مجلة جامعة بابل / العلوم الصرفة والتطبيقية / العدد (4) / المجلد (17) : 2009

Effect of Spraying with N, K , Ca and Daminozide on fruit Fig contents from some nutrients and crackings

Abass Mhson Salman Al- Hmadawi
College of Agriculture , University of Kufa

Abstract

An experiment was conducted on private orchard at Al- Abbasyia / Nijaf on 15/6/ at 2006 and 2007 respictively to investigate the effects of N, K , Ca at conc. of 0.3% each ather and Daminozide at 1000 mg/L in single way or combination on the percentage of these elements , calcium pictate , Firmness , type of crackings and total crackings on ripe Fruits of Fig cv. Aswod Diala . Results indicated that Fruits of treated trees with nitrogen was increased the nitrogen percentage , Kinds of crackings , total of percentage of crackings and decreased the Calcium pictate and Firmness siginificantly compared to control treatment . Treatmented trees with K , Ca , Daminozide in single way or combination together with N produced asiginificat increase on contening Fruits from N , K , Ca , calcium pictate , firmness and reducing percentage of type of crackings and total crackings compared with control treatment . The treatment of (N + K + Ca + Da) was siginificantly increased the contents of fruits of nutrient elements , it was (2.67 , 1.79 , 0.83)% and (2.75 , 1.86 , 0.90)% for the two growing seasons , respectively and , this treatment gave the highest rate of calcium pictate , Firmness (i.e. 4.10% , 0.420 Kg/cm^2) and (3.96% , 0.435 kg/cm^2) and the lowest percentage of lengitudial , tertiary , quaternary , basal Crackings and total cracking it was (2.02 , 1.95 , 1.51 , 0.32 , 5.80)% and (2.32 , 2.32 , 1.46 , 0.15 , 6.25)% for both seasons respectively .
Key words : Nitrogen , potassium , Calcium , Daminozide , Fig. .

الخلاصة

اجريت هذه الدراسة في بستان خاص في ناحية العباسية محافظة النجف الاشرف في 15/6/2006 و 2007 لدراسة تاثير رش النتروجين والبوتاسيوم والكالسيوم بتركيز 0.3% لكل منها والـ Daminozide بتركيز 1000 ملغم/لتر بصورة مفردة او مشتركة في نسبة هذه العناصر في الثمار ومحتوى الثمار من بكتات الكالسيوم وصلابتها والنسبة المئوية لانواع التشقق والتشقق الكلي في ثمار اشجار التين صنف اسود ديالى عند النضج .

اظهرت النتائج ان ثمار الاشجار المعاملة بالنتروجين قد ازداد محتواها من النتروجين وانخفضت فيها بكتات الكالسيوم والصلابة وازدادت فيها نسبة التشقق الكلي وانواع التشقق وبفرق معنوي قياساً بمعاملة المقارنة .

وكان لرش الاشجار بالبوتاسيوم والكالسيوم والـ Daminozide بشكل مفرد او مشترك مع بعضها او مع النتروجين دوراً معنوياً في زيادة محتوى الثمار من العناصر المرشوشة وزيادة بكتات الكالسيوم وصلابة الثمار وتقليل النسبة المئوية لانواع التشقق والتشقق الكلي مقارنة بثمار الاشجار غير المعاملة وقد تفوقت المعاملة (N + K + Ca + Da) معنوياً على باقي المعاملات بزيادة محتوى الثمار من عناصر الـ N , K , Ca اذ بلغت (2.67 , 1.97 , 0.83)% و (2.75 , 1.86 , 0.90)% على التوالي لموسمي الدراسة وكذلك حصلت هذه المعاملة على اكبر معدل لبكتات الكالسيوم وصلابة الثمار (4.10% , 0.420 كغم/سم^2) و (, 0.435 3.96% كغم/سم^2) لكلا الموسمين . وقد تميزت هذه المعاملة ايضاً بحصولها على اقل نسبة من التشقق الطولي والثلاثي والرباعي والقاعدي والكلي اذ بلغت لسنتي التجربة (2.02 , 1.95 , 1.51 , 0.32 , 5.80)% و (2.32 , 2.32 , 1.46 , 0.15 , 6.25)% .
الكلمات المفتاحية : نتروجين , بوتاسيوم , كالسيوم , Daminozide , تين .

