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EFFECT OF POTASSIUM FERTILIZER SOURCE ON TREE FRUITING, FRUIT QUALITY AND STORABILITY OF GOLDEN JAPANESE PLUM

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ABSTRACT

This investigation was carried out during seasons of 2006 and 2007 on Golden Japanese plum trees to study the effect of four potassium fertilizer sources (potassen, liquid potassium, potassium nitrate and Coda-PK) and control treatment sprayed at bud burst, after fruit set and one month after fruit set. Results revealed that all treatments significantly increased fruit set, yield, fruit weight, fruit size, fruit length, fruit diameter, total sugar and K (%) in both seasons, while they decreased fruit drop (%) compared with the control. Coda-PK treatment gave the highest yield compared to other treatments in both seasons followed by liquid potassium, potassium nitrate and potassen in adescending order.

The tested treatments enhanced total carbohydrates and leaf macro-elements content. Storage studies on ”Golden Japanese” plum fruits showed the high ability of fruits for keeping quality at 5°c for about one month without changing in aroma or taste.

INTRODUCTION

Japanese plum, (*Prunus Salicina*) is one of the favorable fruits in Egypt. Potassium is the most important cation not only in regard to its content in plant tissues but also with respect to its physiological and biochemical function (Ansari and Bowling 1972). Furthermore, potassium is very mobile in the plant since it is transported directly towards the meristematic tissues (Greenway and Pitman 1965).

The main function of potassium in biochemistry is the activation of various enzymatic systems (Evans and Sorger, 1966). Besides, Mansour. *et al* (1986) showed that a slight increase in fruit weight, size and yield of peach as a result of adding 1.3Kg K_2SO_4 /tree at pit Hardening or 2.6 kg k_2so_4 at Hardening stage. Moreover, Samra (1989) revealed that spraying guava trees with potassium sulphate at blooming stage increased fruit set percentage and yield, and reduced the fruit dropping. Furthermore, potassium application at fruit set reduced fruit dropping percentage and enhanced fruiting parameters. Besides, all tested potassium applications significantly increased fruit content of T.S.S, T.S.S/acid ratio and the potassium content in both leaves and fruits.

Moreover, Attala., (1997) studied the effect of applying different doses of potassium sulphate from zero to 2kg / tree on Anna apple trees budded on MM106 stock. The results showed that potassium fertilization had no significant effect on leaf N and P content. In addition leaf K, Fe, Zn and Mg content were increased by application of 1.5 or 2.0kg K_2SO_4. Likewise, obvious increases in leaf total soluble and non- soluble carbohydrates were evident. Significant increase in fruit set and decrease in fruit drop were also

achieved. The high rates of potassium sulphate increased yield of Anna apple trees. Fruit weight, size, flesh firmness and T.S.S values were increased by all tested treatments. However, higher values of T.S.S/acid ratio caused earlier fruit ripening.

Ahmed *et al.*, (1997) mentioned that application of nitrogen, potassium and sulphur via soil is usually accompanied with some losses through leaching particularly under the excessive irrigation system followed in Egypt. Therefore foliar application of nutrients such as N, P, K, B and Zn substantially improved the efficiency of nutrition with macro and micro nutrients of fruit trees especially Anna apple trees. In this respect, Achilea; *et al* (2001) noted that potassium nitrate has been specifically developed for foliar feeding of a large variety of crop. It is sprayed at concentration up to 10% for intensive foliar nutrition and for a prolonged effect, without any phototoxic effect. Bonus- NPK is potassium nitrate enriched with soluble phosphates and a special adjuvant. These results verify that Bonus-NPK is an ideal preparation for intensive potasic feeding that considerably increases total yield, primarily by increasing the size of individual fruit units. Bonus-NPK provides its maximum benefit to the growers when the market pays high premiums for larger fruit units.

On the other hand, Awasthi, *et al* (1999) studied the effect of rate and method of potassium application on yield, fruit quality and nutrient status of New Castle apricot during two seasons (1993 and 1994). They found that yield was significantly increased with the increase in K level during 1993, only. However, application methods and number of supplementary foliar sprays had no significant effect on the yield. Foliar application of K in two sprays further increased the fruit weight and T.S.S content. Soil application of K significantly increased leaf and fruit K concentration whereas; the concentration of N, P, Ca and Mg was decreased.

