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MEDIUM CONSTITUENTS AS AFFECTING THE GROWTH OF *Cordyline terminalis* CV. ATOOM *IN VITRO.*

a- EFFECT OF NATURAL SOURCES AND MS SALT STRENGTHS.

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ABSTRACT

Aseptic cultures (shoots) of *Cordyline terminalis* grown *in vitro* were used as source of explants in this study. The medium of all experiments of this study contained I mg/ L BA, 30-g/ L sucrose and 2 g/ L gelrite. Full strength of MS observed the highest values of all parameters (shoot number/explant, colour intensity/ explant and growth vigor/ explant) compared to ½ and ¼ MS strengths. The same treatment (full MS) significantly showed the highest response in the same measured parameters compared to all examined sources of natural nutrients (white corn, bean, chick pea, lentil, banana and date, each alone at 60 g/ L) especially at the second record after 2 months. MS strengths were examined in combinations with banana and date each alone at 60 g/ L. Interestingly, the treatment of banana (60g/ L) and ½ MS significantly showed similar high response as that of full strength of MS in all parameters mentioned before, either with using one or three explants in cultures. Mixing banana and date each at 30g/ L in combinations with the used strengths of MS, observed lower records in all parameters compared to full MS alone. According to the results of this study and from the economic point of view, recommendation can be raised as to use the medium contained banana (60g/ L) + ½ strength of MS to regenerate cordyline *in vitro.*

INTRODUCTION

Cordyline terminalis is considered as one of the most common valuable ornamental plant because it combines the advantages of being adapted to grow in-and out door, and features special combination of colours. A few published reports indicated moderate success in, *in vitro* propagation of cordyline using shoot tip {Peak *et al.*, (1985); Ibrahim, (1994); Arafa and Ibrahim, (1994) and Ibrahim and Emara, (1998)}. However, the type of plant growth regulators showed different responses in cultures. The present study was an attempt to investigate the possibility of propagation of cordyline *in vitro* using some cheap and available natural nutrient sources as culture media instead of the known media like Murashige and skoog (1962) (MS), Gamborg *et al.*, (1968) (B5), Linsmaier and skoog (1965) (LS) and Nitch and Nitch (1969) (NN), and examination of different MS strengths. Chemical and hormonal analysis of these natural nutrients unveiled their richness of almost all elements represented in the standard MS medium, in addition to their content of naturally balanced phytohormones. Corn starch could be the source of sugar needed for the explants to grow *in vitro,* and it can be used to some extent instead of the expensive agar.

MATERIALS AND METHODS

This work was carried out in the Tissue Culture Laboratory, Genetic Engineering Institute, Menofyia University, Sadat city, during the years of 2003 – 2006.

Source of explants:-

New young shoots of ***Cordyline terminals*** were obtained from cluster of shoots grown on Murashige and Skoog medium (MS) ***in vitro*** under sterilized conditions. These shoots were used as explants in all experiments of this study.

1- Effect of MS strength and natural nutrient sources on the growth of *cordyline terminals in vitro.*

1-1: Comparison between MS, $^1/_{2\ MS}$ and $^1/_{4\ MS}$ about their effect on the growth of *Cordyline terminals in vitro.*

The experiment contained three treatments that were MS, $^1/_2$ MS, $^1/_4$ MS. Each treatment consisted of 20 replicates (Jars). Each Jar contained 20 ml of medium and one explant (shoot) of 1 cm length. The used medium contained 6-benzyl adenine (BA) at 1mg/ L and 30g/ L sucrose. Gelrite at 2g/ L was used as solidifying agent to solidify the media. Cultures were incubated for 2 months in the growth room

Incubation conditions: Cultures of all experiments during this study were incubated under the temperature of 24 ^oC day and night. Light was provided by fluorescent tubes giving an intensity of 1500 lux at the level of culture jars for 16 hours per day.

Color intensity and growth vigor were measured according to Pottino (1981), as slight growth vigor or colour intensity (1), moderate (2), excessive (3), high (4).

These cultures were recultured on the same treatments and incubated for another month under the same conditions mentioned before. The same parameters were taken again.

