41 - 62

Zagazig J. Agric. Res., Vol. 36 No. (1) 2009

EFFECT OF FOLIAR SPRAY WITH Ca, Mg, AND VITAMIN B_1 ON THE PRODUCTIVITY AND STORABILITY OF SNAP BEAN GROWN IN SANDY SOIL

Mohammad, Omaima O.[1], H.M. Arisha[1], A. Bardisi[1], and Rawia El-Bassiouny[2]

1- Hort. Dept., Fac. Agric., Zagazig Univ., Zagazig, Egypt

2- Hort. Res. Inst., Agric. Res. Center, Dokki, Egypt

Accepted 13 /1/2009

ABSTRACT: Two field experiments were carried out during autumn seasons of 2005/2006 and 2006/2007 in Experimental Farm at El-Kassasein, Hort. Res. Station, Ismaelia Governorate, Egypt, to study the effect of foliar spray with Ca, Mg, and vit. B_1 on growth, yield, pod quality and storability of snap bean under the conditions of sandy soil. Spraying snap bean plants with Ca, Mg and vit. B_1 significantly increased number of branches/plant, dry weight of shoots, total dry weight, N, P and K total uptake by plant, number of pods/ plant and total yield/feddan. In this respect, vit. B_1 at 25 ppm gave the highest values of the above mentioned traits followed by both Mg and Ca at 0.5 % and Mg at 0.2%. On the other hand, dry matter (%) and appearance of green pods decreased with increasing storage period, whereas weight loss (%), decay (%) and off-odor increased with increasing storage period. In addition, spraying snap been plants with Ca at 0.5 % reduced weight loss (%) decay (%) and off-odor and gave the highest dry matter content (%) during storage in cool room.

Key words: Snap bean, foliar spray, Ca, Mg, vit. B_1, yield and storability.

INTRODUCTION

Snap bean (*Phaseolus vulgaris* L.) is one of the most important vegetable crops grown in Egypt not only for local consumption, but also for export purpose. In Egypt the cultivated area of green beans plants in year of 2005 was 33,835

fed for summer plantations and 12,090 *fed* for autumn plantations. Average total yield/ *fed* was 4.43 and 4.95 ton for summer and autumn plantation, respectively.

Vitamin B_1 (Thiamine) is an organic compound, that can be supplied to plant as seed soaking or as foliar spray to improve their growth and productivity (Oertli, 1987).

For legumes, this vitamin was found to add practical significance as growth stimulation of roots. So, it would not only result in higher water and nutrients uptake, but also to provide larger surface area for *Rhizobium* infection leading to increase in root nodules formation. These effects would be ultimately manifested in bitter growth and higher productivity coupled with considerable fertilizers economy (Samihullah and Afridi, 1988).

In green leaves, Mg has a major function in the action of the chlorophyll molecule (Marschner, 1995). Moreover, calcium is required for cell elongation and cell division. Calcium also appears to play a role in the inhibition of abscission and delays leaf senescence.

Spraying of common bean plants with Bs vitamins increased weight of pods/ plant and weight of seeds/plant (Fathy and Farid, 1996). Foliar spray of pea plants with vitamin B_1 increased plant height, number of leaves and dry weight (Barbieri, 1959) and total yield */fed).* El-Mansi *et al.* (1994) and El-Beheidi (1995) found that spraying cowpea plants with vit B_1 at 50 ppm significantly increased branching and dry weight/plant, number of pod/plant and seed yield per feddan. In addition, number of pods/plant, yield/plant and total yield/fed of pea were significantly increased with increasing vit. B_1 concentration up to 100 ppm without significant differences between 100 and 200 ppm of vit. B_1 (Arisha, 2000). Vitamin B_1 at 50 or 100 ppm, as foliar spray had significant effect on number of pods/plant, seed yield/ plant and total seed yield*/fed* of cowpea (Kamel, 2005).

Under sandy soil conditions, Mg at 5 or 10 kg*/fed* as $MgSo_4$ (10.5% Mg) showed favorable effect on the dry weight of different plant organs of pea plants, while Mg at 10 kg */fed,* being superior treatment for improving the contents of N and P in leaves, as well as total yield (Arisha and El-Ghamriny, 1992), also under the same conditions spraying pea plants with $MgSO_4$ at

1% increased number of total root branches, stem length and number of leaves/ plant, while $MgSO_4$ at 1 or 2% recorded maximum values of dry weight of roots, aerial parts and total dry weight of plant, P and K content in roots and uptake of N, P and K by pea plants, number of pods/plant and feddan (Bardisi, 2005).

Foliar spray with $CaCl_2$ increased plant height and fresh weight/ plant (El-Tohamy, 2000) on snap bean, and pod weight (Toivonem and Powen, 1999) on pepper. Spraying snap bean plants Bronco, Tema and Flexo cvs. with K_2SO_4 (37 % K_2O) at a rate of 2 % or Ca $(NO_3)_2$ (19 % CaO) at a rate of 1 % three time of each increased early and total yield of green pods (El-Mogy, 2001).

Weight loss and decay (%) of stored green pods of snap bean (Bronco cv.) were increased with the prolongation of storage period. In this respect spraying with Ca $(NO_3)_2$ alone or in combination with K_2SO_4 showed the lowest value of weight loss and decay percentage and increased the shelf life (El-Mogy, 2001).

