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RESPONSE OF SOME ORNAMENTAL PALM SEEDS TO GAMMA IRRADIATION

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ABSTRACT

Two pot trails were consummated in the nursery of Orman Botanical Garden, Giza, Egypt, during the two consecutive seasons of 2003/2004 and 2004/2005, in order to find out the effect of pre-sowing gamma irradiation on some germination and chemical traits of the four palms: *Livistona chinensis*, *Phoenix canariensis*, *Sabal peregrina* and *Washingtonia fillifera* seeds from certain mother plants were soaked for 24 hours in a tap-water, then irradiated with gamma rays at 0.0, 5.0, 10.0, 15.0, 20.0, 25.0, 30.0 and 35.0 Kr, (dose rate= 2.37 rad/sec.) during both seasons. It could be concluded that the seeds of Canary Island palm and Washingtonia showed good germination characters in response to all the studied irradiation doses, however, the 15 Kr. dose for the first mentioned palm seeds and the 10.0, 15.0, and 20.0 Kr. doses for the later one, resulted the best germination traits expressed as the highest germination percentage (G%), germination rate index (G.R.I), seed viability (S.V), velocity co-efficient (V.C) and high indole content and total sugars%, in seeds as well as the quickest germination time and mean time to 50% germination, but the least total phenols content in seeds. The 15.0 Kr. irradiation and more and the 25.0 Kr. and more were lethal to seeds of Livistona and Sabal, respectively, whereas the 5.0 Kr. gamma irradiation dose gave the best G%, G.R.I, S.V., V.C., indoles content and total sugars% in seeds and the speedest germination time and mean time to 50% germination, but the lowest content of total phenols in irradiated seeds.

INTRODUCTION

Palms are one of the most frequently plant materials used in landscape design in warm climates, as well as pot specimens indoor, because their characteristic habits immediately set them apart from other plants (Saryan, 2001). Their beauty durability and variety rank palms among the most highly valued of all landscape plants in subtropical and tropical regions (Meerow, 1994) and (Hodel, 1996).

However, one of the main problems of ornamental palms plantation, is the low rate of their seed germination, (Broschat and Meerow, 2000). This might be rendered to hard seed coat that does not permit the permeability of water, exchange of gases, the expansion of embryo or the outward diffusion of germination inhibitors, (Hodel, 1977) and (Odetola, 1987).

Overcoming of seed dormancy or reduction of germination was recommended by various treatments. Radiation presowing treatments was found to affect some physiological processes in seeds of different plants and consequently leads to accelerate and promote seed germination, stimulate plant growth and improve nutritional status. Vose (1980) stated that ionization "gamma radiation" of seeds caused the production of hydrogene peroxide and free radicals which are themselves activators, stimulators and mutagenic through molecular effects. Many investigators gained best germination traits of several plants when were subjected to radiation. Appiah and Amuh (1976) on oil palm (*Eleais guineensis*, Jacq;) Ferroro *et al.* (1987) and EL-Naggar (2002) on *Dianthus caryophyllus;* Chandra and Tarara (1988) on *Gloriosa superba*, L.; Acharya and Tiwari (1996) on Cactus (*Hamatocactus setispinus*); Salama (1998) and Bakry and Ismaeil (2002) on papaya and Bakry *et al.* (2005) on *Cleopatra mandarin* and sour orange seeds, coincided that low gamma doses promoted and accelerated germination processes and parameters, whereas high doses had inhibitory effects on seed germination traits. Jacobsen (1966) noticed that the reductory effects of high gamma irradiation doses could be due to embryo damage. Farag (1981) reported that γ-radiation broke down the meristematic cells which changed to necrotic area as a direct effect of the penetration of gamma-ray through the tissues. In a further report Farag *et al.* (1992) suggested that high irradiation doses decreased IAA and gibberellin-like substances.