Therefore, this study was under taken to evaluate the prospective affects of different sources of potassium fertilization on fruit set, yield, dropping and fruit quality at picking date and fruit quality after storage of Golden Japanese plum trees.

MATERIALS AND METHODS

This study was conducted during two consecutive seasons (2006 & 2007) on 15 years old "Golden Japanese" plum trees (*Prunus salicina*) grown at El- Pharonia Village Al-Monifia Governorate. Selected trees were grown in clay soil, at 5× 5m apart, nearly similar in growth vigor and fruiting, free from any visual infections and received regularly the recommended horticultural practices. Although, soil analyses indicated that available potassium was at the ideal level for plant uptakes. Potassium leaf analysis showed that potassium percentage was at deficiency level. i.e., less than one percentage so potassium deficiency symptoms could be seen in the leaves which means variable, but most typical as browning or scorching of the tips and dry margins of the leaves which may dry out. This effect appears first on the older leaves and the effected leaf edges are often clued (James, *et. al.,* 1989). The

mechanical and chemical analysis of the experimental soil is illustrated in Table (1).

Table (1): Some chemical analyses of the tested soil:

Element	EC (dS/m) (1-5)	pH	K-soluble (ppm)	K-exchange (ppm)	P (ppm)	N (ppm)	S (ppm)	$CaCO_3$ (%)
Ratio	0.26	8	37.5	112.5	39.5	195	19.2	2.9

Four sources of potassium fertilizer were applied as a foliar sprays three times a year i-e at bud burst, at fruit set and one month later as follows:-

1) Potassium nitrate (as K_2O: 13% & NO_3: 43% & P_2O_5 :13%) with concentration 10g/ liter (1%).
2) Liquid potassium (as potassium thio sulphate K_2O: 36.5% and 25% sulphate) with concentration 2cm^3/ liter (0.2%).
3) Coda-PK (as K_2O: 16.1% and P_2O_5:8.5%) with concentration 2cm^3/ liter (0.2%).
4) Bio-potassium named Potassen (K_2O: 30%and P_2O_5:10%) with concentration 2.5cm^3/liter (0.25%)
5) Control: Check trees were sprayed with tap water.

The treatments were arranged in a completely randomized design. Each treatment was replicated three times and each replicate was represented by one tree.

Furthermore to evaluate the efficiency of the tested treatments on tree fruiting, fruit quality and storage ability of plum fruits the following measurements was carried out.

I-Tree fruiting:

a) Fruit set percentage:-
Total number of flowers at blooming stage (11-15th March) was counted on 40 shoots selected randomly at 4 tree directions. Then after month, number of fruits were computed and recorded to calculate fruit setting and before harvest the yield (20th June) number of fruits were counted and recorded to calculate final fruit setting.

b) Yield: - At harvest time (28th June) in both seasons the yield of selected trees was determined as kg/tree for all treatments.

c) Fruit quality: - Samples of fruits were collected from each treatment (60 fruits/tree) for the determination fruit characteristics at the same time (picking date), and after storage.

Sampling at the end of the growing season, thirty fruits were examined to determine physical characters (fruit weight, fruit size, fruit length, fruit diameter and firmness) and chemical characters (total soluble solids and titratable acidity). Another thirty fruits were stored in package (25 x 35 cm) at 5°C & 85% RH for 30 days after picking date and were examined to determine physical characters (Weight loss % & firmness Ib/inch^2) and chemical characters (T.S.S and acidity) after ten days, twenty days and thirty days from picking date.

At picking date:-

1- Fruit physical properties i-e fruit weight (g), size (cm^3), length (cm), diameter (cm), firmness ($lb/inch^2$), and flesh thickness (cm) were determined and recorded.
2- Fruit chemical properties i-e total soluble solids (%), total sugar (%), juice acidity (%) and fruit K (%) content were determined according to A.O.A.C (1995) and recorded.

II- Fruit storage ability:-

The loss of fruit weight %, firmness ($lb/inch^2$), total soluble solid (%) and acidity (%) were determined in "Golden Japanese" fruits and recorded periodically at 10 days intervals up to 30 days.