Therefore, the present work aimed to study the effect of foliar spray with Ca, Mg, and vit. B_1 on yield, pod quality and storability of snap bean (Bronco cv.)

MATERIALS AND METHODS

Two field experiments were carried out during the two autumn seasons of 2005/2006 and 2006/2007 in Experimental Farm at El-Kassasein, Hort. Res. Station, Ismaelia Governorate, Egypt, to study the effect of foliar spray with Ca, Mg, and vit. B_1 on growth, yield, pod quality and storability of snap bean grown under sandy soil conditions.

The physical and chemical analysis of the soil are presented in Table 1.

Seeds of Bronco cultivar were sown in 15th Sept. in both autumn seasons of 2005/2006 and 2006/2007.

This experiment included four treatments as follow: Control, Ca at 0.5%, Mg at 0.2%, and vit B_1 at 25 ppm. The treatments were arranged in a randomized complete block design system with three replications. Plot area was 7.2 m contained two dripper lines (6m length and 60 cm wide). Seeds were sown in hills on two sides of dripper line, then it thinned to leave one plant per hill. The distance between hills was 25 cm.

Plants of snap bean were sprayed with aqueous solutions of Ca, Mg, and vit. B_1 twice at 20 and 35 days after sowing. Each experimental unit received two litter solution using spreading agent (super film) in all treatments. The untreated plants (check) were sprayed with tap water. The source of Ca and Mg was $CaCl_2$ and $MgSO_4$, respectively. While the source of vit. B_1 was Thinamine Hydrochloride.

All plots received equal amounts of farmyard manure (FYM) at rate of 20 m^3/feddan. Nitrogen, phosphorus and potassium were added in the form of ammonium sulphate (20.5% N), calcium superphosphate (15.5% P_2O_5) and potassium sulphate (48% K_2O) at the rates of 40 kg N, 37 kg P_2O_5 and 50 kg K_2O, respectively. One third of all fertilizers was added at the time of soil preparation and the rest were divided into three equal portions and added to the soil at 10 days intervals after emergence. The other normal agricultural treatments for growing snap bean plants were practiced.

Table 1. The physical and chemical properties of the soil

Physical properties			Chemical properties		
	2005/2006	2006/2007		2005/2006	2006/2007
Sand (%)	96.5	95.6	**Organic matter(%)**	0.03	0.08
Silt (%)	1.7	1.6	**Available K (ppm)**	52.0	64.0
Clay (%)	1.8	2.8	**Available P (ppm)**	5.5	6.2
Field capacity (%)	6.5	6.8	**Available N (%)**	5.4	6.9
Wilting point (%)	2.4	2.5	**Calcium carbonate (%)**	0.18	0.26
Available water (%)	4.5	4.5	**PH**	8.1	8.1
Water holding capacity (%)	13.8	14.5			

Sample of the soil was obtained from 25 cm soil surface.

Data Recorded

Plant growth

A random sample of five plants from every experimental unit were taken at 55 days after sowing and the following data were recorded: Plant height, number of both leaves, branches and pods/plant.

Different plant parts were oven dried at 70 °C till constant weight, and the following data were recorded: Dry weight of roots, leaves, branches, and total dry weight of whole plant.

Nitrogen, phosphors and potassium contents

The dry weight of roots, shoots (leaves + branches) and pods at 55 days from sowing were finely ground and wet digested with sulphuric acid and perchloric acid (3:1). Nitrogen, phosphorus and potassium contents were determined according to the methods described by Bremner and Mulvaney (1982), Olsen and Sommers (1982) and Jackson (1970), respectively.

Yield and its components

Green pods of each experimental unit were harvested at proper maturity stage, counted and weighed in each harvest and the following data were calculated: Average number of pods/plant, yield/plot (Kg), and total yield/feddan (ton).

Storability

Packages macro perforated polyethylene bags with pin holes (250 gm beans/ polyethylene bag as initial weight) were used. Packages of each replicate were weighed, packed in carton boxes (each box contains 10 polyethylene bags) and stored at 7°C and 95 % relative humidity. Five samples were randomly taken, one sample at the marketing period, and the other at 7 days intervals during cold storage for evaluation the following data :

Weight loss (%)

It was measured as the percentage of loss from the initial weight (cumulative losses).

$$\text{Weight loss percentage} = \frac{W_1 - W_2}{W_1} X100$$

Where: W_1: Initial weight of sampling

W_2: Weight of next sampling dates

Decay (%)

Any pods showing decay incidence (shrinked, injured, shriveled and spoiled pods) were

removed, weighed and counted. The percentage of decayed pods was calculated in the related to total number of pods.

$$\text{Decay percentage} = \frac{N_2}{N_1} X100$$

Where: N_2: Number of decayed pods

N_1: Total number of pods

Pods Quality at Cold Storage

Dry matter percentage (DM%): It was determined by using 100 gm of fresh pods at 105 °C till a constant weight , then DM % was calculated.

