EFFECT OF FERTILIZATION BY INJECTION OF SOIL AND TRUNK WITH NPK ON PRODUCTIVITY AND FRUITS QUALITY OF SEWY DATE PALM.

Zaen El–Daen, E.M.A.

Plant Production Department, Desert Research Center, Cairo, Egypt.

ABSTRACT

This study was conducted through two successive seasons, of 2015 & 2016 on Sewy date palm cultivar (*Phoenix dactylifera* L.) grown in Siwa desert research station located at Siwa oasis, Matrouh governorate, Egypt. Two fertilization methods (soil and trunk injection) were used to rationalization chemical fertilizers use underflooding irrigation system. Where soil injection system was by three levels (500, 750 & 1000 ml/palm tree /month) and trunk injection system was used by three levels (100, 200 & 300 ml/palm tree/month) from (2:1:2) NPK solution starting from January to October compared with soil application by recommendation doses (control). Some vegetative growth parameters, leaves NPK contents, fruits yield, and quality of sewy date palm trees were studied. Results showed that all fertilization treatments by soil and trunk injection achieved significant increase in all studied parameters compared with control but trunk injection fertilization surpassed on soil injection. Besides, vegetative growth was increased by 18.1%, leaf NPK content by 26 %, yield by 27%, fruit physical properties by 31%, and fruit chemical properties by 13.6% from (2:1:2) NPK trunk injection by 300 ml/palm tree/month. Thus, fertilization sewy date palm using soil injection by 1000 ml/tree/month or using trunk injection by (300 ml/tree/month) from 2:1:2 NPK solution is recommended starting from January to October one dose monthly to improving date palm productivity and fruit quality.

**Key words:** Date palm, Chemical fertilization, NPK, leaves NPK contents, Total and reducing sugars, soil and trunk injection.

INTRODUCTION

Date palm (*Phoenix dactylifera* L.) is considered as a main crop in arid regions of the world. It will not only grow in the most hard desert conditions, but will tolerate an excess amount of alkalinity in the soil that will kill any other crop. It is one of the fruit crops that can grow in such soils due to its capability to tolerate drought and stress. Because date palm can grow under difficult conditions many growers think that it can produce without feeding but to improving yield and fruit quality of date palm orchard we must get down to fertilization (Khayyat et al., 2007; Osman, 2010). Egypt is one of the most producing countries of date. Where, the number of fruitful female palms is almost fourteen million 14,956,331 planted in approximately 115,610 feddan produced 16,849,177 metric tons of fresh, semi-dry and dry dates (Food Agricultural Organization F.A.O. 2015).

Fertilization is one of the important tools to improve the dates physicochemical. Using balanced amounts of essential elements such as N and P will improve nutrient absorption and carbohydrate synthesis and then accumulation.
of soluble solids in date fruits. As (Soliman & Osman 2003) studied the effect of N and K application to Samany date palm. They found that the largest total soluble solid content and total sugar content in the fruit were obtained with an application of 1.5 kg of N and P/tree. Besides, increased the number of leaves and bunches per palm, fruit yield with a high level of fruit quality. Addition of 2.5 g/l (19-19-19) NPK to date palm (Phoenix dactylifera cv Bartomouda) Plantlets produced via tissue culture technique gave highest significant values of plant height (cm), number of leaves/plantlet, length of root (cm), and number of roots/plantlet as compared to control treatment. Moreover, leaves minerals contents. N, p, K, Fe, Zn, Mn and Cu, were significantly increased (Abo-Rekabet et al., 2010). See wy date palms fertilized with 15kg poultry manure with 5kg from NPK mixture (2:3:2) gave the highest values of some vegetative growth parameters as the findings by (El-merghany et al., 2016). Besides, NPK fertilization improves leaf mineral content of Sewy date palm under siwa oasis conditions (Ibrahim et al. 2013).

Previous studies proved that only a small portion of soil-added fertilizers is taken up by plant roots, especially those grown under sandy soil conditions, where high permeability allows fast leaching of fertilizers to underground water (Halliday and Trenkel 1992). Although, it can supply enough nutrients to improve plant production but it causes world wild anxiety about environmental contamination for nutrients leaching into ground water (Dinnes et al., 2002). Optimizing nitrogen agent loss can solve this problem. Thus, the main goal of many researches is reducing nutrients leaching and maximizing its uptake for all crops (Dong et al., 2005). The loss of nitrogen via leaching through drainage water may be reduced to some extent by choosing fertilization method.