III-Leaf mineral content: -

Samples of twenty leaves from the middle part of shoots according to Chuntanaparb and Cummings (1981) were selected at random from each replicate (after harvest) to determine their content of P, K, S (according to Evenhuis, 1978), and used the kjeldahl digestion method for N as described by A.O.A.C (1990), and the colorimetric method for total carbohydrates (%) as outlined by Dubois *et. al.*, (1956). Determinations of the leaves content of nutrients were carried out on a dry weight basis.

Data in this study were statistically analyzed according to the method of Snedecor and Cochran (1990)in each season L.S.D at 5% level and Duncan multiple range test (Waller and Duncan 1969) were used for comparison between means of each treatment.

RESULTS and DISCUSSION

(1) Fruiting parameters

1-a- fruit set and dropping percentage

Table (2) reveals that all tested potassium fertilization forms significantly increased fruit set percent in comparison with the control. Furthermore, trees sprayed with Coda-PK (16.1% K_2O_2 & 8.5% P_2O_5) gave a more pronounced effect on fruit set percentage (12.83 & 15.38) compared with untreated trees (5.7 & 6.22) in 2006 & 2007 seasons respectively. The obtained data are in harmony with those reported by Attala, (1997) who mentioned that potassium application increased fruit set of Anna apple trees. Similar results were found by Samra, (1986) on guava, Mansour (1986) on peach and Achilea et al (2001) on citrus.

With regard to the effect of different potassium fertilizer sources on fruit dropping percentage, data show that all potassium fertilization sources except for potassen treatment reduced fruit dropping percentage occurred during June and at pre-harvest stage than the untreated trees. Yet, trees sprayed with Coda-PK or liquid potassium gave more pronounced reduction effect than the other tested treatments. In this connection, Samra, (1989) mentioned that spraying guava trees with potassium sulphate at flowering stage and fruit set reduced the dropping percentage .Also, Attala (1997) noticed that applying different doses of potassium sulphate decreased fruit drop percentage of Anna apple fruits.

1-b- Yield: - It could be concluded from Table (2) that all tested potassium applications significantly increased the yield per tree than untreated ones. Furthermore, trees sprayed with Coda-PK and liquid potassium gave the highest yield (51.33 & 55.33 kg) and (49.33 & 51.33 kg) in the first season second season respectively. These treatments increased the fruit set percent and there up on, they enhanced total yield per tree.

In this respect, Achilea, *et al* (2001) mentioned that Bonus- NPK is an ideal preparation for intensive potasic feeding that considerably increases total yield of citrus trees. Also, Ahmed *et al*, (1997) reported that yield of Anna apple trees was significantly increased with the increase in K level during 1993, only.

Table (2): Effect of potassium fertilizer sources on fruit set, fruit drop and yield of Golden Japanese plum fruits (2006 & 2007 seasons)

Treatment	Fruit set (%)	Fruit drop (%)	Fruit yield(kg)/ tree
(2006)			
Potassen	9.08 B	1.96 A	44.67 D
Liquid Potassium	7.25C	1.16 B	49.33 B
Potassium Nitrate	8.06 BC	1.45 B	47.33 C
Coda-PK	12.83 A	1.25 B	51.33 A
Control	5.78 D	1.97 A	40.67 E
(2007)			
Potassen	9.93 B	2.47A	49.00 C
Liquid Potassium	8.24 C	1.37 BC	51.33B
Potassium Nitrate	9.14BC	1.46 B	50.67 BC
Coda-PK	15.38A	1.05 C	55.33 A
Control	6.22 D	2.70A	45.67 D

Means within each column followed by the same letter(s) are not significantly different at 5% level.

(2) Physical characteristics of "Golden Japanese" plum fruits at picking date:-

2-a- Effect on fruit weight and size

Average fruit weight was positively affected by spraying "Golden Japanese" plum trees with potassium (Table, 3). Spraying trees with different sources of potassium significantly increased the average fruit weight as compared with untreated ones. Maximum fruit weight and size were produced by Coda-PK or Potassen treated trees (54.15 & 50.36g) in the first season and (59.33 & 53.01g) in the second one, respectively. In this connection, fruit size of Coda-PK & potassen were treated trees gave the highest size in comparison with the other treatments.