Appearance

It was scored 9 to 1 scale, where, 9 = Excellent, 7 = Good, 5 = Fair, 3= Poor and 1 = Unusable (Watada and Morris, 1996; Jimancz *et al.*, 1998)

Off-odor

It was determined by personal panel test on a scale of 5 to 1, where 5= Sever, 4= Moderately sever, 3 = Moderate, 2 = Slight, and 1= None (Kasmire *et al.*, 1974).

Statistical analysis

The data of these experiments were subjected to proper statistical analysis of variance according to Snedecor and Cochran (1980) and means separation was done according to Duncan (1958).

RESULTS AND DISCUSSION

Plant Growth

Morphological characters

Presented data in Table 2 show the effect of foliar spray with Ca, Mg and vit. B_1 on plant height, number of leaves, branches and pods/ plant of snap bean grown under sandy soil conditions.

It is obvious that, spraying snap bean plants grown under sandy soil conditions during autumn season with Ca at 0.5%, Mg at 0.2% or vit B_1at 25 ppm significantly increased number of both branches and pods/ plant in both seasons compared to control, while vit B_1 gave the highest values in this respect, followed by Ca at 0.5% and Mg at 0.2% in both growing seasons.

Dry weight

The effect of Ca, Mg and vit. B_1 on dry weight of roots, shoots (leaves+ branches), pods and total dry weight/ plant in both seasons of study are presented in Table 3.

It can be seen from such data that spraying snap bean plants with Ca, Mg and vit. B_1 reflected a

significant differences in dry weight of roots in the 1st season, dry weight of branches in 2nd season, and dry weight of shoots and total dry weight in both seasons , but did not reflect any significant effect on dry weight of roots in the 2nd season, dry weight of branches in the 1st season, and dry weight of pods in both seasons. Spraying Ca at 0.5 %, Mg at 0.2 % and vit. B_1 at 25 ppm were the best treatments for enhancing dry weight of shoots and total dry weight/plant in both seasons compared to control treatment. Application of vit B_1 recorded the maximum values of total dry weight/plant, followed by Mg at 0.2%, then Ca at 0.5 %, respectively. The increases in the total dry weight/ plant were about 24.41 and 20.97 % for Ca at 0.5 %, 27.55 and 28.63 % for Mg at 0.2 % and 36.85 and 45.83 % for vit. B_1 at 25 ppm over the control in the 1st and 2nd seasons, respectively.

B-vitamins participate in plant growth and development indirectly by enhancing endogenous levels and various growth factors such as cytokinins and gibberllin (Kodandara and Rao, 1985). In addition, leaf applied with thiamin was reported to enhance sugar and starch content in stems,

Table 2. Effect of foliar spray with Ca, Mg and vit. B_1 on morphological characters of snap bean plants during autumn seasons of 2005/2006 and 2006/2007 under sandy soil conditions (after 55 days from sowing)

Treatments	Plant height (cm)	Numbers/ plant		
		Leaves	Branches	Pods
		2005/2006 season		
Control	40.99 a	11.33 a	7.44 b	10.55 b
Ca at 0.5%	40.11 a	12.55 a	9.33 a	13.26 a
Mg at 0.2%	40.77 a	12.44 a	9.11 a	13.88 a
Vit. B_1 at 25 ppm	39.22 a	13.00 a	9.66 a	14.00 a
		2006/2007 season		
Control	46.33 a	12.77 a	8.33 b	11.33 c
Ca at 0.5 %	44.00 a	14.11 a	9.33 ab	14.44 b
Mg at 0.2 %	46.11 a	13.66 a	9.44 ab	14.89 ab
Vit. B_1 at 25 ppm	44.44 a	14.33 a	9.88 a	16.22 a

Values with the same alphabetical letters within column did not significantly differ according to Duncan's test.

Table 3. Effect of foliar spray with Ca, Mg and vit. B_1 on dry weight of snap bean plants during autumn seasons of 2005 / 2006 and 2006/2007 under sandy soil conditions (after 55 days from sowing)

Treatments	Dry weight (gm)						
	Roots	Leaves	Branches	Shoots *	Pod	Total	Relative total dry weight (%)
				2005/2006 season			
Control	0.230 b	4.999 b	2.888 a	7.887 b	3.589a	11.706 b	100.00
Ca at 0.5 %	0.346 a	6.593 ab	3.941 a	10.534 a	3.684a	14.564 a	124.41
Mg at 0.2 %	0.253 b	7.086 a	3.812 a	10.898 a	3.781a	14.932 a	127.55
Vit. B_1 at 25 ppm	0.385 a	7.340 a	4.093 a	11.433 a	4.202a	16.020 a	136.85
				2006/2007 season			
Control	1.032 a	6.338 b	2.474b	8.812 b	3.515 a	13.359 c	100.00
Ca at 0.5 %	1.328 a	6.600 ab	4.402a	11.00 ab	3.831 a	16.161 bc	120.97
Mg at 0.2 %	1.277 a	7.379 ab	4.485a	11.88 a	4.044 a	17.185 ab	128.63
Vit. B_1 at 25 ppm	1.413 a	8.173 a	5.175a	13.35 a	4.721 a	19.482 a	145.83

*shoots = leaves + branches

Values with the same alphabetical letters within column did not significantly differ according to Duncan's test.

leaves and roots and stimulated root development and flower bud differentiation (Lijima, 1956)

These results agree with those reported by Barbieri (1955) on pea with respect to vit. B_1, Arisha and El-Ghamriny (1992) and Bardisi (2005) on pea with respect to Mg and El-Tohamay (2000) on snap bean with respect to Ca. They concluded that spraying vegetable crops with vit. B_1, Mg or Ca increased dry weight of plants.