Introduction

Fig trees are deciduous fruits , belong to genus " Ficus " , which is follows to the Family " Moraceae " , where it belived that its origin is Arabian peninsula and Sproad to the subtropical regions , fig fruits are infected by a number of physiological damages , and the foremost damage is crack , which its ratio increased due to the increase in nitrogen fertilizer (Ibrahim , 1996) .

Studies were conducted in different regions of the world to limit the damage . It was found that , some nutrients , such as Nitrogen , Potassium and Calcium have an important role in reducing this phenomenon. If those nutrients were added in limited concentrations, these will lead to organize fruit growth and creat a state of water

balance between epicarp and fruit inside tissues, and maintain fruit cell walls plasticity and firmness (Mitra , 1997) .

Al – Hamdawi *et. al.* (2006) found that spraying fig tress cv. "Waziri" after one week from rest period of fruits with both nutrient , N and K at conc. of 0.3% each resulted in a unsignificant reduction in fruit cracking and firmness at ripening . Singh *et. al.* (1993) noticed that , spraying pomegranate trees with Potassium nitrate solution conc.of 1% demonstrated effectiveness in reducing fruit cracking . Byers and Carbaugh (1995) Found that , the addition of 2.27kg/tree one dose each year of potassium chloride to apple trees cv. Styman has reduced the proportion of fruit cracking to 22.0% compared with 26.0% in the fruit of control treatment , but when adding ammonium nitrate at the same amount led to an increase in fruit cracking to 35.0% .

Al- Dulaimi (1999) stated that , spraying pomegranate trees cv. Salami by three nutrients i.e. nitrogen in the from of urea conc. (0. , 0.5 and 1%) and potassium in the form of potassium sulphate conc. (i. e. 0 , 0.1 and 0.2%) and calcium formula of calcium chloride conc. (0.0 , 0.25 and 0.50%) three times on 1996 and 1997 growing seasons , the interval between sprays is 30 days started from June at maturation period , there was a significant decline in the proportion of fruit craching for the medium concentration of the above nutrients as well as , increased concent of fruit epicarp of these nutrients compared with control treatment .

Sullivan and Widmoyer (1970) noticed that , the spraying of Alar concentration (500 , 750 and 1000 ppm) on apple trees cvs. Styman and Winesap has reduced the proportion of fruit cracking and increased the Firmness . This was agreed with Byers *et. al.* (1990) when apple trees cv. Styman sprayed with Daminozide (Alar – 85w) conc.of 1000 mg/L on 27 July , 1987 reduced cracking rate to 30% , while , this ratio reached to 50.61% in the fruits of control treatment .

Abo – Zaid (2000) mentioned that , the spraying of Alar conc.of (500 and 1000 ppm) on pear trees in the Egypt has rduced the vegetative growth and increased fruit Firmness . This present study came to be a series of scientific research to assess spraying of N , K , Ca and Alar on fruit content of these nutrient ,calcium pictate ,firmness and cracking percentage during ripening .

Materials and methods

This study was conducted in a privat farm at Abbasiya / Najaf governorate for the 2006 and 2007 seasons on fig trees cv. Asowd Diala , 48 at same size and growth trees were selected with 7 years of age , that planted on (5 x 5 m.) , they watered every five days , and fertilized by Nitrogenous and phosphatic in two periods in March and May of each year at a rate of 500 g. per tree , as well as by manur for the two years . The experiment included 16 treatments with three replicates . It is a dopted according to Randomized Complet Block Design (RCBD) , and the results were statistically analyzed according to LSD test at the probability level of 5% (Al-Rawi and Khalf Allah , 2000) . Treatments were adropted at 15/6/2006 and 2007 , spraying was done early morning until wetness was full addendum . Tween 20 was added at conc.of $1cm^2/L$. as spreader material . Treatments were as follows .

