

पेटेंट कार्यालय  
शासकीय जर्नल

**OFFICIAL JOURNAL  
OF  
THE PATENT OFFICE**

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निर्गमन सं. 42/2023  
ISSUE NO. 42/2023

शुक्रवार  
**FRIDAY**

दिनांक: 20/10/2023  
DATE: 20/10/2023

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पेटेंट कार्यालय का एक प्रकाशन  
PUBLICATION OF THE PATENT OFFICE

(12) PATENT APPLICATION PUBLICATION

(21) Application No.202331058279 A

(19) INDIA

(22) Date of filing of Application :30/08/2023

(43) Publication Date : 20/10/2023

(54) Title of the invention : DOSE OPTIMIZATION USING GAMMA IRRADIATION FOR DIFFERENT CROP SPECIES

(51) International classification :A61L0002080000, G06Q0050020000, G01T0001020000, A61L0002000000, G01T0007000000

(86) International Application No :NA  
Filing Date :NA

(87) International Publication No : NA

(61) Patent of Addition to Application Number :NA  
Filing Date :NA

(62) Divisional to Application Number :NA  
Filing Date :NA

(71)Name of Applicant :

**1)Brainware University, Kolkata**

Address of Applicant :398, Ramkrishnapur Rd, Near Jagadighata Market, Barasat, Kolkata, West Bengal 700125 -----  
-----

Name of Applicant : NA

Address of Applicant : NA

(72)Name of Inventor :

**1)Dr. Soham Hazra**

Address of Applicant :Assistant Professor, Department of Agriculture, Brainware University, 398, Ramkrishnapur Road, Barasat 700125 -----

(57) Abstract :

The present invention pertains to dose optimization using gamma irradiation for different crop species. This invention introduces a method for estimating the optimal gamma radiation dose for crop mutation is disclosed. By determining the median lethal (LD50) and growth reduction (GR50) doses using probit analysis, this invention aids in identifying the precise gamma radiation levels conducive for desired crop mutations. This approach promises genetic stability, crop diversity, and addresses challenges in modern agriculture.

No. of Pages : 11 No. of Claims : 4

<b>“FORM 1</b> THE PATENTS ACT 1970 (39 of 1970) and THE PATENTS RULES, 2003 <b>APPLICATION FOR GRANT OF PATENT</b> (See section 7, 54 and 135 and sub-rule (1) of rule 20)				(FOR OFFICE USE ONLY)	
				Application No.	
				Filing date:	
				Amount of Fee paid:	
				CBR No:	
				Signature:	
<b>1. APPLICANT’S REFERENCE / IDENTIFICATION NO. (AS ALLOTTED BY OFFICE)</b>					
<b>2. TYPE OF APPLICATION [Please tick (✓) at the appropriate category]</b>					
Ordinary (✓)		Convention ( )		PCT-NP ( )	
Divisional ( )	Patent of Addition ( )	Divisional ( )	Patent of Addition ( )	Divisional ( )	Patent of Addition ( )
<b>3A. APPLICANT(S)</b>					
Name in Full		Nationality	Country of Residence	Address of the Applicant	
Brainware University, Kolkata		Indian	India	398, Ramkrishnapur Rd, Near Jagadighata Market, Barasat, Kolkata, West Bengal 700125	
<b>3B. CATEGORY OF APPLICANT [Please tick (✓) at the appropriate category]</b>					
Natural Person ( )		Other than Natural Person			
		Small Entity (✓)	Startup ( )	Others ( )	
<b>4. INVENTOR(S) [Please tick (✓) at the appropriate category]</b>					
Are all the inventor(s) same as the applicant(s) named above?		Yes ( )		No (✓)	
<b>If “No”, furnish the details of the inventor(s)</b>					
Name in Full		Nationality	Country of Residence	Address of the Inventor	
Dr. Soham Hazra		Indian	India	Assistant Professor, Department of Agriculture, Brainware University, 398, Ramkrishnapur Road, Barasat 700125	
<b>5. TITLE OF THE INVENTION</b>					
“DOSE OPTIMIZATION USING GAMMA IRRADIATION FOR DIFFERENT CROP					

