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# SUBSTRATES EVALUATION FOR CONTAINER PRODUCTION OF CROTON PLANT CV." GOLD STAR"

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## ABSTRACT

*A pot experiment was carried out during two successive seasons,2005and 2006 in the greenhouse , at Ornamental Horticulture Department, Faculty of Agriculture, Cairo University, to study the effect of growing media on growth and chemical composition of croton plant.*

*Generally, growing the croton plant cv. "Gold Star" in a mixture of sand+ peatmoss + clay, sand + peatmoss+ vermiculite or sand+ peatmoss + perlite resulted in the tallest plants with the greatest number of leaves and the largest leaf area. The mixture of sand + peatmoss +clay as well as sand+ peatmoss +perlite significantly increased stem diameter. Most of growing mixtures had a favorable effect on increasing the number of branches of the croton as compared with the mixtures of sand+ peatmoss+ sawdust and sand + peatmoss + dried leaves. The fresh and dry weights of leaves and stems were heavier in the mixtures of sand + peatmoss +clay and sand +peatmoss+ vermiculite. The mixtures of sand +peatmoss +sawdust and peatmoss +perlite, sand +peatmoss +clay increased the root length and fresh and dry weights of roots of the croton plants.*

*The mixtures of sand + peatmoss + perlite, sand + peatmoss + clay and sand + peatmoss + vermiculite were the most effective media in increasing the contents of both chlorophyll–a and chlorophyll–b. The highest value of the carbohydrates content in the leaves of croton plants was recorded with the mixture of sand + peatmoss + vermiculite, The stem content of carbohydrates reached the highest value in sand + peatmoss + clay mixture. Using sand + peatmoss + perlite increased the accumulation of nitrogen in the leaves, stems and roots. Adding vermiculite, clay or perlite to sand + peatmoss mixtures had favorable effect on increasing the K content in the leaves of the croton plant, whereas the mixture of sand + peatmoss + perlite increased K content in the stems and roots.*

**Key words:** Container production, croton plant, gold star.

## INTRODUCTION

The plants of *Codiaeum variegatum* (L.) Blume, are commonly called crotons (Family: *Euphorbiaceae*), crotons consists of more than 750 species. Croton is an interesting foliage plant, native to the Moluccan Islands, between the Philippines and New Guinea. Crotons are widely cultivated as ornamentals and houseplants. The plant tolerates a wide range of light, temperature, and watering conditions without loosing its leaves. Croton plant makes a good container specimen, looks attractive as a stand-

alone specimen or as part of a mixed display. Larger specimens are especially useful as feature plants in warm, well-lit atria, shopping malls and offices. Crotons can be grown in full sun or partial shade, this plant is well adapted to outdoor places, it also does well in high light indoor living areas (Conover and Poole, 1983 and 1990)..The effects of potting media on the growth of foliage plants, were investigated by several workers, Matysiak and Nowak ( 1988) on *Ficus benjamina,* stated that peat + perlite resulted in the highest shoot and root fresh weights and the greatest leaf area. Hall *et al* (1994) on *Ficus elastica* cv. Robusta, stated that plants grown perlite had a higher marketable quality than those grown in peatmoss. Tillmann *et al*(1994) on *Codiaeum variegatum*, found that vermiculite was the most suitable medium for root growth , it gave the longest and heaviest roots.Only soil and sand were totally unsatisfactory. Soyergin *et al* (1994) on *Dieffenbachia cv*. Camilla*,* found that of 10 potting mixtures, a mixture of peat + soil + perlite gave the tallest and best quality plants . Also, Karakir *et al* (1994) on Fig *cv.* Sarilop, obtained the best root growth in sand + perlite. . Abo-Hassan *et al* (1994) on *Ficus infectoria*, obtained that the best rooting (rooting percentage, number of roots, root length and DW per cutting) with perlite + peatmoss medium, followed by sand + perlite + peatmoss. Ishtiaq (1995) on *Ficus benjamina, F. elastica, F. elastica* and *F. microcarpa*,showed that the medium had no significant effect plant height and plant thickness, and root length and weight.The number of leaves and number of branches were highest in medium containing sand, while species had a significant effect .El-Sallami (1996) on *Ficus benjamina*, found that plants grown in clay + peat had the widest stems and high numbers of leaves/plant. Media composed of peat + clay or vermiculite produced tall plants with many branches and high fresh weights of branches and roots , the leaf contents of N, P, K, Mg and carbohydrates showed a positive relationship with growth for the 2 media, which gave the best growth. Mukhtar *et al* (1996) on *F. elastica* plants, found that growing medium (sand,silt and clay )had no significant effect on shoot growth or rooting. Zaghloul *et al* (1996) on *Philodendron domesticum*, stated that peat alone or peat + sand (1:1) gave the greatest plant height and leaf and root fresh weights. Ryu *et al* (1996) on *Ficus benjamina,* observed a negative correlation between plant height and media porosity, and a positive correlation with bulk density. Using 5 different growing media, Ziaullah, *et a*l (1999) on *Cordyline terminalis* and *C. fruticosa* stated that media had no appreciable effect on root length and plant height , but significantly affected leaf area and number of roots per plant. Stamps and Evans (1999) on *Dracaena marginata* and *Spathiphyllum* prepared growing media using pine bark, vermiculite and/or perlite in different proportions. Dracaena root growth was not affected by treatments but there were significant effect on plant top growth parameters. Treder *et al* (1999) reported that *F. benghalensis* and *F. lyrata* grown in peat had greater leaf surface area than plants grown in peat + rockwool..Garcia, *et al* (2001)on *Epipremnum aureum* and *Spathiphyllum wallisii*, using observed that the best plant productivity and quality were present in those substrates based on peat : perlite medium. Saleh (2000)on *Ficus benjamina* "Starlight" grew plants in different planting media, and indicated that peatmoss + sand + clay mixture resulted in higher yield and yield components than the other