The present investigation aimed to detect the suitable gamma radiation doses applied to four ornamental palm seeds, *Livistona chinensis* R. Br., *Phoenix canariensis* Hort.*, Sabal peregrina* L.H. Baily and *Washingtonia fillifera* H. Wendl, in order to gain the favourable germination characters, under the Egyptian conditions.

MATERIALS AND METHODS

Seeds of *Livistona chinensis, Phoenix canariensis, Sabal peregrina* and *Washingtonia fillifera* from certain mother trees in Orman Bot. Garden were soaked in a tap-water for 24 hours, then they were irradiated with gamma rays using gamma cell Co-60, Atomic Energy Authority. Doses of gamma rays were: 0.0, 5.0, 10.0, 15.0, 20.0, 25.0, 30.0 and 35.0 Kr, (dose rate= 2.37 rad/second) during the two seasons of 2003/2004 and 2004/2005. Irradiated seeds as well as the seeds of control (0.0 Kr.) were immediately planted after exposure on November 17th, 2003 and 2004 in 20 cm. clay pots filled with a planting medium of a mixture of clay loam: washed sand (1:1 v:v).

The sand was washed and leached with tap-water and disinfected with 1% Rezolex (a fungicide) before being used. Each pot contained 20 seeds to represent one replicate as three replicates of each treatment of every palm species were used. The pots were arranged in a completely randomized design, in the nursery of Orman Botanical Garden, Giza, Egypt. Agricultural practices as watering, weeding….etc., were done whenever required. Data of germination processes were weekly recorded for one year. Clearly visible plumule protrusion was used as a criterion for germination.
The following characters were recorded:-

A: Germination traits.

1- Germination percentage (G%), where

$$\textbf{G\%=} \frac{\text{Number of germinated seeds x 100}}{\text{Total number of sown seeds}}$$

2- Germination velocity (G.V.), in days:

Average number of days from sowing till emergence of the plumule.

3- Mean germination rate (M.G.R), in days:
Mean number of days to attain 50% of total germination, **(Odetola, 1987).**

4- Germination rate index (G.R.I):
According to Bartled equation **(Hartmann and Kester, 1983)**

$$\textbf{G.R.I} = \frac{A+(A+B)+(A+B+C)+\ldots\ldots}{N(A+B+C+\ldots\ldots)}$$

Where: A, B, C,…..= number of germinated seeds counted at different times.
N= is the number of times at which the germinated seeds were counted.

5- Seed viability (S.V).
Number of survived seedlings in each treatment after excluding the deteriorated and dead ones **(Odetola, 1987).**

6- Velocity Co-efficient (V.C.)

$$\textbf{V.C.} = \frac{\text{Total number of germinated seeds x 100}}{N_1T_1+N_2T_2+\ldots\ldots\ldots\ldots N_yT_y}$$

Where N: is the number of germinated seeds within consecutive intervals.
T= is the time between the beginning of the test and particular intervals of measurement (Kotowski, 1926).

B: Chemical determinations.

Samples of irradiated seeds were subjected to the following determinations:-

1-Total indoles and phenols content (mg/g. fresh weight) were assessed using the colourimetric method, mentioned by A.O.A.C. (1995).

2-Total sugars percent in seeds was determined as recommended by Herbert *et al*. (1971)

Data recorded were averaged and the means were subjected to SAS program statistical analysis. Comparing between the means of treatments was carried at using L.S.D. at 5% as mentioned by Snedecor and Cochran (1980)

RESULTS AND DISCUSSION

I- *Livistona chinensis*, R. Br.

A- Germination parameters

Irradiation of Livistonia seeds with gamma radiation at 15.0 Kr. and more was lethal to seeds in both seasons, as shown in Table (1). This might be a result of chromosomal aberriation in cells (Grote and Revell, 1972). Farag (1981) reported that γ-radiation brokedown the meristematic cells.

