JMSR 1(2) (2025)

Journal of Material Science and Radiation

https://journals.balaipublikasi.id/jmsr

Development of Timor Local Lurik Peanut Through Breeding with Multigamma Irradiation Method to Obtain Superior Generations

Bartholomeus Pasangka[1], Irvandi Gorby Pasangka[2], Refli[3]

[1] Department of Physical and Agricultural Science Nusa Cendana University, Kupang, Indonesia.
[2] Department of Mathematics, Faculty of Sciences and Engineering, Nusa Cendana University, Kupang, Indonesia.
[3] Department of Biology, Faculty of Sciences and Engineering, Nusa Cendana University Kupang, Indonesia.

Received: May 23, 2025
Revised: July 29, 2025
Accepted: August 25, 2025
Published: August 31, 2025

Corresponding Author:
Bartholomeus Pasangka
b.pasangka@staf.undana.ac.id

DOI:

Abstract: This research focuses on development of local Timor lurik peanut through breeding using multigamma irradiation method, careful selection, and purification to obtain superior generation. The advantage of method is that superior generations are obtained in a relatively short time. Development using modern technology needs to be carried out considering that the production of lurik peanuts at the farmer level has only reached 0.7 t ha^{-1} to 1.2 t ha^{-1}. The objective of the research is to develop local Timor lurik peanut through breeding using multigamma irradiation method, careful selection, and purification to obtain superior generation seeds. The main research methods are observation, irradiation, careful selection, purification, analysis, and interpretation. Brief procedure of the research: observation for selection of local lurik peanut seeds and identifying the chemical and physical characteristics of parent as comparative materials, preparing the land, cultivating the land, irradiating the seeds, planting on the prepared land, weeding to be free of weeds and fertilizing, irrigating as needed, spraying insecticides as needed, observing and measuring during growth, harvesting, and sorting superior generation seeds. The results obtained: development of local Timor lurrik peanuts through breeding with multigamma irradiation and careful selection obtained superior selected generations that adapt to drought conditions, tolerant of pests and diseases, and high production. The production range of the superior generation resulting from multigamma irradiation was (4.56-4.75) t ha^{-1} with an average production of 4.63 t ha^{-1}. The percentage increase in production of the superior selected generation was 41.04%, an average water content was 11.2%.

Keywords: Generation; Irradiation; Lurik peanut; Multigamma; Superior

Introduction

This study examines the main problems of breeding local Timor lurik peanuts using the multigamma irradiation method to obtain superior generations that can adapt to drought stress, extreme weather (Asis et al., 2022; Rozi et al., 2016), pests and diseases, and high production. This method has the advantage that several variations of superior varieties can be obtained so that it is easy to make selections as desired (Purnomo et al., 2020), and requires a relatively short time compared to conventional methods (Pasangka & Refli, 2022; Siswanti et al., 2022).

This study aims to develop local Timor lurik (zebra) peanuts through breeding using the multigamma irradiation method to obtain superior generations that are able to adapt to drought stress, extreme weather, are tolerant to pests and diseases, and have high production (Malelak et al., 2023; Novianto & Daryono, 2018; Pasangka et al., 2021; Rosyidi, 2018; Rosyidi & Daryono, 2020; Yuan et al., 2024).

How to Cite:
Pasangka, B., Pasangka, I. G., & Refli, R. (2025). Development of Timor Local Lurik Peanut Through Breeding with Multigamma Irradiation Method to Obtain Superior Generations. *Journal of Material Science and Radiation*, *1*(2), 55–65. Retrieved from https://journals.balaipublikasi.id/index.php/jmsr/article/view/385

Plant breeding to obtain superior generations through systematic stages including: seed selection, sorting, irradiation, careful selection, evaluation and testing during purification, and release of superior generations (Udang. & Anugrah, 2020). The results of Marwiyah et al. (2017) research on red peanuts with monogamma ray source irradiation at a dose of 55 Gy showed that the mass per 100 seeds = 45.00 g (parent 39.39 g). The results of Seran & Raharjo (2018) research stated that drought stress has a negative effect on the growth process and production of peanuts, so development is needed to obtain a generation that can adapt to these conditions. The results of Rosyidi & Daryono (2020) research on lurik peanuts through polyploidization techniques (chromosome duplication) reported that the resulting plants had phenotypic character sizes such as roots, stems, leaves, flowers, fruits, and seeds that were generally larger than the parent variety. The characteristics produced by the lurik peanuts include lurik seeds or purple-brown spots (Widiastuti et al., 2017), resistant to bacterial wilt disease, drought resistant, number of seeds per pod 3-5, average number of pods 25 per tree, larger seed size with a weight of 0.89 g per seed or 89 g per 100 seeds, while other types of peanuts average only 0.5 g per seed or 50 g per 100 seeds, with high production potential (Ibrahim et al., 2023).