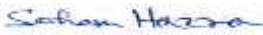
SPECIES"					
<b>6. AUTHORISED REGISTERED PATENT AGENT(S)</b>		IN/PA No.			
		Name			
		Mobile No.			
<b>7. ADDRESS FOR SERVICE OF APPLICANT IN INDIA</b>		Name		Mahua Pal	
		Postal Address		Brainware University, 398, Ramkrishnapur Rd, Near Jagadighata Market, Barasat, Kolkata, West Bengal 700125.	
		Telephone No.			
		Mobile No.		9831960033	
		Fax No.			
		E-mail ID		registrar@brainwareunive rsity.ac.in	
<b>8. IN CASE OF APPLICATION CLAIMING PRIORITY OF APPLICATION FILED IN- CONVENTION COUNTRY, PARTICULARS OF CONVENTION APPLICATION</b>					
Country	Application Number	Filing date	Name of the applicant	Title of the invention	IPC (as classified in the convention country)
<b>9. IN CASE OF PCT NATIONAL PHASE APPLICATION, PARTICULARS OF INTERNATIONAL APPLICATION FILED UNDER PATENT CO-OPERATION TREATY (PCT)</b>					
International application number			International filing date		
<b>10. IN CASE OF DIVISIONAL APPLICATION FILED UNDER SECTION 16, PARTICULARS OF ORIGINAL (FIRST) APPLICATION</b>					
Original (first) application No.			Date of filing of original (first) application		
<b>11. IN CASE OF PATENT OF ADDITION FILED UNDER SECTION 54, PARTICULARS OF MAIN APPLICATION OR PATENT</b>					
Main application/patent No.			Date of filing of main application		
<b>12. DECLARATIONS</b>					

**i) Declaration by the inventor(s)**

(In case the applicant is an assignee: the inventor(s) may sign herein below or the applicant may upload the assignment or enclose the assignment with this application for patent or send the assignment by post/electronic transmission duly authenticated within the prescribed period).

I/We, the above named inventor(s) is/are the true & first inventor(s) for this Invention and declare that the applicant(s) herein is/are my/our assignee or legal representative.

(a) Date 30/08/2023

(b) Name	(c) Signature
Dr. Soham Hazra	

~~(ii) Declaration by the applicant(s) in the convention country~~

~~(In case the applicant in India is different than the applicant in the convention country: the applicant in the convention country may sign herein below or applicant in India may upload the assignment from the applicant in the convention country or enclose the said assignment with this application for patent or send the assignment by post/electronic transmission duly authenticated within the prescribed period)~~

~~I/We, the applicant(s) in the convention country declare that the applicant(s) herein is/are my/our assignee or legal representative.~~

~~(a) Date~~

~~(b) Signature(s)~~

~~(c) Name(s) of the signatory~~

**(iii) Declaration by the applicant(s)**

I/We the applicant(s) hereby declare(s) that: -

- I am/ We are in possession of the above-mentioned invention.
- The provisional/complete specification relating to the invention is filed with this application.
- ~~The invention as disclosed in the specification uses the biological material from India and the necessary permission from the competent authority shall be submitted by me/us before the grant of patent to me/us.~~
- There is no lawful ground of objection(s) to the grant of the Patent to me/us.
- I am/we are the true & first inventor(s).
- I am/we are the assignee or legal representative of true & first inventor(s).
- ~~The application or each of the applications, particulars of which are given in Paragraph-8, was the first application in convention country/countries in respect of my/our invention(s).~~

- ~~I/We claim the priority from the above mentioned application(s) filed in convention country/countries and state that no application for protection in respect of the invention had been made in a convention country before that date by me/us or by any person from which I/We derive the title.~~
- ~~My/our application in India is based on international application under Patent Cooperation Treaty (PCT) as mentioned in Paragraph-9.~~
- ~~The application is divided out of my /our application particulars of which is given in Paragraph-10 and pray that this application may be treated as deemed to have been filed on DD/MM/YYYY under section 16 of the Act.~~
- ~~The said invention is an improvement in or modification of the invention particulars of which are given in Paragraph-11.~~

