.799
Yeast (75 g/L)	T_3	0.103	0.108	0.098	0.103	0.819	0.833	0.819	0.824
Humic (25 ml/L)	T_4	0.102	0.105	0.096	0.101	0.825	0.840	0.826	0.830
Humic (50 ml/L)	T_5	0.102	0.108	0.097	0.102	0.825	0.845	0.830	0.833
Humic (75 ml/L)	T_6	0.104	0.109	0.098	0.104	0.835	0.848	0.842	0.842
Y. + H. (25/25)	T_7	0.106	0.111	0.089	0.102	0.833	0.822	0.835	0.830
Y. + H. (50/50)	T_8	0.123	0.127	0.113	0.121	0.844	0.834	0.845	0.841
Y. + H. (75/75)	T_9	0.124	0.127	0.114	0.122	0.844	0.854	0.853	0.850
Control	T_{10}	0.086	0.090	0.089	0.088	0.765	0.776	0.763	0.768
New LS.D. $_{0.05}$		0.006	0.010	0.005		0.021	0.020	0.018	

So, it could be concluded that spraying the Sewy date palm bunches with yeast, humic acid or their combinations improves the fruit quality in terms of increasing the fruit weight, total soluble solids and sugar contents and decreasing the total acidity.

3. Fruit N, P and K contents

Tables 6 and 7 show the effect of yeast and humic acid as well as their combinations spraying on N, P and K contents of Sewy dates during 2015, 2016 and 2017 seasons. It is obvious that all foliar applications of yeast at 25, 50 or 75 g/L, humic acid at 25, 50 or 75 ml/L and their combinations significantly increased fruit N, P and K contents compared to the foliar water spray (control). The highest mean values of fruit N (0.716%), P (0.122%) and K (0.850%) contents were found for fruits that were picked from bunches which were sprayed with yeast at 75 g/L combined with humic acid at 75 ml/L (T9 treatment). No significant differences of fruit N, P and K were observed due to using any combination of

yeast at 50 or 75 and humic acid at 50 or 75 ml/L (T_8 and T_9). On the other hand, the lowest average values of N (0.575%), P (0.088%) and K (0.768%) were obtained from the water sprayed fruits (control).

Thus the average increment percentages of fruit N, P, K contents were 24.52, 37.64 and 10.67%, respectively, during the studied seasons due to spraying the bunches with yeast at 75 g/L combined with humic acid at 75 ml/L (T9 treatment) compared to the water sprayed ones (control). In general, the results clearly show that combined spray applications of humic acid and yeast at middle (50 ml/L and 50 g/L, respectively) and higher (75 ml/l and 75 g/L, respectively) levels were preferable to be used on Sewy date palms than applying each alone. Moreover, these treatments significantly enhanced the fruit P content than fruit N and K contents.

DISCUSSION

The presence of nutrients and some growth regulators-like in humic acid as well as protein, carbohydrates, vitamins such as thiamine, riboflavin, vit-B12 and folic acid in yeast spraying solution may have a positive effect on increasing the fruit set, fruit retention and decreasing the fruit drop. This may be attributed to the improving effect of such treatments on the nutritional status of the trees, which is reflected on increasing the fruit retention and fruit weight and consequently increases the bunch weight and yield fruit weight of Sewy dates (Subba-Rao, 1984; Zhang et al., 2010).

The promoting effect of yeast and humic acid on growth and nutritional status of palms possesses a positive relationship with improving the fruit quality. These fruit improvement might be attributed to its higher own content from natural hormones, protein and vitamins that are responsible for enhancing the biosynthesis of most foods (Zhang et al., 2010).

Foliar spray of yeast, humic acid or their combinations on Sewy date palms significantly increases N, P and K contents of the fruits. These results may be related to the high contents of macro and micro nutrient of both dry yeast and humic acid. Some investigators reported that using yeast and humic acid either alone or in combination as a foliar application improved the nutritional status of different fruit crops.

The beneficial effects of yeast and humic acid on improving the yield and fruit quality were emphasized by Osman (2003), Gobara (2004), Gobara and Ahmed (2004), Gadalla et al. (2011), Osman et al. (2011), El-Khayat and El-Noam (2013), Ahmed et al. (2014), Mostafa (2015) and El-Salhy et al. (2017). They found that the use of yeast or humic acid was favourable to increase the yield and improve the fruit quality of date palms.

CONCLUSION

It could be concluded that spraying yeast at 50-75 g/L combined with humic acid at 50-75 ml/L at two times (immediately after fruit set and at 45 days after fruit set) could enhance the yield, fruit quality and fruit nutrient content of Sewy date palms under El-Kharga conditions, New Valley governorate.

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تأثير رش الخميرة وحمض الهيوميك علي إثمار نخيل البلح السيوي تحت ظروف الوادي الجديد

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الملخص :

أجريت هذه التجربة خلال موسم ٢٠١٥ و ٢٠١٦ و ٢٠١٧ علي نخيل البلح السيوي في المزرعة البحثية بمحطة البحوث الزراعية بالخارجة بمحافظة الوادي الجديد التابعة لمركز البحوث الزراعية، مصر. تهدف هذه الدراسة إلي تقييم تأثير رش الخميرة وحمض الهيوميك مرتين سواء بصورة فردية أو معاً علي إثمار نخيل البلح السيوي. وكانت الرشة الأولي بعد العقد مباشرة أما الثانية فكانت بعد العقد بـ ٤٥ يوم.

أوضحت النتائج:

- **أدت جميع معاملات الرش سواء في الصورة الفردية أو الصورة الثنائية إلي زيادة جوهرية في نسبة الثمار الباقية ووزن السباطة ووزن الثمرة وحجمها ونسبة اللب مقارنة بالرش بالماء (الكنترول).**
- **سببت جميع المعاملات تحسناً جوهرياً في الصفات الكيماوية للثمار حيث إزداد محتواها من المواد الصلبة الذائبة الكلية والسكريات والعناصر الغذائية كما انخفضت الحموضة الكلية بالثمار.**
- **سجل الرش بالمخلوط المحتوي علي ٥٠ أو ٧٥ جرام خميرة بالإضافة إلي ٥٠ أو ٧٥ سم٣ حمض هيوميك في اللتر الأفضلية في تحسين نسبة الثمار المتبقية ووزن السباطة وكذلك الصفات الطبيعية والكيماوية للثمار.**

من نتائج هذه الدراسة يمكن التوصية برش السباطات بالخميرة بمعدل ٥٠ إلى ٧٥ جرام في اللتر مع ٥٠ إلى ٧٥ سم٣ في اللتر من حمض الهيوميك لتحسين المحصول وجودة الثمار والمحتوي العنصري لثمار نخيل البلح السيوي تحت ظروف الخارجة – محافظة الوادي الجديد.