In the first season the 5.0 Kr. treatment significantly gave the best germination traits. It resulted significantly the highest germination percentage, germination rate index, seed viability and velocity co-efficient which recorded 60%, 0.33, 82% and 0.65%, respectively. This treatment (5Kr.) significantly produced the fastest germination (156 days)and the mean germination rate to attain 50% of total germination (167 days). While, the 10.0 Kr. γ-rays resulted the worst values which were 45%, 0.21, 61%, 0.58, 209 days and 365 days for the aforementioned parameters, consecutively. The results of the second season attained a similar trend to that of the first one.

Such results coincide with those of Chandra and Tara (1988) on *Gloriosa superba* and Salama (1998) and Bakry and Ismaeil (2002) on papaya who concluded that low doses of γ-rays were stimulative to germination, but the high doses had an inhibitory effect.

Table (1):Effect of gamma irradiation on some germination traits and chemical constituents of treated seeds of *Livistona chinensis* R. Br. in two seasons (2003/2004 and 2004/2005).

Gamma rays doses (Kr.)	Germination traits						Chemical constituents of treated seeds		
	G%	G.V	M.G.R.	G.R.I.	S.V.	V.C.	Total Indoles (g/100g f.w.)	Total phenols (mg/100g f.w.)	Total sugars (%)
	2003-2004 seasons								
0.0	45.0	169.0	365.0	0.21	0.61	0.63	0.10	76.20	28.82
5.0	60.0	156.0	167.0	0.33	0.82	0.65	0.13	71.11	27.17
10.0	45.0	209.0	365.0	0.21	0.61	0.58	0.13	87.67	32.17
15.0	0.0	0.0	0.0	0.0	0.0	0.0	0.04	105.96	32.58
20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.03	102.10	35.27
25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.02	107.17	37.95
30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.01	123.20	36.84
35.0	0.0	0 .0	0.0	0.0	0.0	0.0	0.01	122.33	48.49
L.S.D 0.05	1.972	5.233	9.859	0.095	0.1108	0.055	0.023	4.540	3.502
	2004-2005 seasons								
0.0	40.0	206.0	365.0	0.20	0.51	0.61	0.11	76.16	35.75
5.0	55.0	160.0	167.0	0.31	0.82	0.68	0.14	79.10	26.72
10.0	45.0	210.0	365.0	0.21	0.53	0.63	0.13	75.20	31.16
15.0	0.0	0.0	0.0	0.0	0.0	0.0	0.04	101.86	30.41
20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.03	100.17	36.27
25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.01	105.32	37.81
30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.02	118.60	40.15
35.0	0.0	0 .0	0.0	0.0	0.0	0.0	0.02	121.43	41.62
L.S.D 0.05	0.965	4.892	5.62	0.026	0.783	0.068	0.055	6.404	2.577

G%= germination percentage; G.V.= germination velocity; M.G.R.= mean germination rate; G.R.I.= germination rate index; S.V.= seed viability and V.C.= velocity coefficient

B- Chemical traits:

Chemical analysis of irradiating Livistona seeds indicated that the seeds which received 0.0, 5.0 and 10.5 Kr. gamma rays (those showed evident germination) significantly contained higher total indoles content and total sugars % but the lowest total phenols content as compared to most other treatments of irradiation with higher doses in both seasons Table (1).

These results are in a parallel line with those of Mathur (1963) and Farag *et al.* (1992) on potato and tomato that high doses of gamma radiation discouraged and reduced the IAA and gibberellin-like substances content in the seed. Total sugars percent was lower under low doses of irradiation, but it was increased by raising γ-ray doses.

II- *Phoenix canariensis* Hort.

A- Germination parameters:

Data presented in Table (2) revealed that all the used doses of γ-rays caused reasonable germination of Phoenix seeds, in both seasons. Raising irradiation doses up to 15 Kr. gradually increased germination percentage, germination rate index, seed viability and velocity co-efficient. Afterwards these parameters were progressively decreased as γ-rays doses were increased. The dose of 15 Kr. significantly resulted the highest germination percentage, germination rate index, seed viability and velocity co-efficient which were: 75%, 0.44, 90% and 1.21, respectively, in the first season against 60%, 0.28, 72% and 0.61 successively for the control (non radiated seeds).