Contents of N, P and K

Concerning N contents, it is obvious from data in Table 4 that spraying with Ca, Mg and vit B_1 had no significant effect on N content in shoots in both seasons and N content in roots and pods in the 1st season, but had significant effect on N content in roots and pods in the 2nd season. Ca at 0.5% or Mg at 0.2% recorded the maximum values of N content in roots and pods in the 2nd season only.

As for P content, data in Table 4 show that foliar spray with Ca, Mg or vit.B_1 showed a significant effect on P content in pod in 1st season and P content in root and shoots in the 2nd season. In general, Ca at 0.5 %, Mg at 0.2 % or vit.B_1 at 25 ppm increased P content in pods in the 1st season and P content in roots and shoots in the 2nd one.

Regarding K content, presented data in Table 4 show that spraying with Ca, Mg and vit. B_1 had a significant effect on K content in roots, shoots and pods in both seasons. In general, Ca at 0.5 %, Mg at 0.2% or vit.B_1 at 25 ppm increased K content in roots, shoots and pods in both seasons compared to the control treatment.

Uptake of N, P and K

Respecting N uptake, data in Table 5 show that foliar spray of snap bean Bronco cv. with Ca, Mg and vit B_1 had no significant effect on N uptake by roots, shoots and pods, except N uptake by roots in the 1st season and N uptake by shoots in the 2nd one.

As for P uptake, presented data in Table 5 indicate that Ca, Mg or vit.B_1 showed a significant effect on P uptake by roots, shoots and pods, except P uptake by roots in the 2nd season. Generally, spraying with Ca, Mg and vit.B_1 increased P uptake by roots in the 1st season and P uptake by shoots in both seasons.

Concerning K uptake, it is obvious from the same data in Table 5 that Ca, Mg and vit. B_1 had significant effect on K uptake

Table 4. Effect of foliar spray with Ca, Mg and vit. B_1 on mineral contents of snap bean plants during autumn seasons of 2005 / 2006 and 2006/2007 under sandy soil conditions (after 55 days from sowing)

Treatments	N (%)			P (%)			K (%)		
	Root	Shoot	Pods	Root	Shoot	Pods	Root	Shoot	Pods
					2005/2006 season				
Control	1.338a	2.879a	1.927a	0.267a	0.299a	0.593b	1.555b	1.919b	3.904c
Ca at 0.5 %	1.543a	3.510a	2.130a	0.265a	0.308a	0.697a	2.054ab	2.017b	3.564c
Mg at 0.2 %	1.276a	3.291a	1.906a	0.318a	0.293a	0.641ab	2.631ab	2.748a	4.286ab
Vit. B_1 at 25 ppm	1.189a	2.874a	1.770a	0.271a	0.338a	0.626ab	2.942a	2.172ab	4.557a
					2006/2007 season				
Control	1.388a	2.167a	1.974bc	0.175b	0.281b	0.437a	1.940b	3.854ab	2.302b
Ca at 0.5 %	1.313ab	3.073a	2.291a	0.253a	0.296b	0.585a	2.311b	4.509a	3.612a
Mg at 0.2 %	1.313ab	2.471a	2.187ab	0.204ab	0.245b	0.536a	2.117b	4.521a	3.663a
Vit. B_1 at 25 ppm	1.227b	2.593a	1.792c	0.245a	0.411a	0.530a	2.797a	3.450b	3.903a

Values with the same alphabetical letters within column did not significantly differ according to Duncan's test.

Table 5. Effect of foliar spray with Ca, Mg and vit. B_1 on N, P and K uptake by different organs of snap bean plants during autumn seasons of 2005 / 2006 and 2006/2007 under sandy soil conditions (after 55 days from sowing)

Treatments	Uptake (mg/ organ)									Total uptake (mg/ plant)		
	N			P			K					
	Root	Shoot	Pod	Root	Shoot	Pod	Root	Shoot	Pod	N	P	K
						2005/2006 season						
Control	3.205b	238.7a	69.31a	0.617b	23.77b	21.25a	3.579b	153.2b	139.3b	311.2a	45.63c	296.1b
Ca at 0.5 %	5.152a	369.1a	76.62a	0.923ab	32.46ab	25.90a	7.268ab	214.4ab	130.9b	450.8a	59.29ab	352.6b
Mg at 0.2 %	3.229b	371.3a	72.36a	0.805ab	31.11ab	24.11a	6.668ab	300.5a	160.8ab	446.9a	56.03b	468.0a
Vit. B_1 at 25 ppm	4.582a	332.0a	74.47a	1.047a	38.85a	26.32a	11.370a	247.4a	192.2a	411.0a	66.21a	450.9a
						2006/2007 season						
Control	14.37a	189.0b	70.26a	1.806a	24.76b	15.23a	19.85b	337.2b	79.0b	273.6b	41.80b	436.1b
Ca at 0.5 %	17.23a	330.7a	90.15a	3.359a	32.42b	22.42a	30.68ab	461.4a	137.0ab	438.1a	58.19b	629.1a
Mg at 0.2 %	16.68a	293.8a	88.84a	2.689a	29.10b	21.70a	27.79b	535.6a	148.0a	399.3a	53.49b	711.4a
Vit. B_1 at 25 ppm	17.45a	345.7a	85.38a	3.372a	55.09a	25.03a	39.37a	460.7a	184.3a	448.5a	83.50a	684.4a