1- Nitrogen (N) in the form of urea Co $(NH)_2$, N 46% concentration of 0.3% .
2- Potassium (K) in the form of potassium salphate K_{2SO4} , K 50% concentration of 0.32%
3- Calcium (Ca) formula calcium chloride $cacl_2 – 2H_2O$, Ca . 27.2 conc. of 1% .
4- Daminozide (Da) (Alar – 85w) conc. of 1000mg/L .
5- N + K .
6- N + Ca .

7- N + Da .
8- K + Ca .
9- K + Da .
10- Ca + Da .
11- N + K + Ca .
12- N + K + Da .
13- N + Ca + Da .
14- K + Ca + Da .
15- N + Ca + K + Da .
16- Control .

For determination of fruit mineral content , samples of 10 fruits were taken at random on 3/7/2006 and 2007 .

Each sample was washed several times with tap water , rinsed three times with distilled water , dried at 70 c° to conctant weight , The dried materials were ground and digested will HCL for nutrient elements determination according to Chaman and Pratt (1961) .

In each sample , total nitrogen was determined by the micro – kjeldahl method (A.O.A.C.,1980). Calcium was determined by using Atomic absorption spectrophotometer. Potassium was determined against a standard in a Flamephotometer .

Calcium pictate was determined according to (Rouhani and Bassiri , 1976) .

Firmness was measured on two sides of each fruit with an Effegi penetrometer (Model NI , McCormick Fruit Tech , Yakima , WA) Fitted with an 11.1mm tip . The percentage of types of crackings (lengitudial , quaternary , basal) and total cracking were calculated during the months of 7 and 8 for seasons 2006 and 2007 .

Results and discussion

1- The percentage of nitrogen , potassium and calcium in fruits .

Results indicated in table (1) that spraying trees with nitrogen , potassium and calcium led to a significant increase of these elements compared to control treatment of two growing seasons , while spraing was not significant with the Da spray . Control treatment recorded the lowest percentage as compared to the individual or combindation treatments (i.e. 2.01 , 1.20 , 0.64) and (2.15 , 1.24 , 0.65)% of N , K and Ca for the two seasons , respectively . As for the combination treatments which led to an increase in content of fruit elements that sprayed and there were a significant defferences between treatments . Treatment of (N + K + Ca + Da) gave an excellent result which differed of the other treatments , that gave the highest percentages of N , K , Ca , they were (2.67 , 1.79 and 0.83%) and (2.75 , 1.86 and 0.90%) for the two year of study, respectively .

The higher rates of nitrogen , potassium and calsium in the fruit contents were due to the process of spraying of these elements led to increased concentration of these elements in the fruits and thus its rates increased in fruit compared to the untreated trees .

2- Calcium pictate and fruit firmness

N spraying alone led to a reduction in the percentage of calcium pictate in fruits and firmness significantly compared to other treatments . This treatment obtaind the lowest rate for those parameters (2.15% and 0.300 kg/cm^2) and (1.87% and 0.295 kg/cm^2) for both seasons, respectively . Calcium pictate and firmness have increased with combination treatments until it reached its highest rates (4.10% and 0.420 kg/cm^2) and (3.96% and 0.435 kg/cm^2) in the treatment (N + Ca + K + Da) for the 2006 and 2007 growing season, respectively . (Table 2)

The decline in the percentage of calcium pictate by the addition of nitrogen was due to the increase in the vegetative and fruit growth leading to a competition on manufactured carbohydrate materials , including pictate materials (Al- Dulaimi , 1999) , and this proved that there is a positive relationship between fruit pictate content and its firmness (Al- Ani , 1985) . This made the nitrogen treatment get the lowest rate , and spraying calcium gave positive role in increasing of calcium pictate and fruit firmness because it plays an important role in strengthening the cell walls through its role in enhacing pectin coherence which increases the thickness of cell walls , which makes it more strength and stiffness to resiste pectin analysis enzymes . (Roy , 1995)

In addition to the calcium important role in reducing the permeability of cell membranes resulting in obstruction ethylene and enzyme passages that responsible for analysing the cell walls and link pectin . (Carl *et. al.* , 1991) .