1-2: Effect of natural nutrient media on the growth of *Cordyline terminals in vitro.*

This experiment was carried out to investigate the possibility of using some cheap and available natural nutrient sources as media instead of the known nutrient media like MS, B5, LS and Nitch and Nitch, the components of which are expensive and sometimes unavailable. Date fruit, banana pulp and flour of broad bean, white Corn, Lentil, chick pea, were used at 60g/L as nutrient sources (Table, 1). The gelrite at 2g/L was used as solidifying agent to solidify the media. The experiment contained six treatments. Each treatment consisted of 20 replicates (Jars). Each jar contained 20 ml of medium with one explant of 1 cm length; all treatments contained 1 mg/ L BA and 30 g/ L sucrose. The effect of natural nutrient media on the growth was compared with the same effect of MS medium.

Cultures were incubated in the growth room for one month under the same culture conditions as mentioned before. Parameters were taken as, number of shoots, color intensity, growth vigor, and number of roots.

These cultures were recultured and incubated for another month under the same conditions. The same parameters were taken again.

Table (1): Chemical analysis of the following nutritive materials in 100 g weight

Item Analysis	White corn	lentil	Bean	Chick pea	Banana	Date
Water ml	11.10	10.00	10.3	10.5	75.2	76.2
Energy k.cal	359.00	340	326	325	95	85
Protein g	8.90	22.40	24.1	14.6	1.3	2.9
Fat g	2.50	1.10	1.5	4.4	0.3	0.5
Ash g	1.30	2.70	3.2	3.1	0.9	1.4
Fiber g	1.00	3.8	6.9	3.4	0.6	1.4
Carbohydrate g	75.2	60	5.4	59	21.7	17.3
Sodium mg	6.0	30	35	34	3.0	25
Potassium mg	95	725	724	855	350	436
Calcium mg	22	48	85	1.55	10.0	20
Phosphorus mg	183	327	386	430	25.0	38
Magnesium mg	20	86	148	130	30.0	44
Iron mg	2.30	7.3	5.8	5.8	0.6	0.77
Zinc mg	1.05	4.2	3.14	3.4	0.21	0.90
Copper mg	0.14	0.25	0.24	1.30	0.18	0.20
Vit. A µgRE	0.00	12	4.0	14.0	28	0.0
Vit. C mg	0.00	0.00	5.0	2.0	8.0	27
Thiamine mg	0.00	0.4	0.48	0.48	0.04	0.10
Riboflavin mg	0.00	0.22	0.28	0.21	0.05	0.06

According to Food Composition Tables for Egypt, National Nutrition Institute, Second Edition, May, 2006.

1-3: Effect of natural nutrient sources in combination with $^1/_4$ or $^1/_{2\ MS}$ on the growth of *Cordyline terminals in vitro.*

According to the results of the previous experiment (1-2) of the natural sources, this experiment was carried out to examine the following treatments:

A: Using banana pulp as natural nutrient source:

1- Banana pulp only (60g/ L)
2- The same amount of banana pulp combined with $^1/_4$ MS.
3- The same amount of banana pulp combined with $^1/_2$ MS.
4- Full MS medium only.

B: Using date fruit as natural nutrient source:

1- Date fruit only (60g/ L)
2- The same amount of date fruit combined with $^1/_4$ MS
3- The same amount of date fruit combined with 1/2 MS.
4- Full MS medium only.

All treatments of the above experiments (A and B) contained 1 mg/ L BA + 30 g/ L sucrose +2 g/ L gelrite. Each treatment consists of 20 replicates (Jars), and each Jar contained 20 ml of medium with one explant.

Cultures were incubated for one month under the same conditions mentioned before. Parameters were taken (first record) as, number of shoot, color intensity, growth vigor and number of roots**.**

These cultures were recultured and incubated for another month under the same conditions. The same parameters were taken again (second record).

After the second record, the plants were left to grow in the same jars without reculture for another two months, and then the same previous records were taken (third record).

C- Examination of mixing 30 g/ L banana pulp with 30 g/ L date fruit in the same medium in combinations with different strengths of MS medium on the growth of *Cordyline terminals in vitro*.

This experiment contained the following treatments.

1-30 g/ L banana pulp + 30 g/ L date fruit + 1/4 MS.
2- 30 g/ L banana pulp + 30 g/ L date fruit + 1/2 MS.
3- Full MS only.

Treatments of this experiment (C) contained 1 mg/ L BA + 30 g/ L sucrose +2 g/ L gelrite. Each treatment consists of 20 replicates (Jars), and each Jar contained 20 ml of medium with one explant.