Trunk injection with fertilizers can solve this problem because it (1) reduces fertilizers loss; (2) eliminates environmental contamination; (3) solves viable alternative to ineffective or costly leaf or ground treatments; (4) possibility uses in urban areas where other methods prove problematic; and (5) generally confers more precise results (Zamora and Escobar 2000). Mahmud, (2009) mentioned that fertilization by injection: a full nutritional technique for fruit trees saves 90-95% of fertilizers and maintains a clean environment. Abdi and Hedayat, (2010) found that injection method was better than other methods. Because it conveys the element directly to the respective parts of plant, using this method could help us to surmount the problem of absorption and transmission of K in date palm. (Jahanshah et al., 2016) conducted that trunk injection is a more efficient method for iron fertilization. Which increased significant TSS, fruit set %, fruit weight, flesh weight, fruit size, total, reducing and non-reducing sugars of date palms cv. Kabkab grown in calcareous soils (Abdi and Hedayat, 2010). Injection method was better than other methods. Because these methods transfer the element directly to the respective parts of plant through trunk, using this method could help us to surmount the problem of absorption and transmission of K in date palm (Elsaydet et al., 2018)

9th International Conference for Sustainable Agricultural Development 4-6 March 2019
Fayoum J. Agric. Res.,&Dev.,Vol.33 No. 1(B) March, 2019
Thus, the main goal of this trail was to study rationalization of the use of chemical fertilizers and reduces the pollution of the environment and the impact on the productivity and quality of fruits dates.

MATERALS AND METHODS

This study was conducted through two successive seasons of 2015 & 2016 on Sewy date palm cultivar (*Phoenix dactylifera* L.) grown in siwa desert research station located at siwa oasis, Matrouh governate, Egypt. Forty two date palm trees of twelve years-old were planted at 7 x 7 meters apart and received the normal cultural practices commonly adopted for this area except the tested fertilization treatments. Soil farm was analyzed according to *A. O. A. C. (2005)* and reported in Tables (1).

**Table 1. Some physical and chemical properties of the experimental soil.**

<table>
<thead>
<tr>
<th>Properties</th>
<th>Value</th>
<th>Properties</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Soil depth</td>
<td></td>
<td>Soil depth</td>
</tr>
<tr>
<td></td>
<td>(cm) 0-30</td>
<td>(cm) 30-60</td>
<td>(cm) 0-30</td>
</tr>
<tr>
<td>Clay</td>
<td>10.7</td>
<td>11.5</td>
<td>Total CaCO₃ %</td>
</tr>
<tr>
<td>Sil</td>
<td>10.2</td>
<td>10.6</td>
<td>EcdS.m</td>
</tr>
<tr>
<td>Sand</td>
<td>80.0</td>
<td>78.8</td>
<td>pH</td>
</tr>
<tr>
<td>Organic matter</td>
<td>1.05</td>
<td>0.95</td>
<td>Total N (ppm)</td>
</tr>
<tr>
<td>Texture grade</td>
<td>Loamy sand</td>
<td>Loamy sand</td>
<td>Total P</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Total K</td>
</tr>
</tbody>
</table>

To prepare 100 liters from a mixed fertilizer by fertilization ratio 2:1:2 N-P-K, 25% from solid fertilizer was prepared as these formulas.

\[
T_m = 25 \text{ Kg}/100 \text{ litter}, \quad F_N = 33.3 \% \text{ as ammonium nitrate}, \quad F_P = 85\% \text{ as phosphoric acid}, \quad F_K = 50\% \text{ as potassium sulphate}, \quad (\text{element ratio}) \quad R_N = 2, \quad R_P = 1, \quad R_K = 2
\]

\[
R_f = a \times F \times 100 / f_i
\]

\[
R_f_{\text{ANS}} = 2 \times 100 / 33.3 = 6.01
\]

\[
R_f_{\text{P,PA}} = 1 \times 100 / 85 = 1.18
\]

\[
R_f_{\text{K,KS}} = 2 \times 100 / 50 = 4
\]

\[
\text{TR}_f = R_f_{\text{ANS}} + R_f_{\text{P,PA}} + R_f_{\text{K,KS}} = 6.01 + 1.18 + 4 = 11.18
\]

\[
M_f (\text{amount of fertilizer sours}) = R \times (T_m / \text{TR})
\]

\[
M_f_{\text{N,ANS}} = 6.01 \times (25 / 11.18) = 13.43 \text{kg}
\]

\[
M_f_{\text{P,PA}} = 1.18 \times (25 / 11.18) = 2.63 \text{kg}
\]

\[
M_f_{\text{K,KS}} = 4 \times (25 / 11.18) = 8.94 \text{kg}
\]