planting media, and higher total content of carbohydrates a and b, N, P and K, but low concentration of carotenoids in the leaves .Papafotiou *et al* (2001) on *Euphorbia pulcherrima* cv. Peterstar White, *Codiaeum variegatum* var. pictum, *Syngonium podophyllum* and *Ficus benjamina* ,found that medium consisting of peat and perlite(1:1)gave the highest foliage fresh weight. Son, *et al* (2000) grew *Pachira aquatica*, *Saintpaulia ionantha* and *Spathiphyllum patinii* in different composition of peat:perlite:clay loam. Increasing the ratio of clay loam decreased porosity, while increasing the ratio of peat increased moisture capacity. Singh *et al* (2002) on *Maranta bicolor* obtained the longest root, soil + cocopeat mixture (1:1). Singh and Nair (2003) stated that on some foliage plants , found that height, number of leaves, number of shoots, number and length of roots, was maximum with soil, sand, and compost at the ratio of 2:1:1. Wazir *et al* (2003) on *Dracaena deremensis* stated that the soil medium consisting of silt + garden soil + leaf mould + sawdust resulted in the greatest number of leaves, thickness of stem number of roots and root weight per plant. El-Khateeb *et al* (2006) two cultivars of *Ficus alii,* found that, the mixtures of clay +peatmoss +perlite ,clay +sand +vermiculite and clay +sand +peatmoss produced the tallest plants ,whereas clay +peatmoss +perlite and clay +sand +perlite gave the thickest stems.

This study amide to investigate the effect of different growing media on growth and chemical composition of Coroton *(Codiaeum variegatum,*L) plants.

## MATERIALS AND METHODS

This study was carried out at the Experimental Nursery of the Department of Ornamental Horticulture, Faculty of Agriculture, Cairo University, Giza, during the two successive seasons of 2005 and 2006. The aim of the study was to investigate the responses of croton plants cv. "Gold Star" to growing media on growth and chemical composition. On 5 th April, uniform seedlings of croton cv. "Gold Star"(from the local market) with an average length of 14-16 cm, were planted in 25-cm diameter plastic pots filled with the following growing media

1. Sand +peatmoss (1:1 v/v).
2. "" "" +clay (1:1:1 v/v/v).
3. "" "" +perlite (1:1:1 v/v/v).
4. "" "" + vermiculite (1:1:1 v/v/v).
5. "" "" +sawdust (1:1:1 v/v/v).
6. "" "" + dried leaves (1:1:1 v/v/v).
7. Peatmoss +perlite (1:1 v/v).

The plants were fertilized with NPK at 1:1:1 at 5 g/ pot at monthly intervals. The plants were grown in these media for 10 months for each season.

***Data recorded**:* At the end of the each season the following data were recorded: Plant height, stem diameter, number of leaves, number of branches, fresh and dry weights of leaves, stems and roots.

