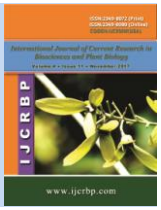
International Journal of Current Research in
Biosciences and Plant Biology
Volume 4 • Number 11 (November-2017) • ISSN: 2349-8080 (Online)
Journal homepage: www.ijcrbp.com



Original Research Article **doi:** https://doi.org/10.20546/ijcrbp.2017.411.002

Utilization of Gamma Radiation to Get Effective Lethal Dose for Short Leaders and Local Rice Cultivation (Ase Buluh) South Sulawesi

Abdul Haris*, Annas Boceng and Amir Tjoneng

Department of Agrotechnology, Faculty of Agriculture, Universitas Muslim, Makassar, Indonesia

Corresponding author.

Abstract

Ase Buluh from Bone Regency is local varieties that currently no longer encountered even almost extinct due to low production, high trunk and easy to fall, aged in, not, therefore, need to be assembled varieties. The purpose of this study was to induce local rice mutation of rice varieties (Ase Buluh) with gamma ray radiation to obtain Lethal Dosage of short and medium-grown local rice mutants. This study was designed using a simple Randomized Block Design (RAK) of one factor consisting of selected lethal dose of seven pretreatment treatments ie without radiation (R0) radiation with 50 GRY (R1), 100 GRY (R2), 200 GRY (R3), 300 GRY (R4), 350 GRY (R5) and radiation with 400 GRY (R6). Each treatment was replicated three times using 50 plants for each treatment. The results of this study obtained a lethal effective dose of gamma-ray radiation are 200 gray and 300 gray. The shortest mutant plant height is 300 gray that is 131 cm not significantly different with 200 gray that is 139 cm. Meanwhile, the number of most tillers obtained at a dose of 0 gray is 18 and is different with 200 gray and 300 grays. The length of panicle showed no significant difference from all treatment while the fastest flowering age at a dose of 300 Gray is 89 days, as well as the fastest harvest age and not significantly different dose 200,grays with 300 gray that is 140 and 141 days compared with 0 gray that is 160 days. Furthermore, it is expected to obtain also local rice mutants Ase Buluh which have an early age.

Article Info

Accepted: 15 October 2017
Available Online: 06 November 2017

Keywords

Ase Buluh
Gamma rays
Gray
Lethal dosage
Mutants

Introduction

This local rice research is the original germplasm and is only available in South Sulawesi. Distinctive local varieties are the ability to adapt to local environmental conditions and high economic value, thus demanding particular attention to the sustainability of germplasm. Among the local varieties contained in South Sulawesi, the varieties which are favored by consumers are Ase Buluh rice from Bone district. Therefore it is necessary to repair or assembly of local varieties.

Gamma rays through mutation induction with gamma-ray radiation are one way to produce mutant characters in local rice varieties. Mutation techniques for shortening (shortening the harvest age) of the plant is relatively easy because of the nature and maturity of a plant visible quickly without the need for special tools. Another case if someone wants to make a disease-resistant plant mutation or protein content is increased,

there should be a unique tool to determine the success of mutations (BPBPI, 2013).

The primary job of breeders is how to produce morphological short-term growth crops and maturity and drought tolerance and pests and diseases (Harahap et al., 2013). In Asia Pacific, there are approximately 343 mutant rice paddies released (Ahloowalia et al., 2004), while in Indonesia since the end of 2009 BATAN has produced various varieties of rice fields, namely varieties Atomica 1, 2, 3, 4, Cilosari, Merauke, Woyla, Kahayan, Winogo, Diah Suci, Yuwono, Mayang and last is Mira which is rice field and one varieties of upland rice that is Situ Gintung. The priority of activities in breeding with mutation induction is directed to the improvement of rice varieties, i.e., early age, small plant morphology, resistance to pathogen attack and drought and taste quality favored by consumers (Soedjono, 2003), Muhiddin et al. (2013) localized under the tree plant.

Induction of mutations to obtain rice tolerant to Al has also been done by Hutabarat (1991) and Rahayu (2009). Similarly, research conducted by Mugiono and Rustandi (1991) to obtain mutant of upcoming rice from Cisadane varieties. Haris et al. (2013) radiates on local Ase Field rice to produce short and mature mutants.