Total solid fertilizers we used = 13.43 kg ANs + 2.63 kg PA + 8.94 kg KS=25 kg then solvate it in 100 litter water. From this solution date palm treated as follows:

1. Control.
2. NPK soil injection (500ml/tree/month).
3. NPK soil injection (750ml/tree/month).
4. NPK soil injection (1000ml/tree/month).

9th International Conference for Sustainable Agricultural Development 4-6 March 2019

*Fayoum J. Agric. Res.,&Dev.,Vol.33 No. 1(B) March,2019*
5) NPK trunk injection (100ml/tree/month).
6) NPK trunk injection (200ml/tree/month).
7) NPK trunk injection (300ml/tree/month).

The treatments were applied beginning from January to October where each dose was applied in two litters water for each palm tree. The experiment was arranged by completely randomized plots design in three replicates and two trees in all replicate.

**Trunk injection method:** at blood rest stage “January” the following steps were conducted: (a) Tree trunk diameter was measured; (b) A 6 mm-diameter hole was drilled to radius of the tree trunk where xylem was found, (c) The injector was hammered into the hole, (d) The hole around the injector was fallen by silicon, (e) The end of the tube was opened, tied to the injector and the NPK solution was fallen in the tube then it tied in any leaf above the hole.

**Soil injection method:** (a) A hole at three inch diameter, one meter deep and on abducted one meter from palm trunk was delved by auger, (b) Filtered pipe at three inch diameter and one meter length was put in the hole, (c) NPK solution was fallen in the hole to filtrates gradually to palm roots.

**Measurements:**
To determine the vegetative growth in the first half of November number of leaflet per leaf was accounted and recorded. Leaf length was measured and recorded and then average total chlorophyll was measured using a chlorophyll meter SPAD 502.

Leaflet samples were collected during November, (Reuther, 1948). Taken leaflets were washed with tap water and then with distilled water to remove the dust and any chemical spray residues. After washing, they were air-dried and put in an electric oven at 70° C for 72 hours. The dried material was ground in an electric mill to be stored in paper bags for analysis:

Wet digestion of plant material was carried out using hydrogen peroxide and sulfuric acid as recommended by Parkinson and Allen (1975). Total nitrogen was determined in digested samples by semi-micro Kjeldahl methods as recommended by Bremner (1965). Phosphorus was calorimetrically determined using the molybdenum method according to Chapman and Pratt (1961). Potassium was determined by the flame photometer as outlined in Jackson (1958).

In the second half of October from each season yield of the experimental palms was determined as Kg/palm.

Fifty fruits at tamer stage were randomly selected from each tree and then their physical properties i.e. (fruit weight, flesh weight, fruit length and fruit diameter) were determined and recorded.

To determine fruit chemical properties fifty gram from fruit flesh were blended in 100 ml distilled water using special electric mixer, then filtered and the filtrate was taken for analysis according to A. O. A. C. (2005). Total soluble solids (T.S.S.) in fruit juice were determined using Carl Zeiss hand refractometer. Reducing, non-reducing and total sugars percentage was determined according to
Miller (1959). Titratable acidity percentage in fruit juice was determined according to Vogel, (1968).

**Statistical Analysis:**

The obtained data of both seasons were subjected to analysis of variance according to Snedecor and Cochran, (1989) and the means were differentiated using Duncan multiple range test at 5% level. Duncan (1955).

To evaluate studied treatments, the reading of the control treatment was discounted from reading of each treatment to calculate the amount of increase achieved by each treatment. The amount of increase in each reading was calculated for a percentage through the equation where percentage of increase over control = the amount of increase from each treatment / control treatment * 100

The average percentage increase over control was calculated for vegetative growth, leaf NPK, yield, and fruit physical and chemical quality.

**RESULTS AND DISCUSSION**

Data in tables (2to6) indicated that all results obtained were a significant increase in all vegetative growth parameters and NPK leaf contents this led to an improving in yield and fruit quality compared with control treatment in both seasons.

