SHORT NOTE

Effect of foliar fertilizers on growth and leaf nutrient contents of papaya seedlings (*Carica papaya* L.)

Adil E. Shattir, El-Fadel M. Hassan and Adam I. Adam

Faculty of Agriculture, University of Sinnar, Abu-Naama, Sudan.

Mineral nutrition is important in seedling physiology, because adequate supply of nutrient elements is crucial for successful growth. Production of well-established seedlings of fruit crops under nursery conditions of perennial plants could be achieved by proper cultural practices, especially fertilization. Application of foliar fertilizers to the fruit seedlings under nursery conditions is not popular in Sudan. Studies on the effect of foliar application on growth characteristics and leaf nutrients content of fruit trees are few in Sudan. Feeding seedlings by foliar fertilization can positively enhance their growth and nutrient contents. The objective of this study was to evaluate the response of papaya seedlings to foliar feeding by two foliar fertilizers.

Seeds of papaya were sown during summer seasons of 2008/09 and 2009/10 at the nursery of the Faculty of Agriculture, University of Sinnar at Abu Namma, in plastic trays containing a mixture of alluvial soil and sand (1:3 ratio, by volume). Papaya seedlings of uniform sizes and shapes were selected and transferred to polyethylene bags 29cm x 7 cm x 0.06 cm (height, width and thickness, respectively) containing the prepared soil material. The seedlings were then arranged in a randomized complete block design and replicated four times. The seedlings were allowed to grow under partial shade (nursery conditions) for another period of 20 days. Prior to application of Bayfolan and the Special liquid foliar fertilizers all growth parameters under investigation were measured and recorded as initial measurements. The control seedlings were sprayed with distilled water. The seedlings were sprayed eight times with Bayfolan and the Special liquid fertilizers separately at 20 days interval during the study period of 160 days. Data on stem diameter, seedling height, number of leaves per seedling and relative growth rate (RGR), were colleted.

Total nitrogen (N) was determined by micro-Kjeldahl method (AOAC, 1990), phosphorus (P) was colorimetrically determined following the procedure described by Murphy and Riley (1962); potassium (K) was determined according to the method described by Brown and Lilleland (1946) and magnesium (Mg) was determined according to the method described by Ryan (1996).

Analysis of variance and Fisher's protected LSD test with a significant level of $p \leq 0.05$ were performed on the data.

Statistical analysis of the two seasons data revealed lack of significant differences in stem diameter among the treatments at both seasons (Fig.1). However, there was a trend of increase in this parameter with the two foliar fertilizers over the control. Bayfolan was superior to Special liquid fertilizer in increasing stem diameter. Similar results were found in seedling height and number of leaves per plant as shown in Figs. 2 and 3. These results showed that higher growth parameters were associated with Bayfolan foliar fertilizer than those of the Special liquid fertilizer. This result was in support of the findings of Al-Amin (1993) who found that Bayfolan foliar fertilizer was more effective than the other foliar fertilizers in increasing growth parameters of banana suckers. Application of Bayfolan or Special liquid fertilizer to papaya seedlings positively affected the seedlings RGR (Table1).Though not statistically significant, the two foliar products enhanced the relative growth rate over that of the

control. Bayfolan had also maintained its superiority in enhancing RGR compared to that of the Special liquid fertilizer (Table 1). Similar results were reported by Al-Amin (1993) in banana and Akanbi *et al*. (2010) in okra.

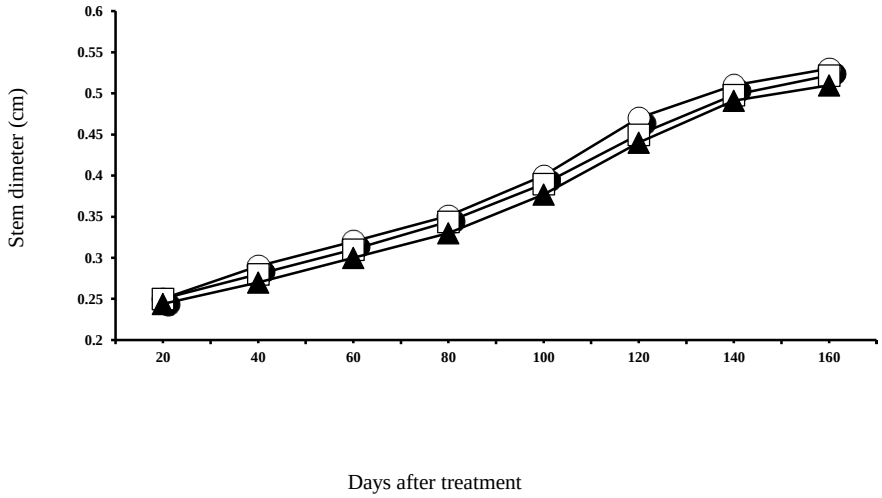

Fig.1. Effect of foliar fertilizers on stem diameter of papaya seedlings sprayed with Bayfolan (○) and Special liquid fertilizer (□), compared to those of the control (▲) during the first season (2008/09).