Materials and methods

Plant material used was the local varieties of rice origin of Bone regency (Ase Buluh). Rice seeds of Ase Buluh varieties in gamma-ray radiation consisted of seven levels, namely: 0, 50, 100, 200, 300, 350 and 400 Gray. Each treatment was grouped into three groups as replicates. Each replica was taken with 50 seeds. Planting was done to see Lethal effective dose that is LD =50 to proceed to plant M1.

This research was designed using Randomized Block Design (RAK) of one factor. Namely local varieties Ase Buluh seven treatment levels each treatment repeated three times by using 50 plants for each replication.

Seedlings and planting of radiation seeds

Before seeding the seeds first soaked in water for 2 hours. After that, the seeds were seeded in a nursery using one tub for each treatment. Nursery media consisted of soil, sand, and manure with a ratio of 2: 2: 1. After seedling was seven days in the planting tube, then observed to get the adequate lethal dose.

Main research

After the obtained effective dose lethal, continued to plant in pots.

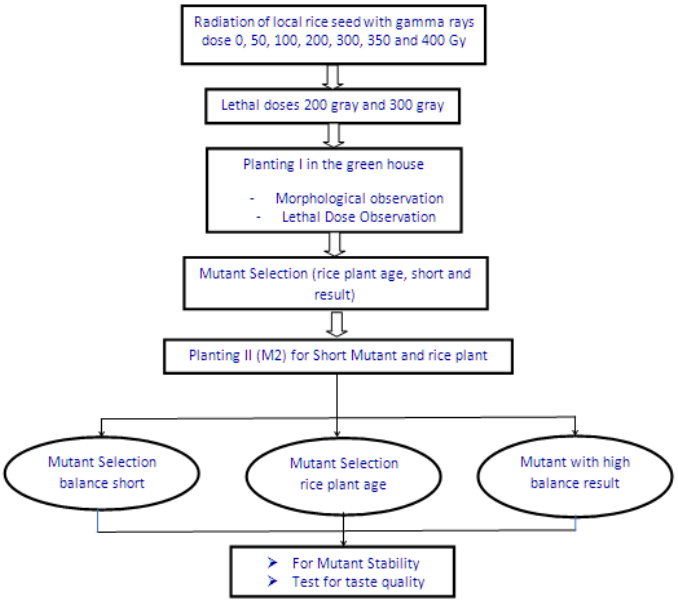


Fig. 1: Flow chart of research stages.

Observation I

Morphological character

Observations of morphological characters include:
1. Plant height. Observed every two weeks since the plants are two weeks after planting until the plants are two weeks old.
2. Some tillers. Calculated the number of tillers at the time the plants are already flowering
3. Flowering age. Calculated the number of days required plants from planting until panicles first appearin each plant.

The observation of nature of agronomical analysis included agronomic properties such as panicle length and harvest age.

Results

Plant height

The average yield data of local rice plant of Ase Buluh at 12 MST is presented on the Variance Tables indicating that the use of radiation treatment of various

doses on rice plants has a genuine effect. BNT test results showed that the average growth of plant height at radiation doses of 200 gray and 300 Gray was not significantly different but significantly different in the treatment of 0 Gray radiation.

Table 1. Mean plant height at various lethal doses.

Treatment	Plant height (cm)	NP. BNT 0.05
0 Gray	169.88 [a]	
200 Gray	139.50 [b]	4.82
300 Gray	131.64 b	

Description: The numbers followed by different letters (a, b dab c) mean different real.

Number of tillers

Sidik variety of data on the average number of tillers of rice plants 12 MST treatment or without treatment of various doses significantly affect the growth of the number of tillers of rice plants.

The result of BNT test of 0.05 indicates that the average number of tillers is mostly on the radiation 0 Gray or without treatment. Meanwhile, the average number of lowest tillers is on 300 Gray radiation and not significantly different in radiation 200 Gray.

Table 2. Mean number of tillers at various lethal doses.

Treatment	Numbers of Tillers	NP. BNT 0.05
0 Gray	18.01 [a]	
200 Gray	15.07 [b]	0.87
300 Gray	15.50 [b]	

Description: The numbers followed by different letters (a, b) mean different real.

Length of Malai

The result of the analysis of variance data showed that the radiation treatment at different lethal dose had a significant effect on the length of the panicle.

Table 3. Average length of panicle plant (cm) Ase Buluh in various Lethal Dosage.