Cultures were incubated for one month under the same conditions mentioned before. Parameters were taken (first record) as, number of shoot, color intensity, growth vigor and number of roots.

These cultures were recultured and incubated for another month under the same conditions. The same parameters were taken again (second record).

All previous experiments (A, B and C) had been carried out again with the same design, concentrations, time of incubation and the taken parameters, but, each jar (replicate) contained three explants instead of one explant as the previous experiments.

All experiments were repeated twice and the represented data were averages. Results of these experiments were analyzed by analysis of variance (ANOVA) according to Gomez and Gomez (1984).

RESULTS AND DISCUSSION

1- Effect of different MS medium strengths and natural nutrient sources on the growth of *Cordyline terminalis in vitro.*

1-1: Comparison between MS, $^1/_2$ MS, $^1/_4$ MS and their effect on the growth of *Cordyline terminalis in vitro,* using one explant for one and two months (as two records).

a- Number of shoots

Data presented in Table (2) indicate that, full strength of MS medium showed the highest significant shoot number in the two records, followed by $^1/_2$ MS medium. The $^1/_4$ MS medium strength showed the lowest shoot number (Fig. 1). These results agreed with that recorded by Evaldsson and Welander (1985) who found that macronutrients (according to Quiorin) or Murashige and Skooge medium (at full strength) resulted in the greatest shoot numbers of *Cordyline terminalis*.

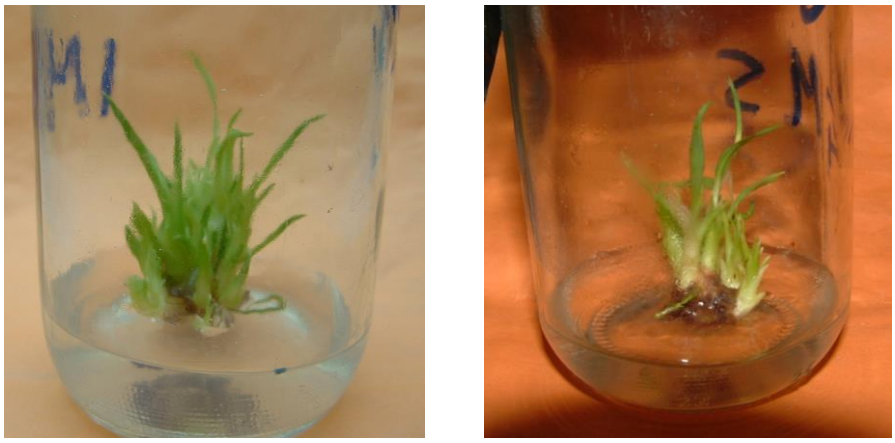
Yang *et al.* (1995) found that strawberry cv. Houkouwase plantlet FW on day 21 of culture was greater in full strength than $^1/_4$ or $^1/_2$ strength modified Hoagland & Arnon (MHA) and MS media. Adelberg *et al.*., (1997) noted that greatest fresh weight and number of plants of two cattleya clones per vessel were obtained on MS medium and dilutions there of full, half and

quarter strength. Saker *et al.*, (1999 b) stated that with *Magnolia grandiflora*, using

MS medium at full strength was more effective in increasing the number of shoots/explants and length of shoots than other medium strengths.

Table (2): Effect of different MS medium strengths on the growth of *Cordyline terminals in vitro,* (1 explant/Jar). Lasted for one (1st record) and two months (2nd record).

Characters / Media	Shoot number record		Colour intensity record		Growth vigor record		Root number record	
	First	Second	First	Second	First	Second	First	Second
Full MS	7.65 a	9.95 a	4.25 a	3.90 a	3.80 a	3.95 a	-	-
1/2 MS	5.55 b	7.95 b	3.20 b	1.95 b	2.85 b	2.55 b	-	-
1/4 MS	4.35 c	6.10 c	2.20 c	1.65 b	2.10 c	1.95 c	-	-
L.S.D	0.94	1.46	0.44	0.43	0.46	0.45	-	-



Full MS **¼ MS**

Fig., (1): Effect of different MS medium strengths on the growth of *Cordyline terminalis in vitro,* after 2 months.

b- Colour intensity

Full strength of MS medium showed the highest significant colour intensity in 1st and 2nd record, followed by the 1/2 MS medium. The 1/4 strength of MS medium showed the lowest colour intensity in the 1st record, but its effect (in 2nd record) was significantly similar to the same record of 1/2 MS.