**13. FOLLOWING ARE THE ATTACHMENTS WITH THE APPLICATION**

(a) Form 2

Item	Details	Fee	Remarks
Complete/ Provisional specification) #	No. of pages: 09		
No. of Claim(s)	No. of claims: 04 No. of pages: 01		
Abstract	No. of pages: 01		
No. of Drawing(s)	No. of drawings: 00 No. of pages: 00		

# In case of a complete specification, if the applicant desires to adopt the drawings filed with his provisional specification as the drawings or part of the drawings for the complete specification under rule 13(4), the number of such pages filed with the provisional specification are required to be mentioned here.

- (b) Complete specification (in conformation with the international application)/as amended before the International Preliminary Examination Authority (IPEA), as applicable (2 copies).
- (c) Sequence listing in electronic form
- (d) Drawings (in conformation with the international application)/as amended before the International Preliminary Examination Authority (IPEA), as applicable (2 copies).
- (e) Priority document(s) or a request to retrieve the priority document(s) from DAS (Digital Access Service) if the applicant had already requested the office of first filing to make the priority document(s) available to DAS.
- (f) Translation of priority document/Specification/International Search Report/International

Preliminary Report on Patentability.

(g) Statement and Undertaking on Form 3

(h) Declaration of Inventorship on Form 5


(i) Power of Authority

(j) **Total fee ₹.....in Cash/ Banker's Cheque /Bank Draft bearing No.....**

**Date on ..... Bank.**

I/We hereby declare that to the best of my/our knowledge, information and belief the fact and matters stated herein are correct and I/We request that a patent may be granted to me/us for the said invention.

**Dated this 30<sup>th</sup> day of August 2023**



**Registrar**

**Brainware University**

**Barasat, Kolkata- 700125**

**Signature:**

**Name: Mahua Pal**

**Applicant: Brainware University, Kolkata**

To,

The Controller of Patents

The Patent Office, at Kolkata

Note: -

- \* Repeat boxes in case of more than one entry.
- \* To be signed by the applicant(s) or by authorized registered patent agent otherwise where mentioned.
- \* Tick (/) /cross (x) whichever is applicable/not applicable in declaration in paragraph-12.
- \* Name of the inventor and applicant should be given in full, family name in the beginning.
- \* Strike out the portion which is/are not applicable.
- \* For fee: See First Schedule";

**FORM 2**

THE PATENTS ACT, 1970

(39 of 1970)

&

The Patent Rules, 2003

**COMPLETE SPECIFICATION**

(See section 10 and rule 13)

**TITLE OF THE INVENTION**

“DOSE OPTIMIZATION USING GAMMA IRRADIATION FOR DIFFERENT CROP SPECIES”

Applicant:

5

**Brainware University, Kolkata,**

398, Ramkrishnapur Rd, Near Jagadighata Market, Barasat, Kolkata, West

Bengal 700125.

The following specification particularly describes the nature of the invention and the manner in which it is performed:

## **FIELD OF THE INVENTION**

[001] The invention relates to the field of agricultural biotechnology, particularly to the optimization of gamma radiation doses for induced mutation in crops. More particularly, a method for Optimum Mutagen Dose Estimation for Crop Enhancement via Gamma Radiation.

## **BACKGROUND OF THE INVENTION**

[002] The following description provides the information that may be useful in understanding the present invention. It is not an admission that any of the information provided herein is prior art or relevant to the presently claimed invention, or that any publication specifically or implicitly referenced is prior art.

[003] With the increasing need for crop diversification and enhancement, there's a rising concern about declining intra and interspecific diversity due to the cultivation of high-yielding varieties. Gamma radiation emerges as an influential tool in crop improvement. However, the challenge lies in determining the optimum radiation dose, considering the diverse radiosensitivity of species, varieties, and genotypes.