A progressive improvement in fruit weight and size were detected due to raising K concentrations particularly, when supplemented with phosphorus fertilizer. The trend was the same in 2006 and 2007 seasons.

2-b- Fruit length and diameter

In 2006 and 2007 seasons the tested potassium fertilizer sources induced similar and higher positive effect on plum fruit length and diameter than untreated trees. (Table 3)

Table (3): Effect of potassium fertilizer sources on physical characteristics of Golden Japanese plum fruits at picking date (2006 & 2007 seasons)

Treatment	Fruit weight (g)	Fruit size $(cm)^3$	Fruit length (cm)	Fruit Diameter (cm)	Fruit Shape index	Flesh thickness (cm)	Firmness $(lb/inch^2)$
(2006)							
Potassen	50.36 B	43.00 B	4.07 B	4.50 A	0.95 A	1.46 AB	4.80 B
Liquid Potassium	43.57 C	37.10 C	4.13 AB	4.30 A	0.96 A	1.46AB	4.60 B
Potassium Nitrate	39.10 D	33.00 D	4.00 B	4.27 A	0.94 A	1.50 AB	4.13C
Coda-PK	54.15 A	50.83 A	4.30 A	4.40 A	0.98 A	1.53 A	4.23 C
Control	31.92 E	26.13 E	3.77 C	3.80 B	1.00 A	1.33 B	5.09 A
(2007)							
Potassen	53.01 B	50.46 B	4.30 B	4.53 A	0.95 B	1.47AB	4.47 C
Liquid Potassium	45.33 C	41.67 C	4.40 AB	4.53 A	0.97 AB	1.56 A	5.53 B
Potassium Nitrate	40.37 D	36.00D	4.33 B	4.43 A	0.98 AB	1.52 A	6.45 A
Coda-PK	59.33 A	56.67 A	4.53 A	4.47 A	1.02A	1.59 A	4.36 C
Control	36.72 E	31.67 E	4.10 C	4.07 B	1.01 A	1.33 B	5.22 B

Means within each column followed by the same letter(s) are not significantly different at 5% level.

2-c- Fruit shape index (L/D)

In both seasons the tested potassium fertilizer sources showed nearly insignificant effect on fruit shape index from the statistical standpoint.

2-d- Flesh thicknesses

It can be noticed that in Table (3) Coda-PK increased flesh thickness as compared with the other tested treatments in both seasons (2006 & 2007)

2-e- Firmness:-

Results in Table (3) show that Coda-PK treatment reduced fruit firmness in both seasons but potassium nitrate gave the highest increment in the second season. Our data are in the same line with Mansour, *et. al.* (1986) which showed that there is a slight increment in fruit weight, size and yield of peach fruits. Moreover, Attala, (1997) noticed that applying different doses of potassium fertilizer caused an increment in fruit weight, size and flesh firmness of Anna apple fruits.

3-Chemical characteristics at picking time

3-a- Total soluble solids

Regarding the effect of potassium (Table 4) showed that an increasing in T.S.S percentage was produced by potassium applications as compared with untreated trees in the both seasons (2006 & 2007). Such results go with Samra ;(1989) who said that all potassium applications significantly increased the values of T.S.S and T.S.S/acid ratio of guava fruits.

3-b-Acidity

It is obvious that in both seasons all tested treatments except for potassin treatment in 2006 season caused significant increase in fruit acidity in comparison with the control Potassium nitrate gave highest percent of acidity in the first season and Coda-PK in the second one (Table 4). Our data go in a line with Samra ;(1989)and Attala (1997).

3-c- T.S.S/acid ratios

Table (4) shows that potassium nitrate gave less value in T.S.S/ acid ratio than the other treatments including the control in 2006 season and Coda-PK gave less value in T.S.S./acid ratio compared with the other treatment in 2007 season. That is due to the raise in fruit acidity percent produced by these treatments in both seasons. Attala (1997) showed that applying different doses of potassium sulphate caused increasing in T.S.S values and T.S.S/ acid ratio of Anna apple fruits.

3-d- Total sugars

According to Table (4), it is clear that all tested treatments gave similarly higher values of total sugars percentage in comparison with the control.