This may be due to that full MS media contained more macro and micronutrients as well, leading to more growth and heavier colour intensity.

C- Growth vigor

Full MS media strength showed the highest significant growth vigor in the two records, followed by the 1/2 MS media. The 1/4 strength MS media showed the lowest growth vigor. The obtained results are in according with that recorded by Cen *et al..*, (1993) who showed that full strength MS medium + 1.0 p.p.m BA had the best inductive effect on bud formation from

Anthurum andraenum. Vij *et al.*, (1994 a) noted that the formation of protocorm like bodies from explants of the orchid *cymbidium pendulum* was the best on basal medium. Ding and Wei (1999) reported that the best media for propagation of *Spathiphyllum palls* were MS + BA (5.0 mg/ L) + NAA (0.2mg/ L) for the differentiation of adventitious buds.

As for the advancing in age, data recorded in Table (2) clearly indicate that as the explant advanced in age, the shoot number increased even in all MS media strengths.

On the other hand, reducing the MS strength ($^1/_2$ and$^1/_4$) retarded the colour intensity and growth vigor, as recorded lesser respond as the explants advanced in age.

1-2: Effect of different sources of natural nutrient media on the growth of *Cordyline terminalis in vitro* using one explant/jar for one and two months (as 2 records).

a- Number of shoots

Data presented in Table (3) indicate that, full strength of MS medium resulted in the highest significant shoot number in the two records.

Natural source media showed insignificant differences in between. They were in all cases lower than the MS medium, even those treatments that showed high responses in the first record, they observed lower responses in the second record compared to MS. These results are in harmony with that reported by kerbauy (1993) who mentioned that root tip explants *of Oncidium varicosum* were grown on Vacin and Went basic medium supplement with ripe banana pulp, activated charcoal, agar, Fe-EDTA, myo–inositol, niacin, pyridoxine and thiamine. The normal concentration of NH_4^+ was reduced by half and NAA was used as the sole growth regulator in the medium. Different concentrations of agar (0.3, 0.5, 0.6, 0.7, 0.9 and 1.1%) and sucrose (5, 10, 20 and 40 g/ L) were compared for effect, control culture were grown without sucrose. In a subtrial, the effect of rigidity of the culture medium on root growth and branching and on meristematic apical activity was investigated using 0.5 and 0.9 % agar. High levels of agar and sucrose promoted longitudinal root growth and lateral branching in particular, whereas relatively low concentrations of both compounds favoured the formation of protocorm like bodies (PLBs)...

Komalavalli and Rae (2000) recorded a maximum number of shoots which were induced from 30 day old seedling axillary node explants of *Gymnema sylvestra* on MS medium containing 6- benzyladenine (1 mg/ L), kinetin (0.5 mg/ L), 1- Naphthalene acetic acid (NAA) 0.1 mg/ L malt extract (100 mg/ L) and citric acid (100 mg/ L). Siddique and Paswan (2001) found that *in vitro* proliferated *Cymbidium longifolium* protocorms were transferred into Nitch culture media supplemented with IBA at 0.5 mg/ L, 0.5 mg/ L NAA, 0.5 mg/ L IBA+ 0.5 mg/ L BAP (benzyladenine), 0.5 mg/ L NAA + 0.5 mg/ L BAP and additives like 150 ml deproteinized coconut water, 50 ml banana extract, 50 ml pineapple juice and 50 ml tomato Juice. Tomato Juice produced the maximum proliferation of protocorms among the plant extracts test. Banana extract also produced satisfactory results.

Table (3) Effect of different sources of natural nutrient media on the growth of *Cordyline terminals* using one explant/Jar, lasted forone (1st record) and two months (2nd record).