In the second season, the corresponding records were 80%, 0.42, 90% and 1.21, consecutively, against 60%, 0.22, 60% and 0.63, respectively for the control.

This treatment produced also the quickest germination and number of days to attain 50% of total germination which in the first season were 86.0 and 106.0 days, against 88.0 and 102 days, successively in the second one. The control gave 114.0 and 109.0 days in the first season and 120.0 and 109.0 days in the second one. It was noticed that mean germination rate was not estimated for 35Kr. treatment in both seasons and for 30 Kr. one in the second season as they resulted less than 50% germination.

In this concern Vose (1980) suggested that ionization (gamma radiation) caused the production of hydrogene peroxide and freed radicals which are themselves activators, stimulators and mutagenetic through molecular effects. Our results agree with those of Appiah and Amuh (1976) who stated that high doses of gamma radiation gave high germination % in seeds of oil palm (*Eleais guineensis*), as well as Kalonji *et al.* (1993) who noticed that germination of *Phaseolus vulgaris* was not inhibited up to 150 Gy.

B-Chemical traits:

Data in Table (2) revealed that increasing of radiation dose was accompanied with concommittant increase in total indoles and total sugars % in seeds upto 15 Kr. exposure after that both compounds began to decrease, gradually, while total phenols took a reverse trend. Such result would be reasonable since it is known that phenolic compounds inhibit germination, whereas indoles activate it and sugars provide the food material and energy supply for germination processes.

Table (2): Effect of gamma irradiation on some germination traits and chemical constituents of treated seeds of *Phoenix canariensis* Hort. in two seasons (2003/2004 and 2004/2005).

Gamma rays doses (Kr.)	Germination traits						Chemical constituents of treated seeds		
	G%	G.V	M.G.R.	G.R.I.	S.V.	V.C.	Total Indoles (g/100g f.w.)	Total phenols (mg/100g f.w.)	Total sugars (%)
	2003-2004 seasons								
0.0	60.0	114.0	109.0	0.28	0.72	0.61	0.086	27.56	9.44
5.0	60.0	111.0	109.0	0.30	0.81	0.96	0.060	26.15	7.66
10.0	65.0	107.0	109.0	0.35	0.80	0.98	0.070	24.72	8.30
15.0	75.0	86.0	106.0	0.44	0.90	1.21	0.090	20.74	12.32
20.0	55.0	107.0	109.0	0.22	0.72	0.98	0.060	26.56	4.51
25.0	55.0	110.0	159.0	0.21	0.63	0.091	0.050	39.67	6.85
30.0	40.0	117.0	365.0	0.11	0.55	0.87	0.050	33.05	20.26
35.0	40.0	132.0	365.0	0.11	0.40	0.64	0.040	40.50	26.47
L.S.D 0.05	3.471	2.692	8.290	0.0959	0.178	0.1108	0.055	1.209	0.862
	2004-2005 seasons								
0.0	60.0	120.0	109.0	0.22	0.60	0.63	0.060	25.65	9.40
5.0	65.0	109.0	106.0	0.24	0.80	0.85	0.070	26.15	7.53
10.0	65.0	106.0	106.0	0.25	0.71	0.90	0.070	26.53	9.95
15.0	80.0	88.0	102.0	0.42	0.90	1.15	0.090	20.72	12.20
20.0	60.0	105.0	105.0	0.21	0.73	1.00	0.060	26.25	12.85
25.0	55.0	115.0	180.0	0.18	0.71	0.90	0.050	27.18	13.73
30.0	50.0	116.0	365.0	0.17	0.50	0.09	0.040	37.23	15.26
35.0	45.0	125.0	365.0	0.16	0.41	0.72	0.040	42.50	21.30
L.S.D 0.05	3.633	10.630	7.300	0.085	0.214	0.078	0.055	1.001	0.882