**Vegetative growth:**

It is clear from table (2) that NPK trunk injection treatments surpassed NPK soil injection treatments in leaf length (m), number of leaflet per leaf and total chlorophyll of sewy date palm in both studied seasons.

**Table (2) Effect of (NPK) soil and trunk injection on leaf length (m), number of leaflet per leaf and total chlorophyll of sewy date palm during 2015 and 2016 seasons.**

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Leaf length (m)</th>
<th>Number of leaflet per leaf</th>
<th>Total chlorophyll</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control.</td>
<td>3.40</td>
<td>E</td>
<td>3.42</td>
</tr>
<tr>
<td>NPK Soil injection (500ml/tree/month).</td>
<td>D</td>
<td>D</td>
<td>191.00</td>
</tr>
<tr>
<td>NPK Soil injection (750ml/tree/month).</td>
<td>C</td>
<td>C</td>
<td>195.33</td>
</tr>
<tr>
<td>NPK Soil injection (1000ml/tree/month).</td>
<td>BC</td>
<td>B</td>
<td>198.00</td>
</tr>
<tr>
<td>NPK Trunk injection (100ml/tree/month).</td>
<td>AB</td>
<td>B</td>
<td>202.33</td>
</tr>
<tr>
<td>NPK Trunk injection (200ml/tree/month).</td>
<td>AB</td>
<td>AB</td>
<td>207.33</td>
</tr>
<tr>
<td>NPK Trunk injection (300ml/tree/month).</td>
<td>A</td>
<td>A</td>
<td>210.00</td>
</tr>
</tbody>
</table>

Values with the same letters were non-significant effect.
To evaluate all treatments compared with control as in fig (2) we find that some vegetative growth parameters increased by NPK soil injection by 500,750 & 1000 ml/tree/month (7.1, 11.1, and 13.4%) and trunk injection by 100,200 & 300 ml/tree/month (14.7, 16.4 & 18.1%) respectively compared with control. Where trunk injection by 300 ml/tree/month achieved an increase in vegetative growth determined by (18.1%) than control. These results may be that these methods transfer the element directly to the respective parts of attributed to plant through trunk which led to an increase in vegetative growth parameters. These results are agree with the findings by (Dong et al., 2005, Abdi and Hedayat 2010 on kabbab date palm and Elsyad et al., 2018 on barhee date palm)

Leaf NPK content:

Leaf NPK content significantly affected by adding NPK to sewy date palm through soil and trunk injection as in table (3) we find that sewy date palm leaf NPK contents increased gradually by increase application levels of NPK soil and trunk injection. In addition to, 1000 ml/tree/month NPK was the best level of soil injection. For instance, this treatment achieved (1.88&1.86%) of nitrogen, (0.27&0.30%) of phosphorous and (1.70&1.71%) of potassium in sewy date palm leaves in the 1st and 2nd seasons, respectively. On the other hand all trunk injection levels created significant increase in leaves NPK contents in both seasons where the highest values in leaf N (1.98&2.02%), P (0.35&0.37%) and K(1.81&1.82%) concentrations obtained from trunk injection with 300 ml/tree/month compared with all treatments in the 1st and 2nd seasons, respectively. Besides, control treatment gave the lowest leaf NPK concentrations in both studied seasons.
Table (3) Effect of (NPK) soil and trunk injection on leaf NPK contents of sewy date palm during 2015 and 2016 seasons.

<table>
<thead>
<tr>
<th>Treatments</th>
<th>% N</th>
<th>% P</th>
<th>% K</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control.</td>
<td>1.47</td>
<td>1.50</td>
<td>0.22</td>
</tr>
<tr>
<td>NPK Soil injection (500ml/tree/month).</td>
<td>F</td>
<td>D</td>
<td>F</td>
</tr>
<tr>
<td></td>
<td>1.63</td>
<td>1.64</td>
<td>0.24</td>
</tr>
<tr>
<td>NPK Soil injection (750ml/tree/month).</td>
<td>E</td>
<td>CD</td>
<td>E</td>
</tr>
<tr>
<td></td>
<td>1.84</td>
<td>1.66</td>
<td>0.26</td>
</tr>
<tr>
<td>NPK Soil injection (1000ml/tree/month).</td>
<td>D</td>
<td>BCD</td>
<td>D</td>
</tr>
<tr>
<td></td>
<td>1.88</td>
<td>1.86</td>
<td>0.27</td>
</tr>
<tr>
<td>NPK Trunk injection (1000ml/tree/month).</td>
<td>C</td>
<td>ABC</td>
<td>C</td>
</tr>
<tr>
<td></td>
<td>1.91</td>
<td>1.93</td>
<td>0.3</td>
</tr>
<tr>
<td></td>
<td>1.94</td>
<td>1.95</td>
<td>0.33</td>
</tr>
<tr>
<td>NPK Trunk injection (3000ml/tree/month).</td>
<td>A</td>
<td>A</td>
<td>A</td>
</tr>
</tbody>
</table>