Characters / Media		Shoot number record		Colour intensity record		Growth vigor record		Root number record	
		First	Second	First	Second	First	Second	First	Second
Full MS		8.25 a	10.60 a	4.15 a	3.65 a	3.65 b	3.80 a	-	-
(60g/ L)	White corm	1.00 b	1.00 b	2.80 bc	1.80 bc	2.50 cd	1.70 cd	-	-
	Bean	1.00 b	1.00 b	3.15 b	2.05 b	2.80 c	2.30 b	-	-
	Chickpeas	1.00 b	1.00 b	2.55 c	1.60 cd	2.35 d	1.90 c	-	-
	Lentil	1.00 b	1.00 b	3.20 b	2.05 b	3.30 b	1.55 de	-	-
	Banana	1.00 b	1.30 b	4.45 a	1.35 d	4.75 a	1.30 ef	-	-
	Date	1.00 b	1.15 b	4.25 a	1.65 bcd	4.35 a	1.20 f	-	-

b- Colour intensity

Full strength of MS medium showed the highest significant colour intensity in the two records, Banana and date media in the 1st record showed similar effect. The other media of natural sources recorded lower effects in the two records.

The obtained results are in according with that reported by Vargas *et al.*, (1996) who mentioned that starch (as the carbon source) promoted higher chlorophyll accumulation in maize callus cultured under light, than sucrose. Colour intensity showed lower records in the 2nd records than in the 1st.

C- Growth vigor

Full strength of MS medium in the 2nd record, banana and date media in the 1st record showed the highest significant growth vigor. These results, are in harmony with that reported by Peng *et al.* (2000) who found that the best germination of seed of *Cymbidium sinense* on culture medium supplement with plant growth regulators (benzyladenine, NAA, kinetin, IAA, 2,4–D) and other additives to culture media (coconut, apple, banana, potato, onion, carrot). Fung *et al.* (2004) recorded that active growth in the germinated seedling of *Dendrobium sp*. Was achieved by reculturing on full strength MS basal medium supplemented with 8 % banana homogenate 8% potato, homogenate 8% coconut water, 1.5% sucrose and 0.9% Difco agar. Alam *et al.*, (2006) mentioned that shoots of vanda rooted on Vacin and Went medium supplement with 20% sucrose, 2g/ L peptone, 15% coconut water, 1 g/ L charcoal, 1.0 mg/ L IBA with or without 50 g/ L banana pulp. By repeating subculture of PLBs on plantlet regeneration medium, plantlets as well as PLBs were produced continuously.

1-3: Effect of different sources of natural nutrient media combined with different MS strengths on the growth of *Cordyline terminalis in vitro* using one explant/jar for one and two months (as 2 records).

a- Number of shoots

Data presented in Table (4) indicate that MS full strength medium in the two records, followed by banana pulp + $^1/_2$ MS medium showed the highest significant shoot number. Moreover, Banana pulp + $^1/_4$ MS and date

fruit + 1/4 MS media recorded more enhancing effects than banana or date medium each alone, respectively, but they were less effective than the three mentioned media at the beginning. These results agreed with that reported by Sudeep *et al.*, (1997) who stated that the multiple shoots of Dendrobium produced were subcultured into the media slightly modified with organic supplements (coconut water, tomato juice, robusta banana pulp, mandarin juice or potato extract). Banana pulp (10%) significantly increased shoot length and leaf number in Vacin and Went medium. Pinaki *et al.*, (2006) recorded that plantlet development from protocorm like bodies (PLB2), was achieved by sub-culturing on half strength MS medium supplemented with banana pulp (50 g/ L), 1g/ L activated charcoal + 10 % coconut water with or without BA (11.1 micro M) within 2 months, by which time new PLBs were induced from the base of developing shoots

b- Colour intensity

Banana pulp + 1/2 MS, date fruit + 1/2 MS media (both in the two records) and Banana pulp + 1/4 MS (1st record) showed the highest significant colour intensity when compared with the other treatments. Banana pulp + 1/4 MS (2nd record), date fruit + 1/4 MS and MS media (the two records) showed lower significant colour intensity than the previously mentioned media before. These results are in harmony with that reported by Vargas *et al.*, (1996) who mentioned that starch promoted higher chlorophyll accumulation in maize callus cultured under light, than sucrose.

Table (4): Effect of different sources of natural nutrient media combined with different MS strengths on *Cordyline terminals* using one explant/Jar, lasted for one and two months.