Values with the same alphabetical letters within column did not significantly differ according to Duncan's test.

by roots, shoots and pods in both seasons. Spraying with vit. B_1 at 25 ppm recorded maximum values of K uptake by roots and pods followed by Mg at 0.2% or Ca at 0.5%, whereas spraying with Mg at 0.2% recorded maximum values of K uptake by shoots followed by vit. B_1 at 25 ppm or Ca at 0.5 %.

Concerning N, P and K total uptake, it is obvious from data in Table 5 that spraying snap bean plants Bronco cv. grown under sandy soil conditions with Ca at 0.5 % , Mg at 0.2 % and vit. B_1 at 25 ppm showed a significant effect on N,P and K total uptake by plants in both seasons, except N total uptake in the 1st season. Spraying with Ca at 0.5 %, Mg at 0.2% or vit. B_1 at 25 ppm significantly increased N and K total uptake by plant compared to control, whereas spraying with vit. B_1at 25 ppm significantly increased P total uptake by plant compared to control and the other treatments. El-Ghamriny *et al.* (1999) found that spraying tomato plants with thiamine at 50 ppm gave maximum values of N and P uptake by stems, leaves and roots.

Yield and its Components

As for the effect of Ca, Mg and vit. B_1 on yield and its components of snap bean plants, it is evident from data presented in Table 6 that, foliar spray with Ca, Mg and vit. B_1 at different concentrations had significant effect on number of pods/plant, yield /plot and total yield/*fed* in both seasons. Spraying snap bean plants Bronco cv. grown under sandy soil conditions with Ca at 0.5 %, Mg at 0.2% or vit. B_1 at 25 ppm increased number of pods/plant compared to control and vit. B_1 recorded maximum values of number of pods/plant, followed by Ca and Mg.

With regard to the total yield/*fed.*, data in Table 6 show that foliar spray with Ca, Mg and vit. B_1 at 0.5%, 0.2% and 25 ppm, respectively increased total yield/*fed* in both seasons compared to control and vit. B_1 was the best treatment, being 3.577 and 4.565 ton/*fed,* followed by Mg, being 3.293 and 4.299 ton/*fed,* then Ca, being 3.285 and 4.015 ton/*fed* in the 1st and 2nd seasons, respectively. The increases of total yield/ *fed* were about 12.65 and 6.24 % for Ca at 0.5 %, 12.92 and 13.76 % for Mg at 0.2% and 22.66 and 20.79 % for vit. B_1 at 25 ppm over the control in the 1st and 2nd seasons, respectively.

Also, obtained results might be attributed to that vit. B_1 improved

Table 6. Effect of foliar spray with Ca, Mg and vit. B_1 on yield and its components of snap bean plants during autumn seasons of 2005/ 2006 and 2006/2007 under sandy soil conditions

Treatments	Yield and its components			
	Pod number/plant	Yield (kg/ plot)	Yield (ton/*fed*)	Relative yield (%)
		2005/2006 season		
Control	14.00 b	5.000 b	2.916 b	100.00
Ca at 0.5 %	17.33 a	5.631ab	3.285 ab	112.65
Mg at 0.2 %	17.82 a	5.645 ab	3.293 ab	112.92
Vit. B_1 at 25 ppm	18.06 a	6.132 a	3.577 a	122.66
		2006/2007 season		
Control	17.20 b	6.478c	3.779 c	100.00
Ca at 0.5 %	20.33 a	6.882 bc	4.015 bc	106.24
Mg at 0.2 %	21.89 a	7.369 ab	4.299 ab	113.76
Vit. B_1 at 25 ppm	22.77 a	7.825 a	4.565 a	120.79

Values with the same alphabetical letters within column did not significantly differ according to Duncan's test.

mineral concentrations and uptake by plant shoots (Tables 4 and 5) and hence plant growth was in turn improved (Table 3). So that, plant performance would be improved accordingly and reflected on its productivity. The obtained results are in harmony with those reported by El-Beheidi *et al.* 1995) on pea, Fathy and Farid (1996) on common bean, Arisha (2000) on pea and Kamel (2005) on cowpea regarding vit. B_1, Arisha and El-Ghamriny (1992) and Bardisi (2005) on pea regarding Mg and Toivonen and Powen (1999) and El-Mogy (2001) on snap bean regarding Ca, they concluded that spraying with vit. B_1, Mg or Ca increased yield and its components.

Storability

Weight loss

The obtained results in Table 7 indicate that there was a considerable increase in weight loss (%) of stored green pods as the storage period was prolonged, where the maximum loss was occurred at the end of storage period (four weeks). Spraying snap bean plants with Ca at 0.5% decreased weight loss (%) in both seasons compared to the other treatments. This increment in weight loss might be attributed to the increase in respiration rate during storage period.