Potassium also had important role in increasing pectic materials and fruit firmness through its effect as a convey to photosynthesis output process (Byers and Carbough , 1995) .

Increasing fruit firmness which results through spraying the (Daminozide) due to the fact that this compound reduce vegetative growth and thus encourages the accumulation of carbohydrate meterials in fruits leading to increased content of pectic materials , there by increasing its firmness (Wielana and Wample , 2007).

3- Type of crackings and total cracking percentage

Table 2 showes , that nitrogen spraying alone led to a significant increase in the percentage of all cracking types and total cracking compared to other individual and combination treatments . The treatment gained (19.84 and 18.21%) for both growing seasons respectively .

Potassium and Daminozide spraying reduced total cracking percentages non significantly for 2006 season , where as its effects reached significant level on 2007 growing season compared to control treatment . This treatment gave (15.37 and 15.10%) and (14.01 and 13.30%) for cracking type and total cracking of both growing seasons , respectively .

In the combination treatments, there were no significant differences in the total percentage between (N + K) and (N + Da) treatments and control treatment for 2006 growing season , but the difference was true in the following season . Other combination treatments gave significant differences in all cracking type percentanges compared to control treatment for both growing seasons . To compare treatments for of both seasons (N + Ca + K + Da) treatment produced the lowest percentage of all type of cracking and total cracking , with significant differences compared to the other treatments for both growing seasons , total cracking percentages for the above treatment reached (5.80 and 6.25%) of 2006 and 2007 . There are also significant differences between studied treatments in reducing the percentage of cracking types .

The increase in cracking percentage because of nitrogen spraying resulted was due to stimulate root growth and deepen , and increase water absorption . This makes fruits to recieve the largest amount of water , thus protoplasmic water content will be high , this lead to an occurance of produced carbohydrate materials consumption and produced the lack of materials that share in interior cell walls , hence , they will become thin , it no enough ability to resist internal pressure controlling the fruit preicarp . (Byers and Carbough , 1995) . The importance of potassium in reducing the rate of cracking may be due to the existence of potassium in the cell wall , which in the young plants that suffer from a shortage of potassium of their cell wall become thin and not solid in addition of this comporent , to reduce water loss from the

pericarp and of its importance in the organization of stomata opening and organizing vital and enzymatic processes that may have some role in increasing the strength of cell walls (Byers and Carbough , 1995) .

The importance of calcium in reducing fruit cracking percentage lies in its role in the cohesion of cell walls due to its connection with pectic acid link by crossed link chains . This increase the strenght and cohesion of cell walls (Gill and Nandpuri , 1970) .

Byers *et. al.* (1990) confirmed that the Da led to a reduction in trees vegetative growth and there by increases transformation of manufactured absorped materials , causing firm fruit and makes it more resistant to cracking .

Conclusion

It could be concluded from this experiment that , spraying potassium , Calcium and Daminozide as a single or combination has led to an increase in the percentage of longitudiral cracking , trilateral , quadrilateral , basal and total with significant differences between treatments for both growing seasons , while the effect of nitrogen spraying produced negative impact for parameters under study .

References

Abo–Zaid , A.N. (2000) . Plant hormones and application Agricultural . Arabic home for putolishing . Cairo .

Al – Ani , A. M. (1985) . Potharavest physiology . Univ. Mosel . Iraq .

Al–Dulaimi , R.M. (1999). Influence of some Factors effection on the splitting of pomegranate fruits. Ph. D. Thesis. Dep. Hort. Agric. Colle. Univ. of Baghdad . Iraq .

