



Short communication

EFFECT OF GAMMA RAYS ON THE GERMINATION OF BOTANICAL POTATO SEED (*Solanum tuberosum* L.)

Comunicación corta

Efecto de los rayos gamma sobre la germinación de la semilla botánica de papa (*Solanum tuberosum* L.)

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ABSTRACT. This paper aims to evaluate the effect of different rates of ^{60}Co gamma rays to stimulate germination in botanical potato seed (*Solanum tuberosum* L.) with very low germination rates. The progeny seeds Atzimba x TPS-13 from the International Potato Center (CIP) in Perú, were irradiated with doses of 10 to 100 Gray (Gy) at intervals of 10 Gy and unirradiated control. It was found that not all doses stimulate the germination of potato seed, a result that could be in agreement with those presented in radiosensitivity studies for both stimulating germination and to increase the genetic variability in crops. The dose 20 Gy showed the greatest stimulation of seed germination.

Key words: rates of application, enzymes, seed dormancy, gamma rays, genetic variation

RESUMEN. El presente trabajo tuvo como objetivo evaluar el efecto de diferentes dosis de rayos gamma de ^{60}Co para la estimulación de germinación en semilla botánica de papa (*Solanum tuberosum* L.) con muy bajos porcentajes de germinación. Para ello se irradiaron semillas de la progenie Atzimba x TPS-13 procedentes del Centro Internacional de la papa (CIP) en Perú, los tratamientos fueron las dosis de 10 a 100 Gray (Gy) con intervalos de 10 Gy y un control sin irradiar. Se constató que no todas las dosis estimulan la germinación de la semilla botánica de papa, resultado que podría estar en correspondencia a los informados en estudios de radiosensibilidad tanto para estimulación de la germinación como para incrementar la variabilidad genética en los cultivos. La dosis de 20 Gy fue la que mostró la mayor estimulación en la germinación de las semillas.

Palabras clave: dosis de aplicación, enzimas, latencia de semilla, rayos gammas, variación genética

INTRODUCTION

There are several projects of technological innovation, among which are the interruption of dormancy in seeds and reduction of germination periods, through nuclear techniques, and in genetic improvement from induced mutagenesis has been tested in crops as important such as wheat, rice, barley, cotton and beans, also in others propagated by asexual seed (1).

The potato (*Solanum tuberosum* L.) propagates asexual (tubers) and sexually (botanical seed) and it is the fourth food in order of importance in the world, after wheat, maize and rice (2).

The use of mutations today is a successful tool in the global efforts of agriculture to feed a human population nutritious increasingly demanding (3).

Ionizing radiation has been widely used to increase genetic variability (4-8); however, low doses have shown stimulating effects on several species with problems in seed germination without causing genetic variations (9, 10).

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Radiosensitivity is an intrinsic property of living beings that varies widely between organisms, species and genotypes (11).

The objective of the present work was to evaluate the effect of different doses of ^{60}Co gamma rays on the germination stimulation in potato botanical seed of the Atzimba x TPS-13 progeny with very low germination of the progeny.

MATERIALS AND METHODS

The potato botanical seeds of the Atzimba and TPS-13 cultivars from the International Potato Center (CIP) were irradiated at the Technological Applications and Nuclear Development Center (CEADEN, according its acronyms in Spanish) in Havana-Cuba with gamma rays of ^{60}Co in an MPX25 device at a dose rate of 0,517 KGy/hr.

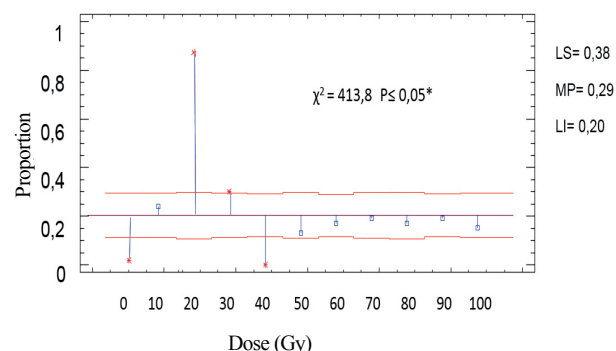
Seeds showing 3 % germination before irradiation were sampled from the same lot to stabilize the internal moisture content to 10% in a silica gel desiccation hood, which was recorded by a humidimeter.

Ten irradiation doses were applied: 10, 20, 30, 40, 50, 60, 70, 80, 90 and 100 Gray (Gy) with gamma rays of ^{60}Co and an unirradiated control. The irradiated seeds and the control were placed in Petri dishes with moistened filter paper applying distilled water. The number of germinated seeds was evaluated every three days for 15 days in a culture room and the percentage of germination was calculated. Three replicates of 100 seeds were mounted in Petri dishes for each treatment. To determine the differences between treatments, the Chi square test of proportions comparison was used for independent samples.

RESULTS AND DISCUSSION

The Chi square test showed significant differences between the proportions at different doses of gamma radiation. The figure shows that the dose of 20 Gy achieved greater germination of the seeds, the values were located above the upper limit (UL), while the control without irradiation and the dose 40 Gy were those that provided less germination of the as their values are below the lower limit (LL). In this same figure it is reflected that the doses from 50 Gy to 100 Gy did not have stimulating effect on the germination of the seeds, the same located their values between the average and the LL.

The results suggest that there are particular and intermediate doses of radiation that stimulate the germination of the seeds. Doses below and 20 Gy were detected that had no effect on the stimulation of these,



Representation of the proportions analysis with different doses of gamma radiation on germination in potato botanic seed

which could be related to the species and the type of damage suffered by the seed, results that coincide with those obtained in other investigations (3, 11, 12), when they stated that high doses did not stimulate the germination of tomato seeds and other agricultural crops.

The use of radiation with 20 Gy could have stimulated some of the metabolic processes that favored the germination of the seeds that at other doses of radiation do not occur. It is argued that ionizing radiation can increase the metabolic activity of cells, increase cell division, differentiate cells, intervene in protein synthesis, hormone balance, gas exchange and enzyme activity (13).

The increase of the germination of the seeds by radio stimulation is generally achieved when they have low germinative power because of the dormancy, or of being subjected to stressful conditions that delay or inhibit the same (12).

The stimulatory effect on seed germination may be related to the increase in permeability of cell membranes, which product accelerates the entry of water and oxygen, increasing the enzymatic activity, such as hydrolytic and oxidation-reduction, which ensure the fastest and most complete access of water and nutrients to the embryo (14).

Other authors relate the stimulation to the activation of several enzymes, such as polyphenol oxidases, catalases, peroxidases and esterases, which lead to the formation of physiologically active substances that at low concentrations accelerate cell division together with morphogenesis in important cells Organelles such as mitochondria and chloroplasts (14, 15).

CONCLUSIONS

The dose of 20 Gy provoked stimulation in the germination of the potato botanical seed of the progeny Atzimba x TPS-13 with low germination.

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