Values with the same letters were non-significant effect.

Moreover, fig (2) shows that all soil and trunk injection treatments achieved an increase in leaves' NPK as percentage over control treatment. For instance, 1000ml/tree/month NPK soil injection gave an increase in leaves' NPK (15%) and the highest increase in leaves' NPK (26%) over control treatment obtained from 300ml/tree/month trunk injection.

These results may be come back to the role of NPK soil injection method in decrease leaching of nutrients from soil and direct transfer of NPK by trunk injection method that enhancing increases leaf nutrient content. These findings are in harmony with those found by (El-merghany et al., 2016) on sewy date palm fertilized with 15kg poultry manure with 5kg from NPK mixture (2:3:2), (Ibrahim 2003)
et al., 2013) and (Abo-Rekabet et al., 2010) which improving leaf mineral content of Sewy date palm.

Fruit yield:

Regarding to the effect of NPK soil and trunk injection on yield parameters of sewy date palm data in table (4) showed a significant difference between all studied treatments in bunch weight (kg), yield (kg/tree) and yield (Ton/Fed) of sewy date palm trees in both studied seasons. All soil and trunk NPK injection achieved significant increase in these characteristics compared with control (recommended dose of NPK as a soil application).

Table (4) Effect of NPK soil and trunk injection on bunch weight (kg) and yield (kg/tree) of sewy date palm during 2015 and 2016 seasons.

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Bunch weight (kg)</th>
<th>Yield (kg/tree)</th>
<th>Yield (Ton/Fed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control.</td>
<td>7.8 E</td>
<td>8.99E</td>
<td>78.27 E</td>
</tr>
<tr>
<td>NPK Soil injection (500ml/tree/month).</td>
<td>8.4 D</td>
<td>9.53 F</td>
<td>83.73 D</td>
</tr>
<tr>
<td>NPK Soil injection (750ml/tree/month).</td>
<td>8.7 D</td>
<td>9.83 E</td>
<td>86.67 D</td>
</tr>
<tr>
<td>NPK Soil injection (500ml/tree/month).</td>
<td>9.2 C</td>
<td>10.45 D</td>
<td>92.00 D</td>
</tr>
<tr>
<td>NPK Trunk injection (100ml/tree/month).</td>
<td>9.5 C</td>
<td>10.84 C</td>
<td>94.67 C</td>
</tr>
<tr>
<td>NPK Trunk injection (200ml/tree/month).</td>
<td>10.2 B</td>
<td>11.32 B</td>
<td>101.50 B</td>
</tr>
<tr>
<td>NPK Trunk injection (300ml/tree/month).</td>
<td>10.7 A</td>
<td>11.64 A</td>
<td>106.83 A</td>
</tr>
</tbody>
</table>

Values with the same letters were non-significant effect.

Wherever, NPK soil injection by 1000ml/tree/month was the best where it gave (9.2 & 10.45 kg) of bunch weight, (92.00 & 104.47 kg) of tree yield and (4.60 & 5.22 Ton) of feddan yield in 2015 & 2016 seasons respectively. Besides, NPK trunk injection by 300ml/tree/month was the best NPK treatments where it gave (10.7 & 11.64 kg) of bunch weight, (106.83 & 116.37 kg) of tree yield and (5.34 & 5.82 Ton) of feddan yield in 2015 & 2016 seasons respectively which assimilate the best treatments in this study.