[004] Accordingly, on the basis of aforesaid facts, there remains a need in the prior art to provide development of a method for Optimum Mutagen Dose Estimation for Crop Enhancement via Gamma Radiation. Therefore, it would be useful and desirable to have an improved method, composition and techniques of preparation to meet the above-mentioned needs.

## **SUMMARY OF THE PRESENT INVENTION**

**[005]** The invention pertains to a method for Optimum Mutagen Dose Estimation for Crop Enhancement via Gamma Radiation, which has all the advantages of the prior art and none of the disadvantages.

5 **[006]** In another aspect of the present invention, the invention presents a method for estimating the optimum dose of mutagen, specifically gamma radiation, for inducing mutations in crops. This estimation is done based on calculating the median lethal (LD50) dose and the median growth reduction (GR50) dose.

10 **[007]** In this respect, before explaining at least one object of the invention in detail, it is to be understood that the invention is not limited in its application to the details of set of rules and to the arrangements of the various models set forth in the following description or illustrated in the drawings. The invention is capable of other objects and of being practiced and carried out in various  
15 ways, according to the need of that industry. Also, it is to be understood that the phraseology and terminology employed herein are for the purpose of description and should not be regarded as limiting.

**[008]** These together with other objects of the invention, along with the various features of novelty which characterize the invention, are pointed out with  
20 particularity in the disclosure. For a better understanding of the invention, its operating advantages and the specific objects attained by its uses, reference should be made to the accompanying drawings and descriptive matter in which there are illustrated preferred embodiments of the invention.

25

## DETAILED DESCRIPTION OF THE INVENTION

[009] While the present invention is described herein by way of example using embodiments and illustrative drawings, those skilled in the art will recognize that the invention is not limited to the embodiments of drawing or drawings described and are not intended to represent the scale of the various components. Further, some components that may form a part of the invention may not be illustrated in certain figures, for ease of illustration, and such omissions do not limit the embodiments outlined in any way. It should be understood that the drawings and detailed description thereto are not intended to limit the invention to the particular form disclosed, but on the contrary, the invention is to cover all modifications, equivalents, and alternatives falling within the scope of the present invention as defined by the appended claims. As used throughout this description, the word "may" is used in a permissive sense (i.e. meaning having the potential to), rather than the mandatory sense, (i.e. meaning must). Further, the words "a" or "an" mean "at least one" and the word "plurality" means "one or more" unless otherwise mentioned. Furthermore, the terminology and phraseology used herein is solely used for descriptive purposes and should not be construed as limiting in scope. Language such as "including," "comprising," "having," "containing," or "involving," and variations thereof, is intended to be broad and encompass the subject matter listed thereafter, equivalents, and additional subject matter not recited, and is not intended to exclude other additives, components, integers or steps. Likewise, the term "comprising" is considered synonymous with the terms "including" or "containing" for applicable legal purposes. Any discussion of documents, acts, materials, devices, articles and the like is included in the

specification solely for the purpose of providing a context for the present invention. It is not suggested or represented that any or all of these matters form part of the prior art base or were common general knowledge in the field relevant to the present invention.

5           **[010]** In this disclosure, whenever a composition or an element or a group of elements is preceded with the transitional phrase “comprising”, it is understood that we also contemplate the same composition, element or group of elements with transitional phrases “consisting of”, “consisting”, “selected from the group of consisting of”, “including”, or “is” preceding the recitation of  
10           the composition, element or group of elements and vice versa.

**[011]** The present invention is described hereinafter by various embodiments with reference to the accompanying drawings, wherein reference numerals used in the accompanying drawing correspond to the like elements throughout the description. This invention may, however, be embodied in many different  
15           forms and should not be construed as limited to the embodiment set forth herein. Rather, the embodiment is provided so that this disclosure will be thorough and complete and will fully convey the scope of the invention to those skilled in the art. In the following detailed description, numeric values and ranges are provided for various aspects of the implementations described.  
20           These values and ranges are to be treated as examples only and are not intended to limit the scope of the claims. In addition, a number of materials are identified as suitable for various facets of the implementations. These materials are to be treated as exemplary and are not intended to limit the scope of the invention.