Lurik peanuts from Insana Fafinesu District, North Central Timor, which are developed using an organic system, have good quality, are free from microbiological contamination and aflatoxin, a type of toxic compound that comes from the fungus Aspergrilus Plafus. Its production has penetrated the European market (Germany and Switzerland) and the United States, although it is still very limited. The development of lurik peanuts from Insana Fafinesu began in 2014, sponsored by PT Profil Mitra Abadi (PMA) with a potential yield of 80-90 tons per year. PMA has exported lurik peanut production from Insana Fafinesi as much as 10 t (2016), 40 t (2017), 80 t (2018), experiencing a decrease in 2020 to only 63 t (Rosyidi et al., 2023; Tabean, 2021). Lurik peanuts (zebra) are identical to peanuts in general, but have several special unique features, including lurik or spotted purple-brown seeds, pod and seed sizes are generally larger, resistant to wilt disease by Ralstonia solanacearum bacteria, have the potential for higher production increases, are adaptive to drought conditions, are rich in nutrients such as protein and Vitamin E, are of good quality, and so on.

Peanuts (*Arachis Hypogaea L*) are classified as the second most important legume after soybeans produced by farmers to meet food needs, the food industry, and nutritional fulfillment because peanuts have properties such as: anti-cancer, anti-bacterial, antioxidants, increase red blood cell function, swelling, increased appetite, back pain, and so on (Abidin et al., 2023; Leonita et al., 2020; Rozi et al., 2016; Sutrisno & Rozi, 2015; Yulifianti et al., 2020). In general, farmers in Indonesia cultivate peanuts on dry land with dominant soil content of latosol and red-yellow podzolic and some also plant them in regosol and alluvial rice fields (Harahap, 2021; Pujiastuti et al., 2021; Rahmianna et al., 2017; Ratunggading et al., 2020). The average peanut production in Indonesia was 638,896 t in 2014, 605,449 t in 2015, 570,470 t in 2016, 495,447 t in 2017, and 52,198 t in 2018 (BPS, 2019). This shows that in the period 2014-2018 the average peanut production in Indonesia has decreased relatively. The results of the 2016 Balitkabi study reported that the average peanut productivity was 2.61 t ha^{-1} (Balitkabi, 2016), and the average peanut productivity specifically in East Nusa Tenggara was 1.12 t ha^{-1} much lower (BPS, 2020). The average productivity of peanuts at the national level is 1.29 t ha^{-1} so that to meet domestic needs at that time Indonesia had to import 130,000 t of peanuts (BPS, 2019). East Nusa Tenggara Province, which is dominated by dry land with an available land area of 18,396 ha, has the potential for peanut development (Hasmawati. & Risal, 2018; Murdolelono, 2017; Zulchi & Puad, 2017).

The relatively low productivity of peanuts is caused by several factors, including (Seran & Raharjo, 2018): the availability of superior variety seeds is still relatively lacking; inadequate irrigation systems; excess water in early growth in rice fields during the rainy season and drought in the dry season at the end of growth (Rohmah et al., 2021); lack of main nutrients such as N, P, K, and Ca; competition with weeds in the vegetative growth phase, rarely or late; shallow soil cultivation so that root growth and pod development are not optimal; the seeds used have low germination (not superior) (Sinaga et al., 2021); and disease attacks such as bacterial wilt and fungal wilt, rust and leaf spots, st. ripe stripe virus (PStV), as well as rats, whiteflies, leaf worms, pod borers, and nematodes. The results of direct observation/survey in Insana Fafinesu District, North Central Timor Regency, East Nusa Tenggara, on several farmers who cultivate local lurik peanut varieties show that local lurik peanut production is only 0.7 t ha^{-1} to 1.2 t ha^{-1}. The advantage of local lurik peanut varieties is that they are resistant to bacterial wilt disease caused by Ralstonia Solanacearum bacteria which often attacks peanut plants from one week old to harvest age, so that harvest failure can be around 15-35% (Tabean, 2021; Wicaksana, 2018).