Decay

Decay (%) in green pods of snap bean was increased with prolonging storage period, and the maximum decay was occurred at the end of storage period (four weeks). Calcium foliar spray at 0.5% reduced decay (%) in green pods compared to the other treatments (Table 7). This increase in decay percentage at the late period of storage might be due to the decrease of the biological activity of pods which in turn facilities infection of pods by microorganisms. These results might be attributed to the fact that Ca is known to be a retardant of senescence and is a major factor in preventing physiological disorders in fruits and other plant tissues (Cheour *et al.*, 1990).

Calcium application can significantly reduce postharvest decay by strengthening the cell wall matrix and presumably enhancing resistance to attacks by fungi and bacteria (Poovaiah, 1986).The proportion of Ca pectate in cell wall is also of important for the susceptibility or resistance of the tissue of fungal and bacterial infections.

Table 7. Effect of foliar spray with Ca, Mg and vit. B_1 on weight loss and decay percentage of snap bean pods during storage period of 2005/ 2006 and 2006/2007 .

Treatments	Weight loss (%)				Decay (%)				
	Weeks in storage								
	1	2	3	4	0	1	2	3	4
					2005/2006 season				
Control	2.28a	4.38a	6.32a	8.61a	1.00a	1.00a	2.33a	4.30a	4.53a
Ca at 0.5 %	2.03a	4.24a	5.88a	7.87b	1.00a	1.00a	1.85b	3.20c	3.66b
Mg at 0.2 %	2.28a	3.96a	5.77a	8.01ab	1.00a	1.00a	2.16ab	3.60bc	4.00ab
Vit. B_1 at 25 ppm	2.25a	4.31a	5.93a	8.01ab	1.00a	1.00a	2.00ab	4.00ab	4.20ab
					2006/2007 season				
Control	3.62a	5.91a	8.03a	11.00a	1.00a	1.00a	2.00a	4.00a	5.00a
Ca at 0.5 %	3.26a	4.85b	7.00b	9.55c	1.00a	1.00a	1.33b	3.00b	4.33a
Mg at 0. 2 %	3.44a	5.05ab	7.43ab	10.22b	1.00a	1.00a	2.00a	3.66a	4.66a
Vit. B_1 at 25 ppm	3.60a	4.54b	7.93a	10.30b	1.00a	1.00a	2.00a	3.66a	4.50a

Values with the same alphabetical letters within column did not significantly differ according to Duncan's test.

Both weight loss and decay (%) of stored green pods of snap bean Bronco cv. were increased with the prolongation of storage period. In this respect spraying with Ca $(NO_3)_2$ alone or in combination with K_2SO_4 showed the lowest values of weight loss and decay percentage and increased the shelf life (El- Mogy, 2001).

Pods Quality During Cold Storage

Appearance

Obtained results in Table 8 indicate that there was a significant decrease in appearance of pods with prolongation storage period for all treatments, where the minimum values were occurred at the end of storage period (four weeks). In general, there were no significant differences among treatments and control treatment during storage period for appearance of green pods.

Dry matter (%)

Presented data in Table 8 show that there was a considerable decrease in dry matter (%) of stored green pods as the storage period prolonged (four weeks). These results might be attributed to the increase in respiration rate during cold storage period. Spraying snap bean plants with Ca at 0.5 % recorded the highest DM (%) in pods after four weeks from cold storage compared to control which gave the least DM % in snap bean pods.

Off-odor

Data in Table 9 show that off-odor of green snap bean pods was increased with increasing storage period. There was no off-odor in green pods after two weeks in storage for treatments and control. These results may be due to that green pods were sealed inside plastic film packages of relatively low gas permeability, the O_2 concentration decreased, while CO_2 concentration increased as a consequence of tissues respiration. Eventually the O_2 concentration is reduced to a level that reduces tissues anoxia while there is a concentration increase in CO_2 which intensifies anaerobic environment in the package atmosphere. These results in anaerobic respiration in the produce, which rapidly destroys produce quality via tissue breakdown, accumulation of ethanol and acetaldehyde and development of off flover and off-odor. In anaerobic respiration, glucose is converted to pyruvate via the Embden- Meyerchaf-Parnas (EMP). Pyruvate is then metabolized into acetaldehyde and ethanol (Wills *et al.*, 1989).

Table 8. Effect of foliar spray with Ca, Mg and vit. B_1 on appearance and dry matter (%) and of snap bean pods during storage period of 2005/2006 and 2006/2007 .