***Chemical composition***: Chlorophyll-a & b and carotenoids contents were determined according to Saric *et al.* (1976),total carbohydrates were determined according to Herbert *et al*. (1971).Nitrogen, phosphorus and potassium were determined using the wet digestion procedure (Piper,1947),total nitrogen content using Nesslar method (Koch and Michelin, 1924),phosphorus according to Troug and Meyer (1939) and the content of potassium was determined by using operation chart of Shimadzu Atomic Absorption /Flame Spectrophotometer A646 with a boiling air acetylene burner and recorded read out.

The treatments were replicated 3 times and each replicate contained 3 pots. The layout of this experiment was a complete randomized design.

The data were statistically analyzed using the L.S.D. test to compare the means of the different treatments as recommended by Steel and Torrie (1980) Normal agricultural practices for the plants were done.

## RESULTS AND DISCUSSION

### 1-Effect of media on vegetative growth

***Plant height***

The responses of seedling height of the croton plant to the different growing media are shown in Table 1.The obtained data on the effect of growing media on the average seedling height ,indicated that, in the first season, growing the plants in a mixture of sand+ peatmoss +clay resulted in the tallest plants(45.67 cm), followed by mixture of sand+ peatmoss +perlite (42.33cm). In the second season, also the mixtures of sand+ peatmoss + clay (51.67cm), and sand + peatmoss + perlite (49.67cm), resulted in the tallest plants ,compared to the other mixtures. A marked increase in the plant height was obtained when the plants were grown in the mixture of sand+ peatmoss+ vermiculite(49.33 cm) in the second season .In the first season, growing the croton plant in a mixture of sand +peatmoss +dried leaves or sand +peatmoss +sawdust gave significantly the shortest plants as compared with the mixtures of sand +peatmoss +clay and sand +peatmoss +perlite. In the second season , the mixture of sand+ peatmoss+ dried leaves as well as sand +peatmoss decreased the height of the croton plant to the minimum values (40.33 and 42.67cm, respectively).Generally, the mixtures of sand +peatmoss +clay and sand +peatmoss +perlite gave the best results. In this respect, Mohamed (1994) on tuberose, stated that loamy + sand + peat (1:1:1) produced the tallest plants. Soyergin *et al* (1994) on *Dieffenbachia* cv. Camilla, found that a mixture of peat + soil + perlite gave the tallest plants. Also, El-Khateeb *et al* (2006)on *Ficus alii,* found that clay +sand +peatmoss produced the tallest plants.

***Stem diameter***

The response of stem diameter of croton plant to the different growing media are shown in Table 1.The data showed significant differences, in both seasons, between the stem thicknesses and the different growing media. In the first season, growing plants in a mixture of sand+ peatmoss +perlite significantly increased stem diameter

of plants (0.72 cm) as compared with that grown in a mixture of sand + peatmoss. (alone or with sawdust or dried leaves) .In the second season, the growing substrates sand+ peatmoss +perlite or sand + peatmoss +clay significantly increased it as compared with the other growing media. While, Ishtiaq (1995)on *Ficus benjamina, F. elastica, F. elastica and F. microcarpa*, showed that the medium had no significant effect on plant thickness.

***Number of branches***

Data in Table 1 Show the response of branches number of croton plant to the different mixtures growing media. The data indicated that the mixture of peatmoss +perlite, sand +peatmoss +vermiculite and sand +peatmoss in the first season had favorable effect on increasing the number of branches of the croton, whereas in the second one, growing plants in the mixtures of sand +peatmoss +clay or sand +peatmoss +perlite had a great effect on enhancing the formation of shoots, as compared with the other growing mixtures. Ishtiaq(1995)on some *Ficus sp*, showed that the number of branches were highest when plants were grown in medium containing sand. El-Sallami (1996) on *Ficus benjamina*, found that the mixture of peat + clay or vermiculite produced tall plants with many branches, number of roots and root weight per plant. Also, El-Khateeb *et al* (2006) on *Ficus alii*, found that the mixture of clay +peatmoss +vermiculite had a favorable effect on increasing the number and length of branches.

In both seasons, using the mixtures of sand +peatmoss +sawdust and sand +peatmoss+dried leaves as growing media for croton markedly reduced.

***Number of leaves***

As shown in Table 1, In the first season the croton plants formed the maximum number of leaves when plants were grown in the mixture of sand +peatmoss +vermiculite followed by the mixtures of sand +peatmoss +clay and peatmoss +perlite. Also, the data indicated that in the first season, the mixtures of sand +peatmoss +sawdust and sand +peatmoss +dried leaves significantly depressed the formation of leaves, compared with the other media. In the second season, the mixture of sand +peatmoss +perlite and sand +peatmoss +clay were the most effective media , which increased the number of leaves per plant to the highest values. As in the mixtures of sand +peatmoss +sawdust significantly depressed the formation of leaves, compared with the other media. El-Khateeb *et al* (2006) on two cultivars of *Ficus alii,* found that, the mixtures of clay +peatmoss +perlite and clay +peatmoss +vermiculite, produced the highest number of leaves .