3-e-Fruit potassium content

Table (4) shows that all potassium treatments significantly increased potassium content in fruits in comparison with the control. Moreover, trees sprayed with potassen gave the highest fruit K values in the both seasons, followed descendingly by potassium nitrate, Coda-PK, liquid potassium. Similarly, **Morris** *et al* (1980) found that excessive levels of potassium fertilizer (225.900 g/h) were applied to "Concord" grapevine resulted in increasing potassium in leaf petioles and berry juice.

Table (4): Effect of potassium on some chemical characteristics of Golden Japanese plum fruits at picking date seasons (2006& 2007)

Treatment	T.S.S (%)	Acidity (%)	T.S.S/acid ratio	Total sugars (%)	K in fruit (%)
(2006)					
Potassen	12.67A	0.52 E	24.37 A	7.57 A	0.90 A
Liquid Potassium	12.50 A	0.70 B	17.85 D	7.24 A	0.78 C
Potassium Nitrate	12.17 AB	0.85 A	14.31 E	7.35 A	0.78 C
Coda-PK	12.40 A	0.62 C	20.00 C	7.64 A	0.80 B
Control	11.83B	0.56 D	21.13B	6.22 B	0.54 D
(2007)					
Potassen	11.43B	0.56 C	20.41B	7.94 A	0.96 A
Liquid potassium	11.33 B	0.54D	20.98 A	7.46 C	0.79 C
Potassium nitrate	10.67 BC	0.63 B	16.93 D	7.620 B	0.83 BC
Coda-PK	12.0 A	0.82 A	14.63 E	7.81 A	0.85 B
Control	10.17C	0.53 E	19.19C	6.34 D	0.59 D

Means within each column followed by the same letter(s) are not significantly different at 5% level.

4- Effect of potassium on fruit characteristics after storage at 5°c:-

4-a- weight loss (%)

Weight loss (%) was significantly increased with the prolonged storage period and this increase varied among the different potassium fertilizer sources and storage periods. Concerning weight loss(%) at 5°C after ten days storage period, reached about 1.94& 2.05 in untreated trees but in the treated with potassen gave less percent in weight loss % (1.74&1.72) followed by Coda-PK and potassium nitrate in 2006 and 2007 seasons respectively (Table 5). Moreover, after 30 days storage period, the weight loss (%) increased in liquid potassium treated fruits to reach (8.62%) in the first season and potassium nitrate reached (7.51%) in the second season. These results are in agreement with Hardenburg *et al*., (1990) who stated that the high storage temperature causes increased respiration rate which leads to a fruit weight loss. In this concern Kuranze and Kaska (1993) mentioned that the rate of weight loss is increased with prolonging storage period. On the other hand, Shaltout, (1987) reported that Flordaprince peach cv. fruits could be stored at 0°C for 5 weeks with about 17% weight loss, whereas, storage at 5°C resulted in about 22.8% weight loss.

Table (5): Effect of potassium fertilizer source on fruit weight loss (%) of Golden Japanese plum fruit during storage at 5°C during (2006 & 2007 seasons).

Treatment	Initial reading	After 10 days	After 20 days	After 30 days
(2006)				
Potassen	0.0	1.74 C	2.76 B	6.43 B
Liquid Potassium	0.0	1.95 A	2.98 B	8.62 A
Potassium Nitrate	0.0	1.87 B	3.97 A	7.25 B
Coda-PK	0.0	1.86 B	3.11 B	6.98 B
Control	0.0	1.94 A	3.5 AB	7.22 B
(2007)				
Potassen	0.0	1.72 D	2.82 B	6.74 BC
Liquid Potassium	0.0	1.82 B	2.82 B	6.73 BC
Potassium Nitrate	0.0	1.70 BC	3.54 A	7.51 A
Coda-PK	0.0	1.67 C	3.21 AB	6.51 C
Control	0.0	2.05 A	3.37 AB	7.25 AB

Means within each column followed by the same letter(s) are not significantly different at 5% level.