Treatments	Appearance					Dry matter (%)				
	Weeks in storage									
	0	1	2	3	4	0	1	2	3	4
	2005/2006 season									
Control	9.00a	9.00a	5.16a	1.83b	1.00a	10.14a	11.48b	8.46b	9.22b	9.62a
Ca at 0.5 %	9.00a	9.00a	6.16a	2.76a	1.00a	10.21a	12.49a	11.49a	10.14ab	9.88a
Mg at 0.2 %	9.00a	9.00a	5.63a	2.76a	1.00a	10.23a	12.64a	10.30ab	10.34ab	9.57a
Vit. B_1 at 25 ppm	9.00a	9.00a	5.40a	2.53ab	1.00a	10.43a	12.53a	11.54a	10.55a	10.29a
	2006/2007 season									
Control	9.00a	8.33a	5.00b	1.66a	1.00a	9.30b	10.66c	9.59a	9.01a	9.21b
Ca at 0.5 %	9.00a	8.33a	7.00a	2.33a	1.00a	11.83ab	12.11b	10.29a	9.60a	10.96a
Mg at 0.2 %	9.00a	9.00a	6.00ab	1.66a	1.00a	12.44a	12.92a	10.22a	9.67a	9.55b
Vit. B_1 at 25 ppm	9.00a	9.00a	5.66b	3.00a	1.00a	13.36a	12.55ab	9.96a	9.46a	9.55b

Values with the same alphabetical letters within column did not significantly differ according to Duncan's test.

Table 9. Effect of foliar spray with Ca, Mg and vit. B_1 on off -odor of snap bean pods during storage period of 2005 /2006 and 2006/2007 .

Treatments	Off- odor			
	Weeks in storage			
	1	2	3	4
		2005/2006 season		
Control	1.00a	1.00a	4.50a	4.73a
Ca at 0.5 %	1.00a	1.00a	3.10b	4.20a
Mg at 0.2 %	1.00a	1.00a	3.00b	4.53a
Vit. B_1 at 25 ppm	1.00a	1.00a	3.00b	4.40a
		2006/2007 season		
Control	1.00a	1.00a	3.66a	4.40a
Ca at 0.5 %	1.00a	1.00a	2.66b	4.00a
Mg at 0.2 %	1.00a	1.00a	2.66b	4.33a
Vit. B_1 at 25 ppm	1.00a	1.00a	3.66a	4.06a

Values with the same alphabetical letters within column did not significantly differ according to Duncan's test.

REFERENCES

Arisha, H.M.E. 2000. Effect of vitamin B_1 on growth, chemical composition and yield of pea under sandy soil conditions. Zagazig J. Agric. Res. 27 (1) : 77-89.

Arisha, H.M.E., and E.A. El-Ghamriny. 1992. Influence of GA_3 and Mg on plant growth and yield of peas under sandy soil. Egypt. J. Appl. Sci. 7 (7): 510-518.

Barbieri, G. 1959. Effects of vit. B_1 and B_6 on pea, board bean, beet and wheat plants. Nuovo G. Bot. Ital. 66:14-22. (C.F. Samihullah and Afridi, 1988, B vitamin in relation to crop productivity. Indian. Rev. Life Sci. 8:5, 1-74).

Bardisi, A. 2005. Foliar application of magnesium in comparison with kinetin on pea production under sandy soil conditions. Zagazig. J. Agric. Res. 31 (4A) :1321-1334.

Bremner, J.M. and C.M. Mulvaney. 1982. Total nitrogen. In [Page, A.L., R.H. Miller, and D.R. Keeney] (Eds). Methods of Soil Analysis, Part 2 Amer. Soc. Agron. Madison. WI-W.S.A. p. 595-624.

Cheour, F., C. Willemot, J. Arul, Y. Desjardins, J. Makhalouf, P.M. Charest, and A. Gosselin. 1990. Foliar application of calcium chloride delays post harvest ripening of strawberry. J. Amer. Soc. Hort. Sci.115 (5):78-792.

Duncan, D.B. 1958. Multiple range and Multiple F test. Biometrics 11:1- 42.

El-Beheidi, M.A., A.A. El-Mansi, A.M. Metwally, A.A. Guirgis, and S.A. Swidan. 1995. Effect of nitrogen source and vitamin B_1on growth and yield of pea plants. Ann. Agric. Sci., Moshtohor, 33 (4): 1481-1495.

El-Ghamriny, E.A., A.M. Arisha, and K.A. Nour. 1999. Studies on tomato flowering, fruity set, yield and quality in summer. I. Spraying with thiamine, ascorbic acid and yeast. Zagazig J. Agric. Res. 26 (5): 1345-1364.

El-Mansi, A.A. E.A. El-Ghamriny, H.M. Arisha, and A.E. Kamel. 1994. Effect of foliar spray with IBA and or vitamin B_1 on growth, seed yield and seed quality of cowpea. Zagazig J. Agric. Res. 21 (3b): 915-925.

El-Mogy, M.M. 2001. Effect of some pre and postharvest treatments on storageability of some snap bean cultivars. M.Sc. Thesis, Fac. Agric., Cairo Univ., Egypt.

El-Tohamy, W.A. 2000. Effects two tunnels, plastic mulch and mineral nutrient treatments on chilling tolerance of snap bean plants. Ph.D. Thesis, Fac. Agric., Ain Shams University.

Fathy, E.S. and S. Farid. 1996. The possibility of using vitamin B_2 and yeast to delay senescence and improve growth and yield of common beans (*Phaseolus vulgaris* L.). J. Agric. Sci. Mansoura Univ. 21 (4): 1415-1423.

Jackson, M.L. 1970. Soil Chemical Analysis. Prentice Hall, Englewood Cliffs, N.J.

Jimanez, M., E. Trejo, and M. Cantwell. 1998. Postharvest quality changes in green beans. Research Report. UC Davis Cooperative Extension Service 9 PP.