Characters / Media		Shoot number record		Colour intensity record		Growth vigor record		Root number record	
		First	Second	First	Second	First	Second	First	Second
Full MS		8.25 a	10.00 a	4.15 b	3.65 b	3.65 c	3.80	-	-
Banana pulp (60 g/ L)	---	1.00 e	1.30 e	4.45 ab	1.35 c	4.75 a	1.30	-	-
	+1/2MS	3.75 b	11.60 a	4.65 a	4.40 a	4.70 a	4.00	-	-
	+1/4MS	1.65 d	4.20 c	4.40 ab	3.45 b	4.20 b	4.25	-	-
Date (60 g/ L)	---	1.00 e	1.15 e	4.25 ab	1.65 c	4.35 ab	1.20	-	-
	+1/2MS	2.80 c	5.35 b	4.65 a	4.35 a	3.95 bc	4.25	2.25	3.30
	+1/4MS	1.50 de	2.40 d	4.05 b	3.45 b	3.55 c	3.50	2.45	2.90

C- Growth vigor

Growth vigor parameter show mostly similar trend like that of the colour intensity mentioned before. These results agreed with that reported by Peng *et al.*, (2000) who showed that the best germination of *Cymbidium sinenses* seeds was observed on half strength MS and other additives to culture media (coconut, apples, banana, potato, onion, and carrot). Sobhana and Rajeevan (2002) found that the protocorms of Dendrobium were cultured in various media supplemented with kinetin or BA (2, 4, 6 and 8 mg/ L) and IBA or NAA (2, 4, 6 and 8 mg/ L). A similar experiment was repeated with coconut water (50, 100 and 150 mg/ L) peptone (500 and 1000 mg/ L) and banana pulp (20, 40, 60 and 80 g/ L). Germination was maximum in Vacin and Went followed knudson – C and one half MS media.

d- Root number

In the same Table (4) data explain that date fruit + $^1/_2$ MS or date fruit + $^1/_4$ MS media showed the highest ability to rooting, whereas other treatments failed to induce that. These results agreed with that reported by George and Ravishankar (1997) pointed out that the best rooting of the *in vitro* produced shoots of *Vanilla planifolia* orchid was observed in half strength MS medium containing activated charcoal. Torres and Mogollon (1997) recorded that rooting the orchid *Cattleya lueddemanniana* was carried out in half strength of MS salts. Nagaraju *et al.*. (1998) reported that shoots of *Ficus religiosa* were transferred to rooting media of $^1/_4$ strength MS + 0.1 mg/ L NAA.

1-4: Effect of different sources of natural nutrient media combined with different MS strengths on the growth of *Cordyline terminalis in vitro,* using three explants/jar for one and two months (as 2 records).

a: number of shoots

Data presented in Table (5) indicate that, MS full strength and banana pulp + ½ Ms media in the two records showed the highest significant shoot number, followed by banana pulp + $^1/_4$ MS (Fig. 2).

Media of date or banana only each alone showed the lowest shoot number.

Table (5): Effect of different sources of natural nutrient media combined with different MS strengths on *Cordyline terminals* using three explants/jar, lasted for one and two months (as 2 records).

Characters / Media		Shoot number record First	Colour intensity record Second	Growth vigor record First	Root number record Second	Shoot number record First	Colour intensity record Second	Growth vigor record First	Root number record Second
Full MS		12.65 a	14.30 a	4.75 a	3.80 a	4.65 a	3..90 a	-	-
Banana pulp (60 g/ L)	---	3.85 d	4. 25 d	3.45 cd	1.88 d	3.65 b	1..90 c	-	-
	+$^1/_2$ MS	13.00 a	14.90 a	4.75 a	3..95 a	4.75 a	3..95 a	-	-
	+$^1/_4$ MS	10.55 b	10.80 b	3.80 bc	2..35 c	3.65 b	2..50 b	-	-
Date (60 g/ L)	---	3. 30 d	3.45 d	3.15 d	1..50 d	2.10 c	1.75 c	4. 25 c	4. 55 c
	+$^1/_2$ MS	8.10 c	8.50 c	4.00 b	3..30 b	4.05 b	3. 65 a	8. 65 a	9. 60 a
	+ $^1/_4$ MS	7.55 c	8.40 c	3.75 bc	2..25 c	3.75 b	2.45 b	7.35 b	7.70 b

¼ MS + 60 g/l banana pulp

½ MS + 60 g/L banana pulp

Fig., (2): Effect of natural nutrient medium (banana pulp) combined with different MS strengths on the growth of *Cordyline terminals in vitro,* after 2 months.

b: Colour intensity and growth vigor

The data recorded in Table (5) showed in general similar trend as that of shoot number.

c: Root formation

All date media encouraged the rooting process. However, date fruit + ½ MS medium showed the highest root number, followed by date fruit + 1/4 MS medium. The medium containing date only significantly recorded a lower root number. No roots were observed with MS full strength or all other treatments contained banana.