**[012]** The present invention describes a method for Optimum Mutagen Dose Estimation for Crop Enhancement via Gamma Radiation.

**[013]** Gamma Radiation in Mutagenesis: Gamma rays offer advantages including easy availability, higher plant tissue penetration, reproducibility, and enhanced mutation frequency. They are identified as effective electromagnetic radiation for various crop improvements.

**[014]** Dose Optimization Principle: Lower doses of gamma radiation may not significantly impact the crop genome, leading to negligible phenotypic changes. Excessively high doses may increase mutation frequency, but the chances of obtaining beneficial mutants reduce.

**[015]** Method of Determining LD50 and GR50:

Monitor the survival rate of seedlings post-radiation. Utilize probit analysis for calculating LD50 and GR50. This regression analysis assesses binomial response variables and transforms the sigmoid dose-response curve into a linear format.

Applications and Advantages:

**[016]** The method offers a strategic approach in the contemporary agricultural framework, countering challenges of biotic and abiotic stresses.

Induced mutagenesis via gamma radiation is a preferred alternative to traditional breeding, introducing beneficial traits without altering the superior agronomic base of crops. It maintains genetic integrity without introducing foreign genes, unlike GMOs. Successful induced mutagenesis is contingent upon the optimum dose of mutagenic agents, which this method reliably determines.

**[017]** It is to be understood that the above description is intended to be illustrative, and not restrictive. For example, the above-discussed embodiments may be used in combination with each other. Many other embodiments will be apparent to those of skill in the art upon reviewing the  
5 above description.

**[018]** The benefits and advantages which may be provided by the present invention have been described above with regard to specific embodiments. These benefits and advantages, and any elements or limitations that may cause them to occur or to become more pronounced are not to be construed  
10 as critical, required, or essential features of any or all of the embodiments.

**[019]** While the present invention has been described with reference to particular embodiments, it should be understood that the embodiments are illustrative and that the scope of the invention is not limited to these embodiments. Many variations, modifications, additions and improvements to  
15 the embodiments described above are possible. It is contemplated that these variations, modifications, additions and improvements fall within the scope of the invention.

**We Claim:**

1. A method for determining the optimum dose of gamma radiation in crops using median lethal (LD50) and median growth reduction (GR50) doses as benchmarks.

5

2. The method as claimed in claim 1, wherein gamma radiation's dose is gauged based on seedling survival rates post exposure.

10

3. The method as claimed in claim 1, where probit analysis is employed to transform dose-response curves, facilitating accurate LD50 and GR50 estimations.

15

4. The method as claimed in claim 1, aimed at maintaining genetic stability while inducing beneficial mutations in crops, without introducing external genes and use of the method for enhancing crop resilience and adaptability, maximizing agricultural yield, and ensuring crop diversity.

**Dated this 30<sup>th</sup> day of August 2023**

20

**Applicant**

Brainware University, Kolkata



**Registrar**

**Brainware University**

**Barasat, Kolkata- 700125**

Signature:

**Name:** Mahua Pal

## ABSTRACT

### DOSE OPTIMIZATION USING GAMMA IRRADIATION FOR DIFFERENT CROP SPECIES

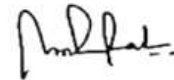
[020] The present invention pertains to dose optimization using gamma irradiation for different crop species. This invention introduces a method for estimating the optimal gamma radiation dose for crop mutation is disclosed. By determining the median lethal (LD50) and growth reduction (GR50) doses using probit analysis, this invention aids in identifying the precise gamma radiation levels conducive for desired crop mutations. This approach promises genetic stability, crop diversity, and addresses challenges in modern agriculture.