***Leaf area***

The response of leaf area of croton plant to the different growing media are shown in Table 1.Croton plants produced the largest leaves in the first season when plants were grown in the mixture of sand +peatmoss +clay followed by the mixtures of peatmoss + perlite and sand +peatmoss + vermiculite. The corresponding leaf areas of these media were 40.43, 39.95 and 37.69 $cm^2$.,respectively.Also, the data indicated

that in the first season, the smallest leaves were obtained with the mixtures of sand +peatmoss +dried leaves followed by the mixture of sand +peatmoss +saw dust.
In the second season, the mixture of sand +peatmoss+ vermiculite as well as the mixtures of sand +peatmoss +clay and peatmoss + perlite were the most effective media, which increased the area of leaves to the highest values. The mixture of sand +peatmoss +sawdust reduced the leaf area to the minimum value(24.66cm$^2$),compared with the other growing media. In this regard, Hassan(1996) on *Aspidistra* plants, found that using a mixture of peat + sand (1:1) increased the leaf area . Matysiak and Nowak(1988) on *Ficus benjamina,* stated that peatmoss + perlite resulted in the greatest leaf area. Treder *et al* (1999) reported that *F. benghalensis* and *F. lyrata* grown in peat had greater leaf surface area than plants grown in peat + rockwool.

***Fresh and dry weights of leaves***

The responses of fresh and dry weights of leaves of croton plant to growing media are shown in Table 2.The data indicated that in the first season the fresh weight of leaves was heavier when plants were grown in the following mixtures sand +peatmoss +vermiculite , peatmoss +perlite and sand +peatmoss +clay a in descending order giving the values of 37.15, 36.57 and 35.78 g , respectively. In the second season, it was noticed that using the mixture of sand +peatmoss +clay was the most effective medium in increasing the fresh weight of leaves(43.55 g).also, growing plants in the mixture of sand +peatmoss +vermiculite, peatmoss +perlite markedly increased the fresh weight of leaves ,as compared with the other growing media .

In both seasons, growing croton plants in the mixtures of sand +peatmoss +sawdust or sand +peatmoss +dried leaves reduced the fresh weight of leaves to the minimum values(28.68 and 25.19 g),compared with the other growing media. Hall *et al* (1994)on *Ficus elastica* cv. Robusta, stated that plants grown in perlite substrates had a higher marketable quality than those grown in peatmoss.

Concerning the effect growing media on dry weight of leaves, the data clearly indicated that the response of dry weights of leaves of croton plant to growing media resulted the same trend of fresh weight as shown in Table 2.Thus, in the first season the dry weight of leaves was heavier than when plants were grown in the following mixtures sand +peatmoss +clay ,sand +peatmoss+ vermiculite, and peatmoss+ perlite giving the values of 7.26, 7.17 and 7.23 g , respectively. In the second season, it was noticed that using the mixture of sand +peatmoss +clay and sand +peatmoss +perlite were the most effective media in increasing the dry weight of leaves(7.87and 7.56g, respectively). Also, growing plants in the mixture of sand +peatmoss +vermiculite, peatmoss +perlite markedly increased the dry weight of leaves ,as compared with the other growing media .

Matysiak and Nowak (1988) on *Ficus benjamina,* stated that peat + perlite resulted in the highest shoot fresh weights. Zaghloul *et al* (1996) on *Philodendron domesticum,* stated that peat alone or peat + sand (1:1) gave the greatest fresh weights. El-Khateeb *et al* (2006)on *Ficus alii*, found that, clay +peatmoss +vermiculite, produced the heaviest fresh and dry weights.

In both seasons, growing croton plants in the mixtures of sand +peatmoss +saw dust or sand+peatmoss+dried leaves reduced the dry weight of leaves to the minimum values,compared with the other growing media.