4-b- Firmness:-

Prolonging storage period resulted in decreasing fruit firmness. Data in Table (6) indicated that storage at 5°C resulted in fruit softness after 10 days storage period recording 2.267, 3.00, 4.133, 4.233, 5.593 Ib/inch^2 for potassen, liquid potassium, potassium nitrate and Coda-PK respectively in the first season and 2.800, 3.033, 3.0833 Ib/inch^2 in the second season respectively. Fruit softness increased until the fourth week (30 days) to reach1.6, 1.6, 1.433, 1.600 Ib/inch^2 in the second season. **El- Oraby** *et al*, (2001) revealed that fruits softened gradually with prolonging the storage period. The decrease in firmness was clear with the rise in storage temperature. On the other hand, Shaltout, (1987) noticed that fruit firmness of

Flordaprince peach cv. was decreased as time of storage advanced and temperature increased. Similar results were noticed by Vanoli, *et al*, (1995) and Dundar, (1997) who stated that peach fruit firmness decreased continuously with the length of storage period.

Table (6): Effect of potassium fertilizer source on firmness (lb/inch^2) of Golden Japanese plum during storage period at 5°C (2006& 2007 seasons).

Treatment	Initial reading	After 10 days	After 20 days	After month
(2006)				
Potassen	4.800 B	2.267 D	1.877 B	1.600 A
Liquid Potassium	4.600 B	3.000 C	2.333 AB	1.600 A
Potassium Nitrate	4.133 C	3.067 C	1.807 B	1.433 A
Coda-PK	4.233 C	4.233 B	2.533 A	1.567 A
Control	5.093 A	5.090 A	1.950 B	1.600 A
(2007)				
Potassen	4.477 C	2.800 A	1.877 A	1.867 A
Liquid Potassium	5.537 B	3.033 A	2.300 A	1.167 C
Potassium Nitrate	6.450 A	3.033 A	1.967 A	1.333 BC
Coda-PK	4.360 C	2.833 A	2.200 A	1.700 AB
Control	5.220 B	3.033 A	1.867 A	1.700 AB

Means within each column followed by the same letter(s) are not significantly different at 5% level.

4-c-Total soluble solids

Data presented in Table (7) revealed that that fruit storage at 5°c resulted in a rapid decrease in T.S.S in all tested treatments. The highest T.S.S value was observed with liquid potassium and Coda-PK. After 10 days in the first season, fruit total soluble solids reached 11.67, 11.83%, but in the second season the T.S.S recorded 11.67, 11.67%, 30 days the highest values 10.67, 10.67% of T.S.S were recorded by Coda-PK and potassium nitrate, respectively in the first season whereas in the second one the highest value was produced by Coda-PK, only.

Table (7): Effect of potassium fertilizer source on T.S.S. (%) of Golden Japanese plum during storage period at 5°C (2006& 2007 seasons).

Treatment	Initial reading	After 10 days	After 20 days	After 30 days
(2006)				
Potassen	12.67A	10.50 BC	9.667 B	9.833 B
Liquid Potassium	12.50 A	11.67 A	11.67 A	9.833 B
Potassium Nitrate	12.17 AB	11.50 AB	11.50 A	10.67 A
Coda-PK	12.40 A	11.83 A	11.50 A	10.67 A
Control	11.83B	10.00 C	9.000 B	9.667 B
(2007)				
Potassen	11.43AB	10.00 C	10.00 B	9.000 C
Liquid Potassium	11.87B	11.67 A	10.17 B	10.33 A
Potassium Nitrate	10.67 BC	10.33 B	10.00 B	10.33 A
Coda-PK	12.0 A	11.67 A	11.00 A	9.833 AB
Control	10.17C	10.00 C	10.00 B	9.500 BC

Means within each column followed by the same letter(s) are not significantly different at 5% level.

In this respect Shaltout, (1987) found that T.S.S of Flordaprince fruits was increased as storage temperature increased and as time of storage progress

4-d- Acidity

Data presented in Table (8) indicated that fruit storage at 5°C resulted in a rapid decrease in acidity in all tested treatments. The lowest fruit acidity value was observed with potassium nitrate (0.20 and 0.17%) in both seasons. Acidity showed a gradual decrease during the storage period. These results are in line with Shaltout, (1987), who found that fruit acidity of Flordaprince peach cv. was decreased as storage temperatures increased and as time of storage prolonged. Nevertheless, Kurnaze and Kaska, (1993), Vanoli, *et al.,* (1995) and Dundar, (1997) cleared that titratable malic acid content of peach fruit was decreased during storage.