Treatment	Length of Malai (cm)	NP. BNT 0.05
0 Gray	30.38 [a]	
200 Gray	29.58 [a]	0.85
300 Gray	28.23 [b]	

Description: The numbers followed by different letters (a, b) mean different real.

The result of BNT 0.05 test in table 3 shows that without using radiation or 0 Gray can show the most extended average panicle. However, it was not significantly different with the lethal dose of 200 grays, but the lethal treatment of radiation dose of 300 Gray and 0 Gray was very different.

Age flowering

Table 4. Average flowering age of M2 of local rice ase Buluh.

Treatment	Flowering age (Day)	NP.BNT 0.05
0 Gray	110.00 a	
200 Gray	90.16 b	1.67
300 Gray	89.71 b	

Description: The number followed by different letters (a, b) means that it is significantly different based on the BNT test at the 0.05 level.

The BNT test results in Table 4 shows that there is a difference in the mean of flowering age between local rice of modality reed varieties irradiated with gamma rays with non-irradiated gamma rays. Even so, between gamma radiation irradiated with a dose of 200 gray (R1) and a dose of 300 grays (R2), there is no difference between the mean of flowering age. However, there is a difference with dose 0 grays (R0).

Based on Table 4 above, it appears that the average age of the fastest flowering of the local Ase buluh plant is found at a dose of 200 grams (R1) with an average flowering rate of 90.16 days. It is followed by a dose of 300 grays (R2) 89.71 days later dosage 0 grays (R0) with average flowering time 110.80 days.

Harvest age

In general, local Ase reed rice treated with gamma-ray radiation has an average harvest age different between local Ase reed rice that is not irradiated with gamma rays. However, gamma-ray radiation between 200 gray radiation doses does not differ from the average age of harvest with local rice reed Ase which is irradiated with a dose of 300 grays.

The average age of local rice harvest Ase reed irradiated with a dose of 200 gray tended to be longer than the 300 gray radiation dose, and still longer in its flowering life compared with no gamma-ray radiation (0 grays) (Table 5).

Table 5. Average age of harvest M2 of local rice Ase reeds at various doses of gamma-ray radiation

Treatment	Harvest day (day)	NP.BNT 0.05
0 Gray	160.40 a	
200 Gray	140.60 b	0.80
300 Gray	141.13 b	

Description: Figures followed by different letters (a, b) mean significantly different based on the BNT test at the 0.05 level.

BNT Test Results Table 10 shows that there is a difference in average harvest age between local rice of Aset reed varieties irradiated with gamma rays and non-irradiated gamma rays. However, between gamma-radiated radiation with a dose of 200 gray (R1) and a dose of 300 grays (R2), there is no difference to harvest age, but there is a difference with dose 0 grays (R0).

Based on Table 5 above, it is apparent that the average age of harvesting of local rice crops is as the fastest ase in 300 gray doses (R2) with an average harvest time of 140.60 days. It is followed by a dose of 200 grays (R1) at a rate of 141.13 days then a dose of 0 grays (R0) with an average yield of 160.40 days.

Discussion

The success of an agricultural business is substantially determined by the growth and production of crops or cultivated crops. If the growth of plants and the results of the maximum or production by what is desired, then it can be said that the business is successful or successful. However, to achieve a maximum effort are many factors that need to be considered, the main one is that affect the growth of plants. So this study aims to suppress the growth of local rice plants Ase Buluh aged maturity with the irradiation done on the plant. Irradiation performed can damage the chromosome cells that exist in the plant so that the cells are disrupted, especially at plant height. Ionization due to irradiation can cause a grouping of little cells along the lagged ion path due to irradiation which may cause gene mutation or chromosomal damage (Aisyah, 2006).

The results of the study for the average height of local varieties of Ase Buluh varieties for 2 MST up to 12 MST by expectations exist in the treatment of gamma-ray radiation with a lethal dose of 300 Gray. At 12 MST the desired mean height is not significantly different from the 200 Gray radiation. However, at 0 Gray or without the treatment is very much different with 300 Gray and 200 Gray is 160.40 cm, meaning not according to what is expected. Plant growth is the most crucial process in the life of plant species that are influenced by environmental factors in this role in determining the response of plants to the environment. Different genotypes will show different looks after interacting with the environment and different cultivation techniques or treatments.