G%= germination percentage; G.V.= germination velocity; M.G.R.= mean germination rate; G.R.I.= germination rate index; S.V.= seed viability and V.C.= velocity coefficient

III- *Sabal peregrina*, L.H. Bailey

A- Germination parameters:

Data exhibited in Table (3) indicated that the 25 Kr. γ-rays irradiation dose and more were lethal to sabal palm seeds during both seasons. Seeds irradiated with 5 Kr. gamma ray gave significantly the best germination traits in the two seasons: 16% germination percentage, 171 days from sowing till emergence of the plumule, 0.26 germination rate index, 75% seed viability and 0.63 velocity co-efficient in the first season, while control resulted 10%, 336 days, 0.10, 61% and 0.30 for the foregoing parameters, respectively. Increasing γ-rays dose more than 5 and upto 20 Kr. had a gradual inhibitory effect on all germination traits. Mean germination rate in days was not assessed as G% did not reach 50%, for any dose. In the second season, the results took a similar trend to the aforementioned parameters which recorded

30%, 167 days, 0.23, 75% and 0.65, respectively, for 5Kr dose against 15%, 320 days, 0.12, 55% and 0.30, consecutively for the control.

Table (3): Effect of gamma irradiation on some germination traits and chemical constituents of treated seeds of *Sabal peregrina*, L.H. Bailey in two seasons (2003/2004 and 2004/2005).

Gamma rays doses (Kr.)	Germination traits						Chemical constituents of treated seeds		
	G%	G.V	M.G.R.	G.R.I.	S.V.	V.C.	Total Indoles (g/100g f.w.)	Total phenols (mg/100g f.w.)	Total sugars (%)
	2003-2004 seasons								
0.0	10.0	336.0	365.0	0.10	0.61	0.30	0.013	12.61	6.47
5.0	15.0	171.0	365.0	0.26	0.75	0.63	0.025	9.63	7.45
10.0	13.0	172.0	365.0	0.20	0.65	0.60	0.025	9.33	6.70
15.0	10.0	181.0	365.0	0.11	0.62	0.49	0.013	12.76	6.95
20.0	5.0	265.0	365.0	0.09	0.53	0.40	0.012	13.30	7.39
25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	19.71	8.54
30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.59	9.86
35.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	19.21	10.72
L.S.D 0.05	1.303	3.917	N.S.	0.055	0.095	0.123	N.S.	1.619	0.591
	2004-2005 seasons								
0.0	15.0	320.0	365.0	0.12	0.55	0.30	0.013	11.20	6.32
5.0	30.0	167.0	365.0	0.23	0.75	0.65	0.016	9.25	8.66
10.0	25.0	187.0	365.0	0.19	0.70	0.67	0.016	8.45	7.98
15.0	15.0	206.0	365.0	0.13	0.60	0.51	0.014	11.50	7.61
20.0	5.0	236.0	365.0	0.08	0.60	0.45	0.013	12.00	6.22
25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	19.33	5.11
30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	19.92	4.10
35.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.03	4.95
L.S.D 0.05	1.424	6.426	N.S.	0.055	0.078	0.123	N.S.	1.571	0.800

G%= germination percentage; G.V.= germination velocity; M.G.R.= mean germination rate; G.R.I.= germination rate index; S.V.= seed viability and V.C.= velocity coefficient

In this concern Ferroro *et al.* (1987) on *Dianthus caryophyllus*, Chandra and Tarar (1988) on *Gloriosa superba* and Jowaharlal *et al.* (1991) on *Citrus* species mentioned that high doses of irradiation were often lethal. Farag (1981) suggested that high γ-radiation brokedown the meristematic cells of garlic. However, Grote and Revell (1972) concluded that radiation caused chromosomal aberration in cells, that is why it was lethal to seeds.