Table (8): Effect of potassium fertilizer source on fruit acidity (%) Golden Japanese plum during storage period at 5°C (2006& 2007 seasons).

Treatment	Initial reading	After 10 days	After 20 days	After 30 days
(2006)				
Potassen	0.5200 E	0.45 CD	0.36 B	0.30 AB
Liquid Potassium	0.7033 B	0.42 D	0.36 B	0.23 BC
Potassium Nitrate	0.8533 A	0.61 A	0.50A	0.20 C
Coda-PK	0.6267 C	0.49 BC	0.30 B	0.23 BC
Control	0.567 D	0.54 B	0.45 A	0.23 BC
(2007)				
Potassen	0.560 C	0.47 D	0.33 D	0.27 B
Liquid Potassium	0.5433 D	0.40 E	0.38 C	0.24 D
Potassium Nitrate	0.6367 B	0.61 A	0.47 A	0.17 E
Coda-PK	0.820 A	0.48 C	0.26 E	0.25 C
Control	0.5367 E	0.51 B	0.41 B	0.31 A

Means within each column followed by the same letter(s) are not significantly different at 5% level.

5-Leaf macro elements and carbohydrates content

Mineral composition of both leave and fruits as affected by foliar application of different potassium at sources during 2006, 2007 seasons are presented in Table (9)

The tabulated results indicated that mean of total carbohydrates varied between 9.85 and 12.14 for control and potassen respectively, in 1st season and 10.03 and 13.8 for control and potassen respectively, in 2nd one Nitrogen % mean values varied between 2.003 and 2.617 for potassen and potassium nitrate respectively, in 1st season and 2.003 and 2.7 for potassen and potassium nitrate respectively, in 2nd season. The same trend was obtained for C/N similar as total carbohydrates.

About the effect of the tested treatments on P, K & S concentration, mean P values varied in the both seasons with the same trend, the high value was for Coda-PK and the lowest was for liquid potassium. Mean K values varied in the both seasons with the same trend, the high value was for

potassen and the lowest was for control. Mean S values varied in the both seasons with the same trend, the high value was for liquid potassium and the lowest was for the control.

Table (9): Effect of potassium fertilizer source on total carbohydrates and leaf macro elements (%) of Golden Japanese plum trees (2006& 2007 seasons).

Treatment	C(g)	N(g)	C/N(ratio)	P (%)	K (%)	S (%)
(2006)						
Potassen	12.14 A	2.003 D	6.057 A	0.230 B	2.103 A	0.226 B
Liquid Potassium	10.10 D	2.087 C	4.843 C	0.186 D	1.510 D	0.320 A
Potassium Nitrate	10.81 C	2.617 A	4.133 E	0.213 C	1.703 C	0.183 D
Coda-PK	11.90 B	2.130 C	5.590 B	0.386 A	1.803 B	0.200 C
Control	9.85 E	2.303 B	4.277 D	0.213 C	0.095 E	0.160 E
(2007)						
Potassen	13.8 A	2.003 E	6.889 A	0.233 B	2.200 A	0.280 A
Liquid Potassium	10.52 D	2.110 D	4.987 C	0.210 E	1.603 D	0.350 A
Potassium Nitrate	11.01 C	2.700 A	4.080 E	0.223 C	1.900 C	0.19
Coda-PK	12.04 B	2.137 C	5.633 B	0.410 A	2.000 B	0.213 A
Control	10.03 E	2.350 B	4.270 D	0.220 D	0.098 E	0.170 A

Means within each column followed by the same letter(s) are not significantly different at 5% level.

Firstly it is very important to take an idea about the role or the importance of these elements for plants. According to Havlin *et. al.*, 1999, P plays an important role in the metabolic processes of the cells such as cell division and expansion, respiration, and photosynthesis. In addition P is significant in plant reproductive functions such as reducing the maturity period and stimulating flowering and seed formation. Potassium is vital to water relations in the plant, it is responsible for movement of water in and out of the guard cells that open and close the stomata and the movement of water in and out of the plant leaf, it also serves as a nutrient regulator; increases vigor, strength, and disease resistance; makes stalks and stems stronger. About S, sulfur is essential for protein synthesis, and involved in nodule formation and nitrogen fixation in legumes. Moreover, nitrogen is essential for synthesis of proteins, it is essential to chlorophyll; induces rapid vegetative growth; increases yields of leaf, fruit, or seed; improve quality of leaf crops.