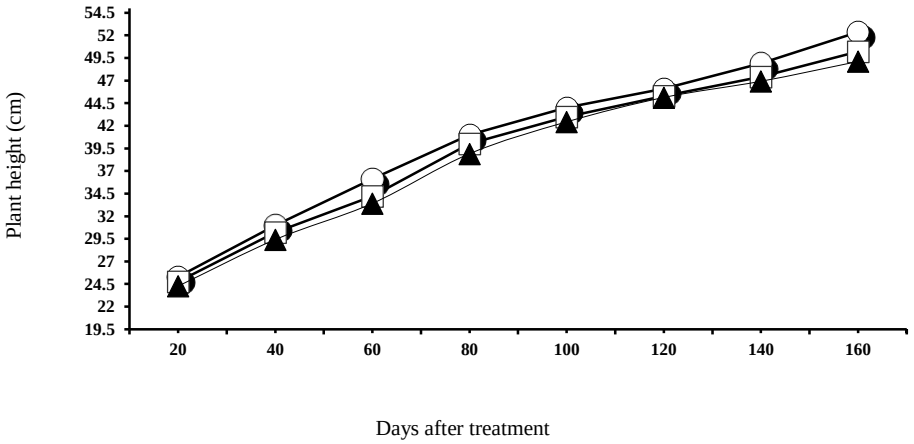

Fig.2. Effect of foliar fertilizers on plant height of papaya seedlings sprayed with Bayfolan (○) and Special liquid fertilizer (□), compared to those of the control (▲) during the first season (2008/09).

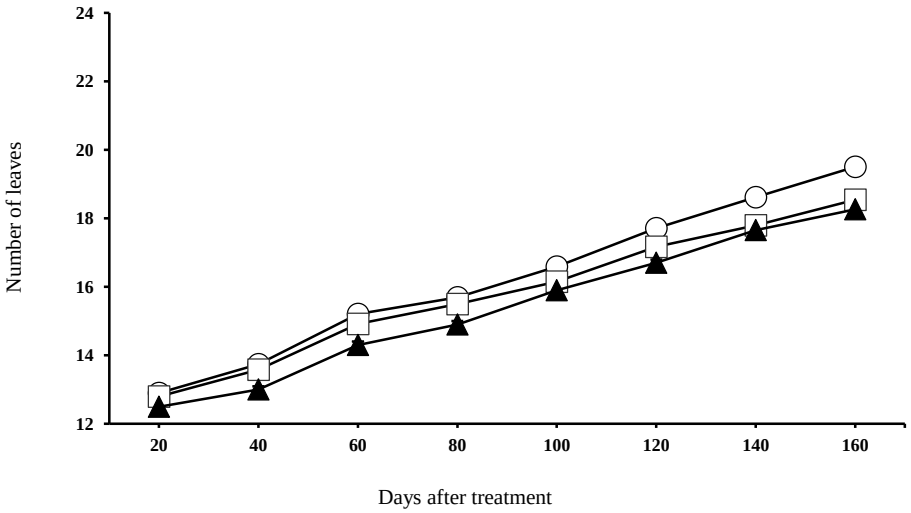

Fig.3. Effect of foliar fertilizers on the number of leaves of papaya seedlings sprayed with Bayfolan (○) and Special liquid fertilizer (□), compared to those of the control (▲) during the first season (2008/09).

Table 1. Effect of foliar fertilizers on relative growth rate (RGR) of papaya seedlings, in seasons 2008/09 and 2009/10.

Treatment	First season	Second season
Bayfolan	0.26	0.32
Special liquid	0.21	0.28
Control	0.16	0.23

The results in Table (2) showed that the leaf-N, P, K and Mg contents were significantly greater in the sprayed papaya seedlings than those of the control in both seasons. Nevertheless, the papaya seedlings sprayed with the Bayfolan gave the highest values of each of leaf-N, P, K and Mg in both seasons. Similar findings were reported earlier by several investigators working with various plant species; viz; in citrus seedlings (El-Otmani *et al.*, 2002), guava (Hussein, 1992; Adel, 2005) and olive trees **(**Sarrwy *et al*., 2010). The present results indicated that Bayfolan foliar fertilizer was more effective in promoting leaf nutrient contents than that of Special liquid fertilizer. Similar results were reported in guava

(Hussein, 1992; Adel, 2005). Although, the two foliar fertilizers applied did not contain magnesium (Mg) in their composition nevertheless, a significant amount of leaf-Mg was detected in papaya seedlings treated with both foliar fertilizers than their counterparts of the control. It seems that these fertilizers led to an increased Mg uptake by the plants.

Table 2. Effect of foliar fertilizers on nutrient elements content (%) of leaves of papaya seedlings, in seasons 2008/09 and 2009/10.