***Fresh and dry weights of stems***

As shown in Table 2 , In both seasons, there were significant differences in fresh weights of stems of croton when plants were grown in the mixture sand +clay+ peatmoss as compared with the other growing media, giving the values of 21.91and 20.43 g, respectively. It was noticed that using the mixtures of sand +peatmoss+ vermiculite and peatmoss +perlite had favourable effect on increasing the fresh dry weight of stems in both seasons(17.46, 19.67, 17.33and 17.57g, respectively). On the other hand, growing plants in the mixtures of sand +peatmoss +sawdust or sand +peatmoss +dried leaves significantly reduced the fresh weight of stem to the minimum values ,compared with the other growing media in both seasons.

Concerning the effect growing media on dry weight of stems, it is clear that the response of dry weight of stems of croton plant to growing media resulted the same trend of fresh weight as shown in Table(2).Thus, in both seasons, the dry weight of stems was heaviest when plants were grown in the mixture sand +peatmoss +clay followed by the mixtures of sand +peatmoss+ vermiculite and peatmoss+ perlite .Also, growing plants in the mixture of sand +peatmoss +vermiculite, peatmoss +perlite markedly increased the dry weight of leaves ,as compared with the other growing media. , In this respect. El-Sallami (1996) on *Ficus benjamina*, found that plants grown in peat + clay or vermiculite produced high fresh weights.

In both seasons, growing croton plants in the mixtures of sand +peatmoss +sawdust or sand +peatmoss +dried leaves reduced the dry weight of stems to the minimum values, compared with the other growing media.

***Root length***

The responses of root length of the croton plant to the different growing media are shown in Table 3.The data showed, in both seasons, that growing the plants in the mixtures of sand+ peatmoss +clay, sand +peatmoss +perlite, sand +peatmoss +sawdust and peatmoss +perlite had favourable effect on increasing the length of roots. In the first season, the mixtures of sand +peatmoss +sawdust and peatmoss +perlite, resulted in the tallest roots, compared to the other mixtures, whereas in the second one growing plants in the mixture of sand +peatmoss +clay gave the tallest roots. Singh and Nair (2003) stated that on some foliage plants, found that the length of roots was maximum with the mixture of soil, sand, and compost at the ratio of 2:1:1.

***Fresh and dry weights of roots***

The effect of growing media on fresh and dry weights of roots are shown in Table 3, It is clear from data of the first season that the fresh weight of roots of the croton plants markedly increased when plants were grown in the following mixtures of sand +peatmoss +clay, sand +peatmoss +vermiculite and peatmoss +perlite, giving the

values of 11.07, 10.02 and 10.70 g , respectively. The fresh weights of roots of in the second season were greatly increased when plants were grown in sand +peatmoss +clay, sand +peatmoss +perlite and sand +peatmoss +vermiculite.

Concerning the effect growing media on dry weight of roots, the data indicated that the responses of dry weights of roots of croton plants to growing media resulted the same trend of fresh weight as shown in Table(3).Tillmann *et al* ( 1994) on *Codiaeum variegatum*, found that vermiculite was the most suitable medium for root growth , it gave the longest and heaviest roots. El-Sallami (1996) on *Ficus benjamina*, found that plants grown in peat + clay or vermiculite produced high fresh weights of roots. Zaghloul *et al* (1996) on *Philodendron domesticum*, stated that peat alone or peat + sand (1:1) gave the greatest root fresh weights. Wazir *et al* (2003)on *Dracaena deremensis*, stated that the soil medium consisting of silt + garden soil + leaf mould + sawdust resulted in the heaviest root weight per plant. El-Khateeb *et al.* (2006) on two cultivars of *Ficus alii*, found that the fresh weight of roots increased in the mixtures of clay +sand +perlite and clay +sand +peatmoss.

**2-Effect on chemical constituents :**

***Pigments content***

Data in Table 4 Showed the effect of growing media on the contents of chlorophyll -a,-b and carotenoids in the leaves of croton plant .The results indicated that in both seasons, the following mixtures sand + peatmoss + perlite, sand + peatmoss + clay and sand + peatmoss vermiculite were the most effective media in increasing the contents of both chlorophyll–a and chlorophyll–b. Whereas, the lowest content of chlorophyll-a (1.01 and 0.95 mg/g F.W) in the leaves of was recorded when plants were grown in sand + peatmoss + saw dust in the first season and sand + peatmoss in the second one. In both seasons, the content of chlorophyll-b in the leaves of croton reached to the lowest values (0.58 and 0.51 mg/g F.W, respectively) when plants were grown in the mixture contained sand + clay + dried leaves. In both seasons ,the highest values of the caroteniods in the leaves of croton was recorded with the mixtures of sand + peatmoss + clay and sand + peatmoss vermiculite. In this regard, El-Deeb (1999) on *Asplenium nidus* plants, found that the mixture of peatmoss + sand + clay increased the content of leaf pigments, while Hassan (1996)on *Aspidistra elatior* plant reported that the plants grown in a mixture of sand + peat contained the highest value of chlorophyll a, b and carotenoids content. Whereas, Saleh (2000)on *Ficus benjamina* "Starlight" indicated that using sand + peatmoss +clay as a growing mixture decreased the content of carotenoids in the leaves . El-Khateeb *et al* (2006) on *Ficus alii,* found that using clay +sand +vermiculite medium showed the highest content of chlorophyll–a.

