SENSITIVITY OF JARAGUA GRASS (*Hyparrhenia rufa*) TO GAMMA RADIATION

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SUMMARY - The sensitivity of seeds and axillary buds of Jaragua grass (*Hyparrhenia rufa*) to gamma radiation was evaluated in greenhouse. In the seed trial, doses from zero to 1100 Gy were applied to 500 fertile seeds per dose. The LD_{50} at 34 days was 600 Gy. For axillary buds, five month old plants with an average of four tillers each were irradiated with doses of zero to 90 Gy. Tiller number before irradiation (initial tillers) and 93 days after treatment (final tillers) were recorded. Doses of 80 and 90 Gy were responsible for the reduction of 31 and 42% in the number of tillers, respectively.

Index terms: gamma radiation, radiosensitivity, *Hyparrhenia rufa*.

SENSITIVIDADE DO CAPIM-JARAGUÁ (Hyparrhenia rufa) À RADIAÇÃO GAMA

RESUMO - A sensitividade de sementes e gemas axilares de capim-jaraguá (*Hyparrhenia rufa*) à radiação gama foi avaliada em casa-de-vegetação. No ensaio com sementes, foram utilizadas 500 sementes férteis/dose que variaram de zero a 1100 Gy. A irradiação de 600 Gy foi a que apresentou LD_{50} aos 34 dias. Para as gemas axilares, plantas com 5 meses de idade foram irradiadas com doses de zero a 90 Gy. Os números de perfilhos antes da irradiação (perfilhamento inicial) e 93 dias depois do tratamento (perfilhamento final) foram registrados. Doses de 80 e 90 Gy foram responsáveis pela redução de 31 e 42% no número de perfilhos, respectivamente.

Termos para indexação: radiação gama, radiossensitividade, *Hyparrhenia rufa*.

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INTRODUCTION

Hyparrhenia rufa, native from tropical Africa, is one of the most widely distributed forage grasses in the tropics (AGREDA & CUANY, 1962). Brazil has extensive areas of poor soils covered with this species (BIANCHINI et al. 1980). Despite its nutritive value, it shows a limited vegetative growth period determined by short days of winter (VELLOSO et al. 1982). Apomixis has been the principal means of its reproduction, and different populations present high levels of uniformity even under different edapho-climatic conditions (BROWN & EMERY, 1957; ARONOVICH & ROCHA, 1985).

Mutation induction has been applied to apomictic species that present low sexuality rates (SINGH & MEHRA 1971). It has also provided substantial numbers of mutant progenies with variation in earliness, plant height, plant morphology, male sterility and various chromosome changes (BASHAW & HOFF 1962; BURTON & HANNA 1975; BUSEY 1980). This kind of approach has been applied to *Cynodon dactylon*, *Poa pratensis*, *Stenotaphrum secundatum*, among others (POWELL et al. 1974; POWELL & MURRAY, 1977; BUSEY, 1980).

The present study was conducted mainly to determine the sensitivity of Jaragua grass to different gamma-ray doses from 60Co, to contribute to future mutation induction programs with *Hyparrhenia rufa*.

METHODS

1. Seed irradiation

Jaragua grass fertile seeds with 12% of moisture and 6 months old were submitted to doses of 60Co radiation (5.26 KGy, dose rate) ranging from zero to 1100 Gy, at the Nuclear Energy Center for Agriculture (CENA) in Piracicaba, SP, Brazil. Five hundred seeds per dose were grown, immediately after irradiation, in greenhouse conditions, in a randomised block design with 12 treatments and 16 replications (plants). Number and height of surviving plants were recorded at the 34th day of sowing. Data were analysed by F test and multinomial regression.

2. Axillary bud irradiation

Five-month old plants of Jaragua grass, with in average four tillers each were irradiated at soil surface level, protecting the root system with lead rings. Doses of 60Co radiation (2.40 KGy, dose rate) ranged from zero to 90 Gy, with the number of plants per dose ranging from 18 to 38, arranged in a randomised block. Tillers were counted before (initial tillers) and 93 days after (final tillers) irradiation. Data were analysed by multinomial regression analysis, using the initial number of shoots as covariable of the final number of shoots (STEEL & TORRIE, 1980).