B-Chemical traits:

The differences between total indoles content in treated seeds did not reach the level of significancy, in both seasons, however, the 5 and 10 Kr. doses resulted the highest total indoles content as compared with other doses as shown in Table (3). The sugars content in seeds attained a parallel trend to that of indoles. Seeds treated with 5 Kr. gamma radiation contained significantly the highest total sugars % of 7.45 and 9.66% in both seasons, respectively. Total phenols content took a reverse trend to that of indoles and total sugars, as seeds treated with 5 or 10 Kr rays contained significantly the least phenols content (9.63 and 9.33 mg/100 g in the first season and 8.45 and 9.25 mg/100g respectively, in the second one) as compared to other treatments.

This result would interprete the germination traits since indoles are growth promoters and sugars are essential for germination as a source of energy for metabolic processes. Mathur (1963) suggested that irradiation reversibly inactivated the endogenous IAA in tubers. Moreover Ussef and Nair (1974) noticed that irradiation might interfere with the synthesis of IAA due to activation of H_2O_2 dependent IAA-oxidase and decrease of tryptophan.

IV- *Washingtonia fillifera*, H. Wendl

A- Germination parameters:

Germination characters were improved gradually upto 10 Kr. gamma irradiation, but were reduced as radiation dose increased starting from 25 to 35 Kr., during the two seasons of the experiment, as shown in Table (4).

The γ-radiation dose of 10, 15 and 20 Kr gave similar values, which were significantly the best germination traits, the highest G%, S.V., V.C. and G.R.I. parameters and the shortest germination velocity, mean germination rate, that meant fastest germination. Raising gamma irradiation doses more than 20 Kr., or decreasing them to less than 10 Kr., caused gradual reductions in germination (%), germination rate index (G.R.I.), seed viability and velocity co-efficient traits, whereas progressively increased number of days till emergence of the plumule (G.V.), as well as mean number of days to attain 50% of total germination, which meant delay of germination time, during both seasons of the investigation.

Such results are in a parallel trend with those previously attained and discussed in case of *Phoenix canariensis*.

B-Chemical traits:

It is clear from data in Table (4) that both total indoles content and total sugars (%) in seeds of *Washingtonia fillifera* were significantly the highest at 10 to 20 Kr irradiation doses, whereas they were reduced progressively by increasing or decreasing γ-ray doses more than these doses. However, total phenols content showed an opposite trend to total indoles or total sugars, in both seasons.

The discussions of these results were previously reported in the case of *Phoenix canariensis.*

Table (4): Effect of gamma irradiation on some germination traits and chemical constituents of treated seeds of *Washingtonia fillifera*, H. Wendl in two seasons (2003/2004 and 2004/2005).

Gamma rays doses (Kr.)	Germination traits						Chemical constituents of treated seeds		
	G%	G.V	M.G.R.	G.R.I.	S.V.	V.C.	Total Indoles (g/100g f.w.)	Total phenols (mg/100g f.w.)	Total sugars (%)
	2003-2004 seasons								
0.0	45.0	45.0	365.0	0.4	0.5	1.16	0.12	90.23	35.58
5.0	65.0	39.0	48.0	0.5	0.6	2.57	0.11	87.01	36.84
10.0	75.0	34.0	38.0	0.6	1.0	3.57	0.10	72.60	41.12
15.0	75.0	35.0	38.0	0.5	1.0	3.55	0.13	73.91	40.11
20.0	75.0	35.0	38.0	0.5	0.8	3.50	0.09	73.06	42.48
25.0	70.0	39.0	40.0	0.5	0.8	3.11	0.05	79.30	30.65
30.0	60.0	46.0	48.0	0.5	0.5	2.44	0.02	80.43	31.16
35.0	55.0	55.0	74.0	0.4	0.4	2.00	0.02	80.91	31.58
L.S.D 0.05	1.449	2.210	4.029	0.055	0.096	0.602	0.055	2.333	4.027
	2004-2005 seasons								
0.0	40.0	48.0	365.0	0.4	0.4	0.90	0.10	82.11	41.01
5.0	55.0	40.0	56.0	0.5	0.5	1.85	0.12	88.60	45.32
10.0	80.0	30.0	32.0	0.7	1.0	4.00	0.17	83.25	35.67
15.0	80.0	35.0	38.0	0.7	1.0	3.50	0.17	83.90	34.10
20.0	75.0	35.0	40.0	0.5	0.9	3.50	0.15	85.40	37.20
25.0	65.0	45.0	43.0	0.3	0.8	3.30	0.15	90.11	37.10
30.0	60.0	45.0	50.0	0.2	0.6	3.00	0.13	91.30	37.91
35.0	60.0	58.0	82.0	0.2	0.6	2.20	0.12	95.55	38.60
L.S.D 0.05	2.441	2.434	1.937	0.055	0.078	0.207	0.055	3.239	1.934