**Dated this 30<sup>th</sup> day of August 2023**

10

**Applicant**

Brainware University, Kolkata



**Registrar**

**Brainware University  
Barasat, Kolkata- 700125**

Signature:

**Name: Mahua Pal**


**FORM 3**  
 THE PATENTS ACT, 1970  
 (39 of 1970)  
 and  
 THE PATENTS RULES, 2003  
**STATEMENT AND UNDERTAKING UNDER SECTION**  
**8**  
 (See section 8; Rule 12)

1. Name of the applicant(s).	We, <b>Brainware University, Kolkata</b> having office at, 398, Ramkrishnapur Rd, Near Jagadighata Market, Barasat, Kolkata, West Bengal 700125.
------------------------------	--

2. Name, address and nationality of the joint applicant.	<p>(i) that <del>I/We</del> have not made any application for the same/substantially the same invention outside India</p> <p>Or</p> <p>(ii) <del>that I/We who have made this application No... dated alone/jointly with....., made for the same/ substantially same invention, application(s) for patent in the other countries, the particulars of which are given below:</del></p>
--	---

Name of the Country	Date of Application	Application No.	Status of the Application	Date of Publication	Date of grant
-	-	-	-	-	-

3. Name and address of the assignee	<p>(iii) that the rights in the application(s) has/have been assigned to ..... none .....</p> <p>..... that I/We undertake that upto the date of grant of the patent by the Controller, I/We would keep him informed in writing the details regarding corresponding applications for patents filed outside India within six months from the date of filing of such application.</p> <p style="text-align: right;"><b>Dated this 30<sup>th</sup> day of August 2023</b></p>
-------------------------------------	--

<p>4. To be signed by the applicant or his authorized registered patent agent.</p>	 <b>Registrar</b> <b>Brainware University</b> <b>Barasat, Kolkata- 700125</b> <b>Signature:</b> <b>Name: Mahua Pal</b>
<p>5. Name of the natural person who has signed.</p>	<p>Brainware University, Kolkata  <b>Name of the Applicant</b></p>
	<p>To  The Controller of Patents,  The Patent Office, at  Kolkata</p>
<p>Note.- Strike out whichever is not applicable;</p>	

**FORM- 5**  
THE PATENTS ACT, 1970  
(39 of 1970)  
&  
The Patents Rules, 2003  
DECLARATION AS TO INVENTORSHIP  
[See Section 10(6) and Rule 13(6)]

1. NAME OF THE APPLICANT(S)

We, **Brainware University, Kolkata** having office at, 398, Ramkrishnapur Rd, Near Jagadighata Market, Barasat, Kolkata, West Bengal 700125.

hereby declare that the true and first inventor(s) of the invention disclosed in the complete specification filed in pursuance of my/ our application numbered \_\_\_\_\_ dated 30-08-2023 is/are

2. INVENTOR(S)

(a) NAME	(b) NATIONALITY	(c) ADDRESS
Dr. Soham Hazra	Indian	Assistant Professor, Department of Agriculture, Brainware University, 398, Ramkrishnapur Road, Barasat 700125

~~3. DECLARATION TO BE GIVEN WHEN THE APPLICATION IN INDIA IS FILED BY THE APPLICANT(S) IN THE CONVENTION COUNTRY:--~~

N.A.

~~We the applicant(s) in the convention country hereby declare that our right to apply for a patent in India is by way of assignment from the true and first inventor(s).~~

Dated this 30<sup>th</sup> day of August 2023

**Applicant**  
Brainware University, Kolkata  
  
**Registrar**  
**Brainware University**  
Barasat, Kolkata- 700125  
Signature: **Name: Mahua Pal**

To,  
The Controller of Patents  
The Patent Office, Kolkata

# FORM 9

THE PATENT ACT, 1970  
(39 of 1970)  
&  
THE PATENTS RULES, 2003

## REQUEST FOR PUBLICATION

[See section 11A (2) rule 24A]

I/We **Brainware University, Kolkata** hereby request for early publication of my/our [Patent Application No.]  
TEMP/E-1/67605/2023-KOL

Dated **30/08/2023 00:00:00** under section 11A(2) of the Act.

Dated this(Final Payment Date):-----

Signature

Name of the signatory

To,  
The Controller of Patents,  
The Patent Office,  
At Kolkata

This form is electronically generated.