1-5: Effect of different sources of natural nutrient media combined with different MS strengths on the growth of *Cordyline terminalis in vitro,* using one and three explants/jar, lasting four months (third record).

a: Number of shoots

Data presented in table (6) clearly indicate that in the 3rd record, i.e. cultures of one explant grown for 4 months, value of shoot number/jar obtained with banana pulp + 1/2 MS medium surpassed all the values of shoot number/jar of all used media, even full strength of MS medium. In case of three explants/jar, results showed similar trend.

b: Colour intensity

The medium containing banana pulp + 1/2 MS resulted in the highest colour intensity when compared with other treatments in the two experimental cases, i.e. one or three explants/jar. MS medium showed similar trend in case of one explant/jar only.

The value of colour intensity produced by banana pulp + 1/4 MS medium followed them.

c: Growth vigor

The media contained date fruit + 1/2 MS significantly recorded the best growth vigor with using one explant. However, banana pulp + 1/4 MS recorded the highest growth vigor in case of three explants. MS medium showed lesser growth vigor in the two cases (one or three explants/jar).

Table (6): Effect of different sources of natural nutrient media combined with different MS strengths on *Cordyline terminals,* using one and three explants/jar, lasted four months (3rd record) .

Characters / Media		One explant/jar				Three explants/jar			
		Shoot number	Colour intensity	Shoot number	Colour intensity	Shoot number	Colour intensity	Shoot number	Colour intensity
Full MS		18.80 b	3.65 a	3.75 b	-	21.15 b	2.70 b	2..55 c	-
Banana Pulp (60 g/L)	---	1.65 f	1.10 e	1.15 d	-	4.55 e	1.20 e	1.45 d	-
	+1/2MS	23.55 a	3.50 a	3.65 bc	-	34.30 a	4.40 a	3.70 b	-
	+1/4MS	10.95 d	3.20 b	3.35 c	-	14.00 c	2.60 b	4.40 a	-
Date (60 g/L)	---	1..30 f	1.30 e	1.15 d	9.10	3.60 e	1.35 de	1..35 d	13.50 c
	+1/2MS	12.10 c	2.60 c	4..30 a	27.80	14.00 c	2.05 c	3.80 b	33.15 a
	+ 1/4MS	7.70 e	2.20 d	3.80 b	14.80	8.65 d	1.65 d	3.65 b	20.20 b

d: Root number

The medium of date fruit + 1/2 MS showed the highest root number/jar followed by date fruit + ¼ MS medium, whereas, the medium of date fruit

only showed lower effect in that concern. No roots were recorded with the media contained MS at full strength alone or all treatments of banana.

Adding date to the media enhanced the root initiation and growth.

1-6: Effect of mixing banana and date in combination with different MS medium strengths on the growth of *Cordyline terminalis* using one and three explants/jar, each for one and two months (as two records).

a: Number of shoots

Data in Table 7 (one explant) and 8 (three explants) indicate that, Full strength of MS medium induced the highest shoot number/jar in the two records with both cases of explants. The media of ¼ MS contained 30 g/ L banana pulp and 30 g/L date fruit showed the lowest shoot number/jar in the two records with all used explants (one or three explants).

b: colour intensity

The highest value of colour intensity was significantly observed with Full strength of MS medium in the two records with both cases of explants compared to other treatments. The media of ¼ MS contained 30 g/ L banana pulp and 30 g/ L date fruit showed the lowest colour intensity in the two records with all used explants (one or three explants).

c: Growth vigor

A significant increase in growth vigor was recorded with Full strength of MS medium in the two records with both cases of explants compared to other treatments. The media of ¼ MS contained 30 g/ L banana pulp and 30 g/ L date fruit showed the lowest growth vigor in the two records with all used explants (one or three explants).

Table (7): Effect of mixing (30 g/ L) banana pulp and (30 g/ L) date fruit in combination with different MS medium strengths on the growth of *Cordyline terminals* using one explant/jar, for one and two months (as 2 records).