G%= germination percentage; G.V.= germination velocity; M.G.R.= mean germination rate; G.R.I.= germination rate index; S.V.= seed viability and V.C.= velocity coefficient

CONCLUSION

From the foregoing results, it could be concluded that exposing seeds of *Livistona chinensis, Sabal perigrina, Phoenix canariensis* and *Washingtonia fillifera* to 5, 5, 15 and 10 to 20 Kr. gamma rays, respectively, gave the highest germination and chemical constituents traits.

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استجابة بذور بعض أنواع نخيل الزينة لأشعة جاما

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أجريت تجربتا أصص لمدة موسمين بمشتل حديقة الأورمان النباتية، جيزة مصر، خلال الموسمين المتعاقبين 2004/2003 و 2005/2004 لبحث تأثير التعرض لأشعة جاما قبل البذر على بعض صفات الانبات و المكونات الكيميائية لبذور أربعة أنواع من النخيل هي:

(1) لفستونا تشيننسز *Livistona chinensis* (Chinese fan palm)
(2) فوانكس كانارينسز *Phoenix canariensis* (Canary date palm)
(3) سابال برجرينا *Sabal peregrina* (Thatch palm)
(4) واشنجتونيا فيلليفرا *Washingtonia filliefra* (Peticoat palm)

و تم نقع البذور في ماء الصنبور لمدة 24 ساعة، ثم عرضت لأشعة جاما بجرعات صفر، 5، 10، 15، 20، 25، 30 و 35 كيلوراد (معدل الجرعة = 2.37 راد/ثانية) خلال الموسمين. و قد أمكن استخلاص أن بذور نخيل جزر الكناري و الواشنجتونيا قد أعطتا صفات انبات جيدة استجابة لكل جرعات الاشعاع تحت الدراسة، الا ان الجرعة 15 كيلوراد بالنسبة لبذور النوع الاول، الجرعات 10، 15 و 20 كيلوراد بالنسبة للنوع الأخير قد أعطت أحسن صفات للانبات معبرا عنها بأعلى نسبة انبات، معامل انبات، حيوية البذرة، معامل سرعة الانبات و أعلى محتوى من الاندولات الكلية و النسبة المئوية للسكريات في البذرة و كذلك أسرع وقت انبات و متوسط الوقت للحصول على 50% انبات و لكن أقل محتوى للفينولات الكلية في البذرة. و كانت الجرعات 15 كيلوراد و 25 كيلوراد فما فوق مميتة لبذور الليفستونيا و السابال على الترتيب بينما أعطت جرعة 5 كيلوراد اشعاع جاما احسن نسبة انبات، و معامل انبات و حيوية البذرة و معامل سرعة انبات و محتوى البذور من الاندولات الكلية و النسبة المئوية للسكريات و أسرع زمن انبات و متوسط الزمن للوصول الى 50% انبات و أقل محتوى من الفينولات الكلية في البذور المشععة.