Al– Hamdawi , A.M.; Al– Khaffaf, A.A. and Al–Attabi, A.A. (2006) . Effect of some nutrient spraying on vegetative and fruiting growth of fig CV. Wazeri . J. of Babylon University . 1 (3) : 439 – 446 .

Al– Rawi, K.M. and Khalf Allah A.M. (2000) . Design and Analysis of Agricultural Experiments . College of Agric. Univ. Mosel . Iraq .

Association of Officisal Analytical Chemist (1980) . Official Methofds of Analysiks . 13th Ed. APAC . Washington . D. C. U. S. A.

Byers, R.E. and Carbough. D.H. (1995) . Chemical cultural and physiological Factors influencing Stayman fruit cracking. Virginia Polytechnic Instiutes and state Univ. Bulletin . 95 (1) : 1 – 33 .

Byers, R.E.; Carbough D.H. and Presley C.N. (1990) . Stayman Fruit cracking as affected by surfactants , plant growth regulators and other chemicals . J. Amer. Soc. Hort. Sci. 115 (3) : 405 – 411 .

Carl , E.; Sams W.R. and Noach B.A. (1993) . Firmness and decay of apples following postharvest pressure infiltration calcium and heat treatment . J. Amer. Soc. Hort. Sci. 118 (5) : 623 – 627 .

Chapman, H.D. and Pratt P.F. (1961). Methods of Analysis for Soil , Plant and Water . Univ. Calif. Div. Agric. Sci. USA .

Gill, P.S. and Nandpuri K.S. (1970). Comparative resistance to fruit cracking in tomato . Indian . J. Agric. Sci. 40 : 89 – 98 .

Ibrahim, A.M. (1996). Deciduous Fruit , Growth and Production . College of Agric. Univ. Alex. Egypt .

Mitra, S.K. (1997). Postharvest physiology and storage of tropical and sub – tropical fruits. CAB. INT . Nadia , West Bengal . India .

Rouhani, I. and Bassiri A. (1976). Changes in the physical and chemical characteristics of Shahani dates during development and maturity . Hort. Sci . 15 : 480 – 498 .

Roy G.G. (1995) . Use secondary ion mass spectrometry to image calcium – UV uptake in the cell wall of apple Fruit . Protoplasma ., 189 : 163 – 172 .

Singh , R.P.; Sharma Y.P. and Awasthi R.P. (1993). Influence different cultural practices on premature fruit cracking of pomegranate. Progressive . Hort., 22 (1–4) . (C. F. Hort. Abst. 1995 .Vol. 63 . No. 7148) .

Sullivan, D.T. and Widmoyer. F.B. (1970) . Effect of Alar on Fruit cracking of stayman , Winesap apple . Fruit Var. and Hort. Dig., 24: 17 – 22 .

Wielana, W.F. and Wample R.L. (2007). Effects of Daminozide on growth, photosynthesis and synthesis and carbohydrate content of Delicious apples. Scientia ., Horticulturae., 26 : 139 – 147 .

Table 1 . Effect of spraying of N , Ca , K and Daminozide on contening these nutrient elements , calcium pictate and Firmness of Fig Fruit cv. Asowd Diala for seasons 2006 and 2007