***Total carbohydrates content (%D.W.) :***

Data in Table 4 showed the effect of growing media on the contents of carbohydrates in the different parts of croton plant. The results showed that in both seasons, growing the croton plants in sand + peatmoss + perlite, sand + peatmoss +

**Table 4 : Effect of growing media on the contents of chlorophyll -a , b, caroteniods and total carbohydrates in the different parts of croton plant, during seasons of 2004/2005 and 2005/2006.**

| Growing media | | 2004/2005 | | | 2005/2006 | | |
|---|---|---|---|---|---|---|---|
| | | Chlorophyll content mg/ g F.W | | | | | |
| | | Chl-a | Chl-b | Carot -ene | Chl-a | Chl-b | Carotene |
| Sand + peatmoss | ——— | 1.14 | 0.82 | 0.90 | 0.95 | 0.56 | 1.12 |
| | + Perlite | 1.25 | 0.92 | 0.86 | 1.30 | 0.78 | 0.99 |
| | + Clay | 1.33 | 0.88 | 1.24 | 1.36 | 0.91 | 1.22 |
| | + Vermiculite | 1.29 | 0.88 | 1.32 | 1.44 | 0.87 | 1.15 |
| | + Saw dust | 1.01 | 0.84 | 1.20 | 1.24 | 0.74 | 0.89 |
| | + Dried leaves | 1.05 | 0.58 | 1.04 | 1.10 | 0.51 | 1.15 |
| **Peatmoss + Perlite** | | **1.09** | **0.80** | **1.08** | **1.15** | **0.73** | **0.94** |

| | | Total carbohydrates % | | | | | |
|---|---|---|---|---|---|---|---|
| | | leaves | Stem | Roots | leaves | Stem | Roots |
| Sand + peatmoss | ——— | 22.75 | 28.50 | 33.50 | 25.75 | 32.00 | 35.00 |
| | + Perlite | 36.25 | 30.00 | 34.75 | 34.25 | 33.25 | 32.25 |
| | + Clay | 34.50 | 31.90 | 33.25 | 34.25 | 37.25 | 31.75 |
| | + Vermiculite | 37.35 | 30.00 | 32.50 | 30.10 | 35.25 | 25.50 |
| | + Saw dust | 28.25 | 27.10 | 21.35 | 25.00 | 26.40 | 24.50 |
| | + Dried leaves | 19.00 | 26.25 | 27.10 | 23.75 | 26.75 | 24.65 |
| **Peatmoss + Perlite** | | **21.50** | **24.75** | **32.20** | **28.35** | **27.25** | **30.35** |

Chl-a= Chlorophyll a Chl-b= Chlorophyll b F. W. = Fresh weight

clay and sand + peatmoss + vermiculite markedly increased the content of carbohydrates in the leaves, in both seasons, the highest value of the carbohydrates content in the leaves of croton plants was recorded with the mixtures of sand + peatmoss+ vermiculite, whereas the lowest content in the leaves of was recorded when plants were grown in sand + clay + dried leaves. The stem content of carbohydrates reached to the highest value when plants were grown in sand + peatmoss + clay in both seasons. The highest value of carbohydrates in the roots of croton, was recorded with the mixture of sand + peatmoss and sand + peatmoss + perlite. On the other side ,the content of carbohydrates in the roots reached to the minimum value when plants were grown in sand + peatmoss + sawdust mixture. In this connection, El-Deeb (1999) on *Asplenium nidus* plants found the mixture of peatmoss + sand markedly increased the content of carbohydrates in the leaves. El-Sallami (1996) on *Ficus benjamina*, found that media composed of peatmoss + clay or vermiculite produced high leaf contents of carbohydrates. Saleh (2000)on *Ficus benjamina* "Starlight", indicated that peatmoss + sand + clay mixture resulted in the highest total content of carbohydrates. El-Khateeb *et al* (2006) on *Ficus alii,* found that the mixtures of clay +peat+ perlite, and clay +sand +vermiculite , increased the

content of carbohydrates in the leaves whereas the highest content of carbohydrates in the roots was obtained on media containing vermiculite.