Characters / Media		Shoot number record		Colour intensity record		Growth vigour record		Root number record	
		First	Second	First	Second	First	Second	First	Second
Full MS		7..65 a	9..95 a	4..25 a	3..90 a	4..05 a	3..95 a	-	-
Banana pulp+Date+	1/2 MS	5.70 b	8. 00 b	3..25 b	2.10 b	2..95 b	2.60 b	-	-
	1/4 MS	4.40 c	6..25 c	2.40 c	1. 85 c	2..30 c	2.00 c	-	-

Table (8): Effect of mixing (30 g/ L) banana pulp and (30 g/ L) date fruit in combinations with different MS medium strengths on the growth of *Cordyline terminals* using three explants/jar, for one and two months (as 2 records).

Characters / Media		Shoot number record		Colour intensity record		Growth vigor record		Root number record	
		First	Second	First	Second	First	Second	First	Second
Full MS		12.05 a	13.85 a	4..55 a	3.75 a	4.15 a	3.80 a	-	-
Banana pulp+ Date+	1/2 MS	6.75 b	8..95 b	3. 25 b	2. 20 b	2. 90 b	2.65 b	-	-
	1/4 MS	5. 60 c	6.45 c	2..55 c	1. 95 c	2.40 c	2.15 c	-	-

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تأثير مكونات البيئة على نمو نبات الكورديلين معمليا:
أ-تأثير بعض المصادر الغذائية الطبيعية وقوى أملاح بيئة موراشيج وسكوج

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أجريت هذه الدراسة بغرض دراسة استخدام مصادر غذائية طبيعية كبيئة لزراعة الأنسجة النباتية كبديل للبيئات المعروفة ذات المكونات الكيميائية غالية الثمن مثل بيئة موراشيج وسكوج.

استخدمت افرع نبات الكورديلين المعقمة والناتجة معمليا كمصدر للأجزاء النباتية المستخدمة لبدء هذه الدراسة. وجدير بالذكر ان كل البيئة المستخدمة فى تجارب هذه الدراسة تضمنت ١ مجم/لتر بنزيل ادنين، ٣٠ جم/لتر سكروز، ٢ جم/لتر جيلرايت. وكانت النتائج المتحصل عليها كما يلى:

اظهرت بيئة املاح موراشيج و سكوج الكاملة تفوقا معنويا بالنسبة لعدد الافرع الناتجة ولون الافرع وقوة النمو مقارنة بقوى الاملاح الاخرى (١/٢، ٤/١ موراشيج وسكوج) وكذلك فقد اظهرت نفس البيئة (الاملاح الكاملة) تفوقا فى نفس الصفات المذكورة سابقا عندما تم مقارنتها بكل بيئات المصادر الغذائية الطبيعية المستخدمة, والتى تم اختيارها كبديل لبيئة موراشيج وسكوج (ذرة، فول، عدس، حمص، بلح، موز كل منهما على حدة بتركيز ٦٠ جم / لتر).

وعند اختبار خلط الموز والبلح كل على حدة (٦٠ جم/لتر) مع قوى املاح موراشيج وسكوج المختلفة، اظهرت البيئة التى احتوت على ٦٠ جم/لتر موز مع ½ قوى املاح موراشيج وسكوج تفوقا معنويا ملحوظا يماثل تلك الناتج مع بيئة قوى الاملاح الكاملة لموراشيج وسكوج وذلك فى كل الصفات الخضرية (عدد الافرع، لون الافرع, قوة النمو). وعند اختبار خلط كل من الموز والبلح معا بتركيز ٣٠ جم/لتر لكل منهما مع قوى املاح موراشيج وسكوج المختلفة. اظهرت النتائج ان البيئة المتضمنة املاح موراشيج وسكوج كاملة تفوقت على جميع البيئات الاخرى لنفس الصفات الخضرية المذكورة سابقا.

وطبقا لنتائج هذه الدراسة ومن وجهه النظر الاقتصادية فانه يمكن ان ينصح بإكثار نبات الكورديلين معمليا باستخدام بيئة تحتوى على ٢/١ املاح موراشيج وسكوج مع ٦٠ جم/ لتر موز وكذلك باقي المكونات المذكورة سابقا والتي أضيفت لكل البيئات المختبرة فى هذه الدراسة (١ مجم/لتر بنزيل ادنين، ٣٠ جم/لتر سكروز، ٢ جم/لتر جيلرايت).

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