RESULTS

In greenhouse conditions, survival rate and plant height were significantly reduced with the increase of gamma-ray doses (TABLE 1) applied to Jaragua grass seeds. High values of coefficient of determination, R2 = 0.94 (Y = 5.183 - 0.039 X) and R2 = 0.98 (Y = 36.1595 + 0.2745 X - 0.0151 X2 + 0,0001 X3), were obtained for both plant height and survival rate. As linear and cubic regression, respectively. LD50 of approximately 600 Gy for Jaragua grass seeds was obtained. This dose was also responsible for 45% growth reduction (GR45). The dose of 500 Gy was equivalent to 35% growth reduction (GR35). Germination tests in laboratory indicated tendency for the occurence of abnormal seedlings above 400 Gy. Later observations under field conditions showed no plant survival for doses above 700 Gy.

TABLE 1 - Survival rates (SR) and plant height (PH) in Jaragua grass (*Hyparrhenia rufa*), 34 days after sowing in greenhouse, following seed treatment with 12 gamma-ray doses. Average of 16 replications

Dose (Gy)	% (control = 100.00)	
	SR	PH
0	100.00	100.00
100	122.91	99.72
200	105.08	96.07
300	104.96	85.87
400	70.49	78.40
500	72.35	75.87
600	34.44	60.28
700	13.49	23.67
800	14.25	36.22
900	4.59	9.62
1000	1.78	1.40
1100	2.35	8.68

The number of tillers before and after different irradiation doses for axillary buds and the percentage increase or reduction in the number of tillers are presented in TABLE 2. A significant linear regression ($Y = 2.565 - 0.093 X$; $p < 0.01$), with a high coefficient of determination value ($R2 = 0.93$), was obtained. As shown in TABLE 2, the doses 30 Gy and 40 Gy showed a small inhibiting effect on the emergence of new buds. No buds occured in doses above 50 Gy, and lethal physiological effect of gamma-rays was observed on the existing buds.

TABLE 2 - Number of initial tillers (IT), number of final tillers (FT) and variation percentage (higher or lower) in the number of tillers, 93 days after gamma-irradiation of axillary buds in Jaragua grass (*Hyparrhenia rufa*). Mean of replications varying from 18 to 38

Dose (Gy)	IT (control = 100.00)	FT (control IS = 100.00)	Variation (%)
0	4.89 (100.00)	6.47 (132.31)	32.3
10	4.47 (91.4)	6.08 (124.3)	32.9
20	4.59 (93.9)	6.25 (127.8)	33.9
30	3.83 (78.3)	4.83 (98.8)	20.5
40	3.22 (65.8)	3.97 (81.2)	15.4
50	4.83 (98.8)	4.80 (98.2)	- 0.6
60	3.28 (67.1)	3.03 (92.0)	- 5.1
70	5.26 (107.6)	4.79 (98.0)	- 9.6
80	4.63 (94.7)	3.16 (64.6)	- 30.1
90	5.61 (114.5)	3.22 (65.8)	- 48.7

DISCUSSION

The gamma-ray dose applied to Jaragua grass seeds to achieve LD50 was 500 - 600 Gy in the present study. No other reports of this nature on *Hyparrhenia rufa* have been found in literature. The use of radiation in breeding programs in other forage species has been reported by HANSON & JUSKA (1962), POWELL et al. (1974), POWELL & TOLER (1980), BUSEY (1980), among others.

BURTON & JACKSON (1962) treated seeds of apomictic prostrate dallisgrass with 15 to 25 hours of thermal neutrons and from 5 to 30 Krad of X-rays, and observed that only the 20-hours thermal neutron treatment incresed the frequency of R1 vegetative and floral mutants. The authors did not observe any break in apomixis. Irradiation of jute seeds (*Corchorus capsularis* L.) with gamma-ray doses from zero to 120 Krad showed 50% reduction in seedling height for the doses 96 and 64 Krad on diploid and tetraploid plants, respectively (JOSHUA et al., 1972).

Bud treatment with irradiation or other chemical mutagens may also be effective for induction of mutants in new tillers or branches. The aim is to treat meristematic regions from which new plants will originate (vegetative mutants). The selection of mutants is then started, by means of cutting-back, after V2 generation, due to the expected formation of chimerism.

POWELL et al. (1974) irradiated rhizome pieces of bermudagrass (*Cynodon* sp) with 6.8, 9.0 and 11.2 Krad, reducing tiller emergence to 60, 40 and 25%, respectively. Busey (1980) tested gamma ray doses from zero to six Krad for the irradiation of stolon pieces of St. Augustinegrass, electing 4.5 Krad as the most apropriate dose for 50% reduction in growth and 40% in survival rate.

The results obtained in the present study provided the basis for future mutation breeding programs in Jaragua grass by gamma-irradiation leading to investigation of morphological and phenological changes as well as a break in apomixis.

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