Kamel, A.E. 2005. Studies on some factors affecting growth and productivity of cowpea crop. Ph.D. Thesis, Fac. Agric., Zagazig Univ., Egypt.

Kasmire, R.F. A.A. Kader and J.A. Klaustermeyer. 1974. Influence of aeration rate and atmospheric composition during simulated transit on visual quality and off odor production by broccoli. Hort Science.9: 228-229.

Kodandara N.J. and P.G. Rao. 1985. Influence of p-Bitamins on stomatal index, frequency and diurnal rhythms in stomatal opening in Cyamopsis tetraganoloha (L.) Taub. J. Biol. Res. 5: 68-73.

Lijima, 1956. On the physiology and utilizations of vitamin B_1 in garden crops. VII. The effects of foliage thiamine spray on the chemical composition of taste of some garden crops. Ibid. 25: 194-198. Indian Rev. Life Sci. 8: 51-74.

Marschner, H. 1995. Mineral nutrition of higher plants. 2nd ed. Academic Press, Harcourt Brace and Company, Publisher London, San Diego, New York, Boston, Sydney, Tokyo, Toronto, pp. 864.

Oertli, J.J. 1987. Exogenous application of vitamins as regulators for growth and development of plants. A review. Z. pflanzenernahr. Bodenk. 150: 375-391.

Olsen, S.R. and L.E. Sommers. 1982. Phosphorus In [Page, A.L., R.H. Miller, and D.R. Keeney (Eds.). Methos of Soil Anaylsis, Part 2- Amer. Soc. Agron. Madison. WI- USA pp. 403-430].

Poovaiah, B.W. 1986. Role of calcium prolonging storage life of fruit and vegetables. Food Technol.40:86-89.

Samihullah, A.S.S., and M.M.R. Afridi. 1988. B-vitamins in relation to crop productivity. Indian Rev. Life Sci. 8: 51-74.

Snedecor, G.W. and W.G. Cochran. 1980. Statistical Methods, 7th ed. Iowa State Univ. Press. Ames. Iowa, USA.

Toivonem, P.M.A. and P.A. Powen. 1999. The effect of pre harvest foliar sprays of calcium on quality and shelf life of two cultivars of sweet bell peppers (*capsicum annum* L.) grown in plasticulture. Can. J. Plant. Sci. 79: 411-416.

Watada, A.E. and L.L. Morris. 1996. Effect of chilling and non- chilling temperatures on snap beans fruits. Proc. Amer. Soc. Hort. Sci. 89:368-374.

Wills, R.B.H., W.B. McGlassan, D. Graham, T.H. Lee, and E.G. Hall. 1989. Post harvest an introduction to the physiology and handling of fruit and vegetables, 3rd edit. New York: Van Nostrand Reinhol.

تأثير الرش بالكالسيوم، الماغنسيوم وفيتامين ب١ على الإنتاجية والقدرة التخزينية للفاصوليا النامية فى الأراضى الرملية

أميمة عثمان محمد [١] – حامد محمد الهادى عريشة[١] –
عبد الله برديسى أحمد[١] – راوية البسيونى إبراهيم[٢]

[١]– قسم البساتين– كلية الزراعة– جامعة الزقازيق– مصر

[٢]– معهد بحوث البساتين– مركز البحوث الزراعية– مصر

أجريت تجربتان حقليتان فى الموسمين الخريفيين لعامى ٢٠٠٥/٢٠٠٦، ٢٠٠٦/٢٠٠٧ فى محطة بحوث البساتين بالقصاصين، محافظة الاسماعلية – مصر، بهدف دراسة تأثير الرش الورقى بكل من الكالسيوم، الماغنسيوم وفيتامين ب١ على النمو والمحصول والقدرة التخزينية للفاصوليا الخضراء تحت ظروف الأراضى الرملية.

أوضحت النتائج المتحصل عليها أن رش نباتات الفاصوليا بالكالسيوم والماغنسيوم وفيتامين ب١ أدت الى حدوث زيادة معنوية فى كل من عدد الأفرع على النبات والوزن الجاف للمجموع الخضرى والوزن الجاف الكلى للنبات والممتص الكلى من النيتروجين والفوسفور والبوتاسيوم، وعدد القرون على النبات، والمحصول الكلى للفدان، كما أعطى الرش بفيتامين ب١ بتركيز ٢٥ جزء فى المليون أعلى القيم للقياسات السابق ذكرها، يليه الرش بالكالسيوم بتركيز ٠,٥ % والماغنسيوم بتركيز ٠,٢% على الترتيب.

ومن ناحية أخرى فقد انخفضت كل من النسبة المئوية للمادة الجافة، ومظهر القرون الخضراء بزيادة فترة التخزين، بينما ازدادت نسبة الفقد فى الوزن ونسبة تدهور القرون والرائحة الكريهة فى القرون الخضراء مع زيادة فترة التخزين، وعلاوة على ذلك فقد أدى الرش بالكالسيوم بتركيز ٠,٥ % الى نقص كل من نسبة الفقد فى الوزن، ونسبة تدهور القرون، والرائحة الكريهة فى القرون الخضراء، وفى الوقت نفسه أدى لزيادة نسبة المادة الجافة بالقرون الخضراء.