***N ,P and K contents :***

The response of nitrogen content in the leaves, stems and roots of the croton plants to the different growing media are presented in Table 5. The results show ,in the both seasons, that using sand + peatmoss + perlite , sand + peatmoss + clay and peat moss + perlite in the first season, and sand + peatmoss + clay , peat moss + perlite and sand + clay + dry leaves in the second season showed the highest content of nitrogen in the leaves, whereas the highest content of N stems was recorded when plants were grown in sand + peatmoss + perlite. The content of N in the roots , in both seasons , reached to the highest values when plants were grown in sand + peatmoss + perlite followed by sand + peatmoss+ vermiculite. Similar findings were reported by Mansour (1985) on *Aspidistra lurida* plant, found that the plants grown in peatmoss + sand mixture contained higher N in leaves, Gomaa (2000) on *Ornithogalum thyrsoides* plants, they stated that using a mixture of sand + composted leaves medium increased the content of nitrogen. On the other hand, on tuberose plant, Mohamed (1994) reported that growing the plants in a mixture of loam + sand + vermiculite (1:1:1v/v/v) resulted in more considerable increase in N content. El-Khateeb *et a*l (2006) on *Ficus alii*, found that clay +sand +perlite medium showed the highest content of nitrogen in the leaves and stems

Concerning the effect of growing media on P-content, in both seasons, as shown in Table 5,It is clear that growing the plants in a mixture of sand + perlite ,sand + peatmoss + saw dust as well as sand + peatmoss increased P content in the leaves to the highest values, whereas, the mixtures of sand + clay + dried leaves and sand + peatmoss + sawdust markedly increased the P content in the stems. On the other side, the highest phosphorus content the roots were recorded in plants grown in sand + perlite. In this regard, Gomaa (2000) on *Ornithogalum thyrsoides* plant, stated that composted plus sand significantly increased the P% in foliage.

Data on the effect of media on K-content are shown in Table 5. In both seasons, growing the plants in a mixtures of sand + peatmoss , sand + peatmoss + perlite , sand + peatmoss + clay and sand + peatmoss vermiculite increased K content in the leaves of the croton. The highest K- value in the leaves was recorded with the mixture of sand + peatmoss + vermiculite. Growing the plants on sand + peatmoss + sawdust mixture decreased the K- content to the minimum value. As shown in Table 5, growing the plants in a mixture of sand + peatmoss + perlite in both seasons increased K content in the stems to the highest values, the highest K content in the roots was recorded in plants grown in sand + peatmoss + clay followed by sand + peatmoss + perlite. In this regard, Gomaa (2000) on *Ornithogalum thyrsoides* plant, stated that composted plus sand significantly increased the P% in foliage. El-Sallami (1996) on *Ficus benjamina*, found that the mixture of peat + clay or vermiculite increased the leaf contents of N, P, K and Mg. Saleh (2000)on *Ficus benjamina* "Starlight" indicated that peatmoss + sand + clay mixture increased the contents of N, P and K. El-Khateeb *et al* (2006) on *Ficus alii*, found that growing the plants in a

**Table 5 : Effect of growing media on the percent of nitrogen, phosphorus and potassium in the different parts of croton plant, during seasons of 2004/2005 and 2005/2006.**