Thereupon, fig (3) indicates that all yield parameters increased gradually by NPK soil and trunk injection increase where NPK soil injection by 1000ml/tree/month achieved an increase in yield by 15% over control but the highest yield increase 27% were obtained from NPK trunk injection by 300ml/tree/month treatment.
These results may come back to the role of sufficient NPK on improving vegetative growth and nutrients status of sewy date palm which led to this increase in all yield parameters. These results are agree with the findings by El-merghany et al., 2016 on sewy date palm, Jahanshah, et al., 2016 on date palm cv. kabkab and Abdi and Hedayat, 2010 who use K trunk injection in date palm.

**Fruit physical properties:**

It is clear from table (5) and fig (4) that there was significant increase in all studied fruit physical properties of sewy date palm obtained from all NPK soil and trunk injection treatments compared with control treatment in both studied seasons. In this respect, we found that the highest fruit weight (10.4 & 12.4 g) and flesh weight (9.5 & 11.5 g) obtained from NPK trunk injection by 300 ml/tree/month this led to an improvement in flesh percentage which gave the highest values (91.5 & 93.8%).

**Table (5) Effect of NPK soil and trunk injection on some fruit physical properties of sewy date palm during 2015 and 2016 seasons.**

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Fruit weight (g)</th>
<th>Flesh weight (g)</th>
<th>Flesh percentage</th>
<th>Fruit length (cm)</th>
<th>Fruit diameter (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>7.47F</td>
<td>6.05F</td>
<td>80.8C</td>
<td>3.19D</td>
<td>2.02D</td>
</tr>
<tr>
<td>NPK Soil Injection (500ml/tree/month)</td>
<td>8.42E</td>
<td>6.99B</td>
<td>83.0E</td>
<td>3.31F</td>
<td>2.05B</td>
</tr>
<tr>
<td>NPK Soil Injection (750ml/tree/month)</td>
<td>8.46D</td>
<td>7.42B</td>
<td>87.7A</td>
<td>3.57C</td>
<td>2.10C</td>
</tr>
<tr>
<td>NPK Soil Injection (1000ml/tree/month)</td>
<td>8.69C</td>
<td>7.61B</td>
<td>87.6A</td>
<td>3.75C</td>
<td>2.19C</td>
</tr>
<tr>
<td>NPK Trunk injection (100ml/tree/month)</td>
<td>8.77C</td>
<td>7.64B</td>
<td>87.2A</td>
<td>3.84AB</td>
<td>2.25B</td>
</tr>
<tr>
<td>NPK Trunk injection (200ml/tree/month)</td>
<td>9.74B</td>
<td>8.79A</td>
<td>90.3A</td>
<td>3.88AB</td>
<td>2.31B</td>
</tr>
<tr>
<td>NPK Trunk injection (300ml/tree/month)</td>
<td>10.4A</td>
<td>9.5A</td>
<td>91.5A</td>
<td>3.95A</td>
<td>2.50A</td>
</tr>
</tbody>
</table>

Values with the same letters were non-significant effect.
Besides, positive effect to soil and trunk injection treatments in fruit length and diameter compared with control were found. Where, these treatments provided fruit length and diameter gradually by increase use levels. The highest fruit length (3.95\&3.96 cm) and flesh weight (2.50\&2.59 cm) obtained from NPK trunk injection by 300 ml/tree/month as in table (5) in 2015 \& 2016 respectively.

Moreover, from fig (4) we find that gradually increase in fruit physical properties of sewy date palm obtained from soil and trunk injection by increase using levels over control treatment. Trunk injection by 300ml/tree/month achieved the highest increase (31\%) over control treatment as average two studied seasons.

These results may be come back to the role of sufficient NPK on improving nutrients status of sewy date palm which led to this increase in all fruit physical properties. These results are agree with the findings by El-merghany et al., 2016 on sewy date palm, Jahanshah, et al., 2016 whose conducted that trunk injection is a more efficient method which increased significant fruit weight, flesh weight, fruit size, of date palms cv. Kabkab grown in calcareous soils.

**Fruit chemical properties:**

According to table (6) and fig (5) we find that fruit chemical properties take the same trend of all previous studied parameters. Significantly increase in tss, total, reducing and non-reducing sugars were found by using NPK soil and trunk injection treatments compared with control while significant decrease in total acidity of sewy date palm fruits were recorded in all NPK soil and trunk injection treatments compared with control.
Table (6) Effect of NPK soil and trunk injection on some fruit chemical properties of sewy date palm fruits during 2015 and 2016 seasons.