Treatments	Season 2007					Season 2006				
	Firmness Kg/cm^2	% calcium pictate	Ca %	K %	N %	Firmness Kg/cm^2	% calcium pictate	Ca %	K %	N %
Control	0.330	2.29	0.65	1.24	2.15	0.313	2.28	0.64	1.20	2.01
N	0.295	1.87	0.68	1.36	2.46	0.300	2.15	0.65	1.28	2.33
K	0.339	2.83	0.67	1.49	2.32	0.318	2.75	0.67	1.55	2.26
Ca	0.346	2.90	0.76	1.33	2.30	0.346	2.98	0.72	1.23	2.19
Da	0.337	2.79	0.68	1.30	2.21	0.322	2.81	0.66	1.25	2.14
N + K	0.342	2.76	0.68	1.57	2.47	0.324	2.80	0.70	1.60	2.35
N + Ca	0.344	2.96	0.77	1.55	2.42	0.335	2.98	0.75	1.56	2.37
N + Da	0.332	2.59	0.70	1.38	2.35	0.333	2.76	0.64	1.38	2.32
K + Ca	0.348	2.99	0.79	1.54	2.20	0.352	3.01	0.78	1.63	2.28
K + Da	0.336	2.77	0.63	1.58	2.32	0.340	2.85	0.69	1.65	2.27
Ca + Da	0.351	3.10	0.75	1.47	2.38	0.357	3.16	0.76	1.54	2.31
N + K + Ca	0.363	3.19	0.80	1.60	2.47	0.375	3.28	0.79	1.67	2.40
N + K + Da	0.350	3.04	0.69	1.72	2.53	0.362	2.93	0.70	1.70	2.45
N + Ca + Da	0.372	3.25	0.78	1.50	2.59	0.364	3.30	0.75	1.58	2.45
K + Ca + Da	0.405	3.48	0.81	1.75	2.40	0.391	3.62	0.79	1.72	2.38
N + Ca + K + Da	0.435	3.96	0.90	1.86	2.75	0.420	4.10	0.83	1.79	2.67
L . S. D. 0.05	0.014	0.27	0.04	0.07	0.11	0.008	0.12	0.04	0.06	0.15

Table 2 . Effect of N , Ca , K and Daminozide on types of crackings of fig fruits cv. Aswod Diala for seasons 2006 and 2007

Treatments	Season 2007					Season 2006				
	% Total cracking	% Basal cracking	% Quaternay cracking	% Tertiary cracking	% Lengitudial cracking	% Total cracing	Basal cracking %	Quaternay cracking %	% Tertiary cracking	% Lengitudial cracking
Control	16.70	1.60	3.17	5.13	6.80	15.93	1.31	3.61	5.23	5.78
N	18.21	1.67	3.85	5.31	7.38	19.84	2.31	4.77	5.84	6.92
K	14.01	0.47	2.70	4.50	6.34	15.37	1.01	3.36	4.99	6.01
Ca	9.37	0.30	2.44	3.45	3.18	11.15	0.50	2.65	3.89	4.11
Da	13.30	0.65	0.32	4.46	5.87	15.10	0.87	3.24	4.51	6.48
N + K	14.86	1.22	2.75	4.39	6.50	16.53	1.58	3.82	5.46	5.67
N + Ca	9.40	0.31	2.55	3.24	3.30	11.92	0.69	2.78	4.20	4.25
N + Da	13.28	0.73	2.47	4.73	5.35	15.85	1.22	3.50	5.17	5.96
K + Ca	8.65	0.40	2.19	3.08	2.98	10.36	0.71	2.46	3.44	3.75
K + Da	12.43	0.52	2.80	4.00	5.11	13.81	0.80	3.07	4.32	5.62
Ca + Da	9.16	0.28	2.15	2.97	3.76	9.60	0.64	2.59	2.97	3.40
N + K + Ca	8.54	0.30	2.25	2.88	3.11	7.17	0.48	2.11	2.35	2.23
N + K + Da	8.97	0.46	2.09	3.20	3.22	9.75	0.75	2.73	2.77	3.50
N + Ca + Da	7.30	0.27	1.96	2.28	2.69	8.48	0.60	2.21	2.40	3.27
K + Ca + Da	7.02	0.19	1.85	2.59	2.39	6.24	0.41	2.09	1.56	2.18
N + Ca + K + Da	6.25	0.15	1.46	2.32	2.32	5.80	0.32	1.51	1.95	2.02
L . S. D. 0.05	0.97	0.09	0.29	0.80	0.58	1.18	0.05	0.46	0.75	0.83