The results of the research for the characteristic parameters on the chart of the variety of growth rate of the number of tillers that significantly affect the treatment of 200 Gray and 300 Gray radiation performed, but not much different from 0 Gray or without treatment. At 12 MST 0 Gray, the average number of tillers obtained 18.01 on 200 Gray radiation of 15.07 and at gamma-ray radiation of 15.50. It can be concluded that the radiation treatment performed for 200 Gray or 300 Gray can show the difference between the number of tillers there is the effect of the effect when compared to 0 Gray or without radiation.

The results of the research conducted in the field for the length of panicle (cm) of local varieties of Ase Buluh varieties showed that there is a difference between the radiation treatment (200 Gray and 300 Gray) or without radiation (0 Gray). In the table the average yield of the highest panicle that is at 0 Gray is 30.38 cm, while the lowest value is in the 300 Gray radiation of 28.23 cm not much different from the 200 Gray is 29.58 cm. On the table, the standard variety of panicle length panicle (cm) of local varieties of Ase Buluh varieties is very significant on the radiation was done. The higher the radiation value performed, the more significant effect on the long growth of panicle plants.

Conclusion

Based on the results obtained, it can be concluded that at the level of lethal gamma radiation dose of 200 Gray and 300 Gray gamma can significantly affect plant height, some tillers, panicle length, and harvest age. While the no significant effect on the number of leaves and production per hectare. The highest yield per hectare of Ase Buluh Local rice crop is found in 0 Gray radiation.

Suggestions

Based on the research done it is suggested to do further research about a lethal dose of gamma radiation rays

selected next generation to be stable even better from growth and yield of production and high quality maximal.

Conflict of interest statement

Authors declare that they have no conflict of interest.

References

Ahloowalia, B.S., Maluszynski, M., Nichterlein, K., 2004. Global impact of mutation-derived varieties. Euphytica. 135, 187-204.

Aisyah, S. I., 2006. Mutasi induksi, hal. (Ed.: Dalam S. Sastrosumarjo), Sitogenetika Tanaman. IPB Press, Bogor. pp.159-178.

BPBPI, 2013. Indonesian Biotechnology Research Institute for Estate Crops. http://www.ibriec.org/ index.php? option=com_content&view=article&id= 161:merekayasa-varietas-genjah-dengan-radiasi & catid=9:artikel&Itemid=58 Diakses 26 Nopember 2013.

Harahap, F., Jusoff, K., Poerwanto, R., Nusyirwan, Syarifuddin, Hasruddin, 2013. Mangosteen DNA analysis (*Garcinia mangostana* L) with molecular markers after gamma ray irradiation treatment, Amer.-Eur. J. Sust. Agric. 7(2), 37-44.

Haris, A., Abdullah, Bakhtiar, Subaedah, Aminah, J. Kamaruzzaman. 2013. Gamma ray radiation mutant rice on local aged dwarf. Middle East J. Scient. Res. 15(8), 1160-1164.

Hutabarat, D., 1991. Pengaruh sinar gamma terhadap toleransi aluminium pada padi varietas sentani melalui teknik kultur jaringan. Risalah Pertemuan Ilmiah Aplikasi Isotop dan Radiasi dalam Bidang Pertanian, Peternakan dan Biologi. 30-31 Oktober 1990. Jakarta, BATAN.

Mugiono, Rustandi, T., 1991. Mutan Genjah dari Varietas Cisadane. Risalah Pertemuan Ilmiah Aplikasi Isotop dan Radiasi dalam Bidang Pertanian, Peternakan dan Biologi. 30-31 Oktober 1990. Jakarta, BATAN.

Muhidin, K. J., Elkawakib, S., Yunus, M., Kaimuddin, M., Sadimantara, G.S., Rianda, B.L., 2013. The development of upland red rice under shade trees. World Appl. Sci. J. 24(1), 23-30.

Rahayu, Sagirah Yeni., 2009. Induksi mutasi dengan radiasi sinar gamma pada padi sensitive dan toleran Aluminium. Tesis IPB, Bogor.

Soedjono, S., 2003. Aplikasi mutasi induksi dan variasi somaklonal dalam pemuliaan tanaman. J. Litbang Pertanian. 22, 70-78.

How to cite this article:
Haris, A., Boceng, A., Tjoneng, A., 2017. Utilization of gamma radiation to get effective lethal dose for short leaders and local rice cultivation (Ase Buluh) South Sulawesi. Int. J. Curr. Res. Biosci. Plant Biol. 4(11), 9-13. **doi:** https://doi.org/10.20546/ijcrbp.2017.411.002