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Tss</th>
<th>acidity</th>
<th>Total sugars</th>
<th>Reducing sugars</th>
<th>Non reducing sugars</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>68.6</td>
<td>68.8</td>
<td>0.27</td>
<td>0.26</td>
<td>58.6</td>
</tr>
<tr>
<td>NPK Soil injection (500ml/tree/month)</td>
<td>72.2</td>
<td>72.8</td>
<td>0.24</td>
<td>0.25</td>
<td>59.9</td>
</tr>
<tr>
<td>NPK Soil injection (750ml/tree/month)</td>
<td>74.1</td>
<td>74.1</td>
<td>0.25</td>
<td>0.25</td>
<td>63.0</td>
</tr>
<tr>
<td>NPK Soil injection (1000ml/tree/month)</td>
<td>78.6</td>
<td>75.5</td>
<td>0.23</td>
<td>0.23</td>
<td>65.5</td>
</tr>
<tr>
<td>NPK Trunk injection (100ml/tree/month)</td>
<td>80.7</td>
<td>78.6</td>
<td>0.22</td>
<td>0.21</td>
<td>68.4</td>
</tr>
<tr>
<td>NPK Trunk injection (200ml/tree/month)</td>
<td>82.7</td>
<td>80.9</td>
<td>0.21</td>
<td>0.21</td>
<td>72.6</td>
</tr>
<tr>
<td>NPK Trunk injection (300ml/tree/month)</td>
<td>85.3</td>
<td>82.0</td>
<td>0.20</td>
<td>0.19</td>
<td>78.2</td>
</tr>
</tbody>
</table>

Values with the same letters were non-significant effect.

The best one from soil injection treatments was NPK soil injection by 1000ml/tree/month where give fruit tss (78.6 & 75.5%), fruit total sugars (65.5 & 66.3%), fruit reducing sugars (55.5 & 55.8%) and fruit non reducing sugars (9.99 & 10.6%) in 2015 and 2016 seasons respectively. But the highest values of fruit tss (85.3 & 82.0%), fruit total sugars (78.2 & 79.4%), fruit reducing sugars (65.5 & 67.4%) and fruit non reducing sugars (12.7 & 12.0%) were obtained from NPK trunk injection by 300ml/tree/month treatment compared with all treatments in this study in 2015 and 2016 seasons respectively. This treatment gave the lowest fruit total acidity (0.20 & 0.19%) in the first and second season’s respectively.

Besides, from fig (5) we find that gradually increase in fruit chemical properties of sewy date palm obtained from soil and trunk injection by increase using levels over control treatment. Trunk injection by 300ml/tree/month achieved the highest increase (13.59%) over control treatment as average two studied seasons.
The obvious data may be back to sufficient K that inhibits carbohydrates transferring from leaves to fruits and improving all fruit chemical properties. These results are agree with the findings by Jahanshah, et al., 2016 conducted that trunk injection is a more efficient fertilization method which increased significant TSS, total, reducing and non-reducing sugars of date palms cv. Kabkab grown in calcareous soils Abdi and Hedayat, 2010 and Elsayd et al, 2018 who use K trunk injection in barhee date palm.

Finally, from table (7) using NPK as quantities (g/tree/year) or as percentage from recommendation doses and NPK saving as percentage from recommendation doses were calculated. From the table we find that the best treatment from soil injection treatments (1000ml/tree/month) saved 55.3% from nitrogen as ammonium nitrate and phosphorus as phosphoric acid but this percentage was 40.4% from potassium as potassium sulphate. Besides, the best treatment from trunk injection treatments (300ml/tree/month) saved 86.6 %from nitrogen as ammonium nitrate and phosphorus as phosphoric acid but this percentage was 82.1% from potassium as potassium sulphate. These results achieve the aim of this study in rationalization fertilizers use and reducing environment pollution.