Treatment	N	P	K	Mg
	First season			
Bayfolan	1.63[a]	0.95[a]	0.41[a]	2.11[a]
Special liquid	1.50[a]	0.90[a]	0.35[a]	1.84[a]
Control	0.60[b]	0.70[b]	0.21[b]	1.21[b]
L.S.D.	0.17	0.13	0.10	0.42
	Second season			
Bayfolan	2.10[a]	1.00[a]	0.44[a]	2.23[a]
Special liquid	1.70[a]	0.80[a]	0.37[a]	1.99
Control	0.91[b]	0.60[b]	0.25[b]	1.21[b]
L.S.D.	0.59	.0.31	0.09	0.73

Means followed by the same letters in a column and each season are not significantly different at p ≤0.05 according to fisher's protected L.S.D.

REFERENCES

Adel, D.S. 2005. The effect of foliar fertilization of NPK on early growth and nutrient concentration of guava (*Pisidium guajava* L.). Assuit Journal of Agricultural Sciences 36 (3):122-128.

Akanbi, W.B, A.O. Togun, J.A. Adediran and E.A.O. Ilupeju. 2010. Growth, dry matter and fruit yields components of okra under organic and inorganic sources of nutrients. American-Eurasian Journal of Sustainable Agriculture 4 (1): 1-13.

AL-Amin, M.A. 1993. Effect of Different Fertilizer Materials and Pruning Technique on Growth Yield and Yield Components and Fruit Quality of Banana Plant .M.Sc. (Agric.) Thesis, University of Khartoum, Sudan

AOAC.1990. Official Methods of Analysis. Association of Official Analytical Chemist, Washington, D.C. Fourth Edition.

Brown, J.O. and O. Lilleland.1946. Rapid determination of potassium and sodium in plant material and soil extracts by flame photometry. Proceeding of the American Society of Horticultural Sciences 48: 341-346.

El-Otmani, M.A., F.Z., Ait-Oubahou and C.J.Lovett .2002. Efficiency of foliar urea as N source in sustainable citrus seedlings production systems. International Symposium on Foliar Nutrition of Perennial Fruit Plants. Merano, Italy, Acta Horticulture 1: 93.

Hussein, M.A. 1992. Studies on mineral nutrition of guava *(Pisidium guajava* L.) Seedlings and Trees under Nursery and Orchard Conditions. M.Sc Thesis (Agric.), University of Khartoum, Sudan.

Murphy, J. and I. P. Riley. 1962. A modified single solution method for the determination of phosphate in natural waters. Analytical Chemistry, Acta 27:31-6.

Ryan, J.S. 1996.Soil and Plant Analysis Manual Adapted for West Asia and North Africa Region. Soil and Plant Analysis 27(8): 1579-1593.

Sarrwy, S.M.A., E.A. Mohamed and H.S. Hassan. 2010. Effect of foliar mineral contents, fruit set, yield and fruit quality of olive trees grown under nursery conditions. American-Eurasian Journal of Agriculture and Environmental Sciences 8 (4): 420-430.

تأثير الأسمدة الورقية على النمو ومحتوى العناصر الغذائية في أوراق بادرات البابای

عادل الطيب شاطر والفاضل محمود حسن وأدم إبراهيم أدم

قسم الإنتاج النباتي، كلية الزراعة، جامعة سنار، أبو نعامة، السودان.

الخلاصة

تم إجراء هذه التجربة خلال موسمي 2008 /09 و10/2009 بمشتل كلية الزراعة بابي نعامة، جامعة سنار لدراسة تأثير أثنين من الأسمدة الورقية على النمو وكذلك محتوى العناصر الغذائية في أوراق بادرات البابای تحت ظروف المشتل. السمادان الورقيان هما سماد البايفولان (1. 6 نتروجين-8.13 فسفور-9 .10 بوتاسيوم) وسماد المحلول الورقي الخاص (8 نتروجين-6 فسفور-8 بوتاسيوم) إضافة إلي محتواهما من العناصر الصغرى . تم رش بادرات الباباي ثمان مرات خلال فترة الدراسة التي استغرقت 160 يوماً علي فترات 20 يوماً بين الرشة والأخرى بتركيز 5 مليجرام لكل لتر ماء. وسجلت بيانات معايير النمو المختلفة عن قطر الساق وطول البادرات وعدد الأوراق. وعند نهاية التجربة تم تحديد محتوي العناصر الغذائية في أوراق بادرات الباباي. أوضحت النتائج أن الأسمدة الورقية المختبرة أعطت أعلى قيم معدلات قطر سيقان وطول بادرات وعدد أوراق واعلي معدل نمؤ نسبي مقارنة مع رصيفاتها في بادرات البابای الغير معامله خلال الموسمين. كما أظهرت نتائج التحليل الإحصائي عدم وجود فروق معنوية بالنسبة لمعايير النمو مقارنة بالشاهد. أيضاً أوضحت النتائج أن سماد البايفولان أعطي قيم قياسات اعلي مقارنة بسماد المحلول الورقي الخاص. أوضحت النتائج أن الأسمدة الورقية أدت إلي زيادة معنوية في كل من عناصر النيتروجين والفسفور والبوتاسيوم والماغنسيوم **في أوراق بادرات** الباباي مقارنة مع رصيفاتها في الشاهد.