| Growing media | | 2004/2005 | | | 2005/2006 | | |
|---|---|---|---|---|---|---|---|
| | | Leaves | Stem | Roots | Leaves | Stem | Roots |
| | | | | Nitrogen % | | | |
| Sand + Peatmoss | ——— | 1.49 | 1.85 | 1.80 | 1.76 | 2.33 | 1.61 |
| | + Perlite | 2.03 | 2.92 | 2.40 | 1.86 | 2.52 | 1.88 |
| | + Clay | 2.83 | 2.28 | 1.51 | 2.76 | 2.21 | 0.99 |
| | + Vermiculite | 1.87 | 1.91 | 2.56 | 1.48 | 2.23 | 2.07 |
| | + Saw dust | 1.88 | 1.63 | 1.32 | 1.56 | 1.50 | 1.35 |
| | + Dried leaves | 1.89 | 1.13 | 1.28 | 2.16 | 1.41 | 1.14 |
| Peatmoss + Perlite | | 2.68 | 1.93 | 1.21 | 2.97 | 2.39 | 1.69 |
| | | | | Phosphorus % | | | |
| Sand + Peatmoss | ——— | 0.145 | 0.135 | 0.272 | 0.160 | 0.140 | 0.210 |
| | + Perlite | 0.115 | 0.110 | 0.100 | 0.095 | 0.130 | 0.120 |
| | + Clay | 0.070 | 0.255 | 0.106 | 0.090 | 0.210 | 0.100 |
| | + Vermiculite | 0.135 | 0.095 | 0.055 | 0.155 | 0.145 | 0.090 |
| | + Saw dust | 0.160 | 0.200 | 0.115 | 0.175 | 0.235 | 0.072 |
| | + Dried leaves | 0.125 | 0.370 | 0.140 | 0.095 | 0.295 | 0.115 |
| Peatmoss + Perlite | | 0.205 | 0.195 | 0.285 | 0.265 | 0.150 | 0.300 |
| | | | | Potassium % | | | |
| Sand + Patmoss | ——— | 1.23 | 1.19 | 1.13 | 1.28 | 0.76 | 0.89 |
| | + Perlite | 1.32 | 1.77 | 1.39 | 1.24 | 1.36 | 1.25 |
| | + Clay | 1.15 | 1.17 | 1.50 | 1.29 | 0.99 | 1.34 |
| | + Vermiculite | 1.60 | 1.05 | 1.18 | 1.42 | 0.90 | 1.12 |
| | + Saw dust | 0.87 | 0.88 | 1.05 | 0.81 | 1.06 | 1.03 |
| | + Dried leaves | 0.92 | 1.11 | 1.09 | 0.96 | 1.14 | 0.87 |
| Peatmoss + Perlite | | 1.13 | 1.17 | 1.22 | 0.98 | 0.89 | 0.89 |

mixture of clay + sand + peatmoss or clay + sand + vermiculite increased K-content in the leaves.

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# تقييم بعض أوساط الزراعة لإنتاج الكروتن صنف جولد ستار في الأصص

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أجريت هذه الدراسة بالصوب الزجاجية بقسم بساتين الزينة- كلية الزراعة- جامعة القاهرة خلال موسمي ٢٠٠٤/٢٠٠٥ و ٢٠٠٥/٢٠٠٦ بهدف دراسة تأثير أوساط الزراعة المختلفة علي النمو والتركيب الكيماوي لنيات الكروتن صنف " "Gold Star ٠

أوضحت النتائج أن:

إضافة البيرليت و الطين أو الفيرموكيوليت الي مخلوط الرمل والبيتموس أدت إلي اكبر زيادة في طول النباتات وعدد الأوراق ومساحتها٠

بينما أدي مخلوط الرمل والبيتموس مع كل من الطين والبيرليت كان الأكثر تأثيرا في زيادة سمك الساق ومعظم المخاليط المستخدمة أدت إلي زيادة التفريع٠كما أدي استخدام مخلوط الرمل مع البيتموس المضاف إليه الطين أو الفيرموكيوليت إلي زيادة معنوية في الأوزان الطازجة والجافة للأوراق والسوق .

أوضحت النتائج أيضا أن مخلوط الرمل مع البيتموس المضاف اليه نشارة الخشب او الطين أدي إلي زيادة معنوية في طول الجذور- بينما استخدام مخلوط الرمل مع البيتموس المضاف اليه الطين او الفيرموكيوليت ادي الي زيادة معنوية في الاوزان الطازجة والجافة للجذور .

- إضافة البيرليت والطين أو الفيرموكيوليت إلي مخلوط الرمل مع البيتموس ادت الي زيادة محتوي الكلوروفيل ٠
- مخلوط الرمل مع البيتموس المضاف الية الفيرموكيوليت كان اكثر تاثيرا في زيادة تراكم الكربوهيدرات في الاوراق ومخلوط الرمل مع البيتموس المضاف الية الطين ادي الي زيادة تراكم الكربوهيدرات في السوق ٠
- وجد أن إضافة البرليت إلي مخلوط الرمل مع البيتموس ادي الي زيادة محتوي الاوراق و السوق والجذور من النتروجين ٠
- إضافة البيرليت والطين أو الفيرموكيوليت إلي مخلوط الرمل مع البيتموس ادت الي زيادة محتوي الاوراق من البوتاسيوم ٠
- مخلوط الرمل مع البيتموس المضاف الية البيرليت كان اكثر تاثيرا في زيادة تراكم البوتاسيوم في كل من السوق والجذور ٠