Thus, fertilization sewy date palm using soil injection by 1000ml/tree/month or using trunk injection by (300ml/tree/month) from2:1:2 NPK solution is recommended starting from January to October one dose monthly to improving date palm productivity and fruit quality.
Table (7) NPK using quantity (g/tree/year) from fertilizer forms (ammonium nitrate “Nan”, phosphoric acid “Ppa”, potassium sulphate “Kks”), NPK using as percentage from recommendation doses and NPK saving as percentage from recommendation doses

<table>
<thead>
<tr>
<th>Treatments</th>
<th>NPK using quantity (g/tree/year)</th>
<th>NPK using as percentage from recommendation doses</th>
<th>NPK saving as percentage from recommendation doses</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Nan</td>
<td>Ppa</td>
<td>Kks</td>
</tr>
<tr>
<td>Control.</td>
<td>3003.00</td>
<td>588.23</td>
<td>1500</td>
</tr>
<tr>
<td>NPK Soil injection (500ml/tree/month).</td>
<td>671.4</td>
<td>131.5</td>
<td>447.1</td>
</tr>
<tr>
<td>NPK Soil injection (750ml/tree/month).</td>
<td>1007.0</td>
<td>197.3</td>
<td>670.7</td>
</tr>
<tr>
<td>NPK Soil injection (1000ml/tree/month).</td>
<td>1342.7</td>
<td>263.0</td>
<td>894.3</td>
</tr>
<tr>
<td>NPK Trunk injection (100ml/tree/month).</td>
<td>134.3</td>
<td>26.3</td>
<td>89.4</td>
</tr>
<tr>
<td>NPK Trunk injection (200ml/tree/month).</td>
<td>268.5</td>
<td>52.6</td>
<td>178.9</td>
</tr>
<tr>
<td>NPK Trunk injection (300ml/tree/month).</td>
<td>402.8</td>
<td>78.9</td>
<td>268.3</td>
</tr>
</tbody>
</table>

REFERENCES


تأثير التسديم بحقن التربة والجزء بمخلوط النيتروجين والفوسفور والبوتاسيوم على النتائج وجودة ثمار خليج البلح السيوي

عبد محمد أحمد زين الدين
قسم الانتاج النباتي - مركز بحوث الصحرا - القاهرة - مصر

أجريت هذه الدراسة خلال مواسم متتاليين لعامي 2015 و2016 على أشجار نخيل البلح السيوي النامات في محطة بحوث سوسة التابعة لمركز بحوث الصحرا في ولاية سوسة، محافظة مطروح، مصر. تم استخدام الثمانية طرق التسديم (حقن التربة وحقن الجذع) فيصبح هذين نظامين استنادًاًا إلى الأسمدة النيتروغينية تحت نظام الري بالفرز، حيث كان نظام حقن الراتب بأفقي مستويات (500 و1000) مل/ شجرة/ شهر.

وتم استخدام نظام حقن الجذع بأفقي مستويات (0.02 و0.01 و0.03) مل/ شجرة/ شهر من مخلوط NPK بنسبة (2:1:2) (بالمول) مع إجراء ترشيده باستخدام الأسمدة الكيميائية تحت نظام الري بالفرز.

وقد أوضحت النتائج أن جميع معاملات التسديم حقن الراتب وجذع حقن زيادة معنوية في جميع الصفات المتنوعة، بما فيها معاملات حقن الفوسفور، وحقن نباتات纠结 الزعنفرية، وحقن العظام. وقامت معاملة حقن NPK بمعدل 1800 مل/ شجرة/ شهر زيادة في الفوسيول بنسبة 15، وزيادة في الورق بنسبة 13 وزيادة في المحتوى الفيزيولوجي للشجر بنسبة 31% عن معاملة الاتنين.

كما وجد أن أفضل معاملة من معاملات حقن الراتب هي (0.01 مل/ شجرة/ شهر) حيث وفرت 3.3% من النيتروجين في صورة نترات الأمونيوم والفوسفور في صورة حامض الفوسفور، كما وفرت 4.4% من البوتاسيوم في صورة سيلفات البوتاسيوم. مع زيادة معنوية في نتائجها، حيث وفرت 8.8% من النيتروجين في صورة نترات الأمونيوم والفوسفور في صورة حامض الفوسفور، كما وفرت 7.1% من البوتاسيوم في صورة سيلفات البوتاسيوم.

هذه النتائج تحقق هدف هذه الدراسة في تنويع استراتيجيات الأسمدة والحد من تلوث البيئة. وبالتالي، فإننا نوصي باستخدام نخيل البلح باستخدام حقن نخيل تربة بمعدل 0.01 مل/ شجرة/ شهر أو استخدام حقن NPK بـ 1800 مل/ شجرة/ شهر، بدءًا من يناير إلى أكتوبر، و الجمعية واحدة شهرياً، لتحسين إنتاجية وجودة صفات ثمار خليج البلح.