Of course, the attendant element for tested materials had an important effect on the concentration of these elements.

It is clear from Table (9) that all K treatments, increased C, N, P, K & S concentrations values than control and also the concentration of the element more related to the attendant element i.e. S is attendant element to K in liquid potassium; N is chaperon element to K in potassium nitrate, then we get high values for N concentration for potassium nitrate. P is chaperon element to K in both potassen and Coda-PK, but the ratio between potassium and P in the

two materials is nearly, 3:1 and 1:1 respectively, the effect of P for Coda-PK is more than P for potassen to get high concentration P value.

Our data go in line with Wangsin and Pankasemsuk (2001) who found that the results revealed that total nitrogen of all $KCLO_3$ treated trees were tended to be higher than untreated ones and C/N of all $KCLO_3$ treated trees tended to increase after flowering, while the untreated trees tended to decrease.

Finally, Coda-PK foliar application is more practical and has positive effect on yield and fruit quality.

Referring to the present results, it could be concluded that “Golden Japanese” plum trees grown on old soils must be supplied with potassium as a foliar application especially at pre flowering, fruit set and one month after fruit set to enhance tree yield and fruit quality.

Our results also proved that, foliar application of potassium as Coda-PK and potassen 2% & 2.5% concentration is efficient to give a great effect on yield and fruit quality at picking time and after storage as well as in prolonging storage period and enhancing fruit marketability of Golden Japanese plum fruits.

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تـأثير صـور التسـميد البوتاسـي علـى المحصـول وجـودة الثمـار والمقـدرة التخزينيـة لثمار البرقوق اليابانى الذهبى

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أجريت هذه الدراسة خلال موسمي ٢٠٠٦-٢٠٠٧ علي اشجار البرقوق اليابانى عمرها ١٥ سنة، ومنزرعة في ارض طينية بقرية الفرعونية - محافظة المنوفية بهدف دراسة تأثير الرش بالبوتاسيوم فى صور متعددة مثل بوتاسيوم مع نترات (نترات البوتاسيوم) بوتاسيوم مع الفوسفور (بوتاسين "بوتاسيوم حيوى" وكودا-PK) بوتاسيوم مع كبريت (ثيوسلفات بوتاسيوم) وذلك بتركيز ١% نترات بوتاسيوم، و٢% بوتاسيوم سائل و٢% كودا-PK وبوتاسين ٢,٥% رشاً في مرحلة انتفاخ البراعم و فترة العقد و بعد العقد بشهر لتحديد أنسب صوره يمكن الاستفادة منها للشجرة وتأثيرها على المحتوى المعدنى للاوراق ونسبة العقد والتساقط وكمية المحصول والصفات الطبيعية والكيماوية للثمار بعد الجمع وعند التخزين على درجة ٥°م .

بصفة عامة أعطت صورة البوتاسيوم المرتبطة مع الفوسفور (كودا-PK) أحسن النتائج من حيث تحسين المحتوى المعدنى للاوراق وارتفاع نسبة العقد والمحصول وتحسين جودة الثمار.وبعد فترة تخزين تصل الي ٣٠ يوم كانت حالة الثمار جيدة حيث أقل نسبة فقد فى الوزن والصلابة والمواد الصلبة الذائبة الكلية.

و بناء علي نتائج هذه الدراسة فإنه يُفضل استخدام صورة البوتاسيوم المرتبط مع الفوسفور بمعدل ٢% (كودا PK) و٢,٥% (بوتاسين" بوتاسيوم حيوى") رشا علي اشجار البرقوق اليابانى في مرحلة انتفاخ البراعم و فترة العقد وبعد العقد بشهر لتحسين المحصول و صفات جودة الثمارعند الجمع وبعد التخزين لفترة تصل الي ٣٠ يوم.