This study aims to develop local Timor lurik peanut varieties through genetic engineering with multigamma irradiation techniques and careful selection to obtain purified superior generations that can be widely cultivated on a commercial scale.

State the objectives of the work and provide an adequate background, avoiding a detailed literature survey or a summary of the results.

Method

Research Location

Sampling of lurik peanuts at the lurik peanut cultivation center in Insana Fafinesu District, North Central Timor, Timor Island, Indonesia. Sample irradiation was carried out at the Nuclear Mini Laboratory of the Physics Study Program, Faculty of Science and Engineering, Nusa Cendana University, Indonesia. The planting locations were centered in four local farmer gardens in four provinces, namely East Penfui (East Nusa Tenggara Province), Tinoring (Tana Toraja, South Sulawesi Province), Mamuju (West Sulawesi Province), and Palu (Central Sulawesi Province).

Research Instruments

The main research instruments are: Standard multigamma irradiation source for sample irradiation; Radiation dose counter: measuring the dose of multigamma radiation used; Water content analyzer; Tractor: land processing; Digital scales: weighing the mass of pods and seeds; Other supporting tools: crowbar, hoe, bucket, PVC pipe, pest sprayer, shovel, saw, hammer, sickle, etc.

Research Methods

The main method applied in the research is irradiation. Other supporting methods include: observation/survey, sampling, selection, purification, comparative, and interpretation. The advantages of this method are that superior generations are obtained in a relatively short time and several variations of superior mutant generations are obtained, making it easy to make selections as desired. The research was conducted for one year with the acquisition of superior generations that had been tested for purity and multi-location tests.

Research Design

First stage research procedure

Conducting observations for the selection of local lurik peanut seeds from Insana Fafinesu District, North Central Timor, developed by utilizing multigamma irradiation and determining the planting location. At this stage, observations and measurements were made of several important characteristics of the parent plant such as plant height, resistance to pests and diseases, flowering age, fruit size (pods), harvest age, mass per 200 seeds, water content, and so on.

Cultivating the planting land by plowing using a tractor so that it is free from weeds and loose so that the lurik peanuts grow well. Furthermore, beds were made with a width of 100 cm, a height of 30 cm, a distance between beds of 40 cm, and a ditch width for the drainage system of 25 cm.

Samples of selected local lurik peanut seeds were then irradiated with a multigamma source at a dose of 3000 rad for 30 minutes. The growth of sprouts can be stimulated by giving the hormone gibberellic acid (Tamonob et al., 2024).

Soak the cultivated land and let it dry again for two days (moist). Irradiated local lurik peanut seeds are immediately planted in the prepared land with a planting distance of 40 cm x 15 cm and 40 x 35 cm, a planting hole depth of 4 cm, and each hole is filled with 4 seeds. Irrigation after planting is adjusted to the rainfall at the research site.

Observing the growth ability and growth age of both parent varieties and treatments. The number of seeds that did not grow in the selected sample of 50 seeds from both treatments was calculated. Plant replanting was carried out at the age of 7 days after planting. Weeding the plants and fertilizing with NPK and Urea 2: 1 so that the plants are free from weeds and grow well so that production is optimal (Novianti, 2021).

Conducting a series of observations during plant growth, including: pest-disease resistance, dry land adaptation, and plant selection. When approaching the harvest time, selection is carried out again, measuring plant height, number of pods per tree, and number of seeds per pod. Carrying out the 1st selection at the age of the plant 30 days after planting, the 2nd selection when the fruit begins to fill solidly, approaching the harvest Mn selection, and the final post-harvest selection.

Harvesting and drying. Harvesting is carried out after the pods are well ripe which is indicated by solid content and dull black-brown and rough pod skin color by plucking with the help of a crowbar so that no pods are left in the soil. Counting the number of pods per tree in the recovered sample randomly. After that, the pods are separated from the tree, the pods are dried until they are well dry (Purnomo et al., 2020).

In post-harvest, mass measurements per 200 seeds are carried out, as well as water content analysis (service model in the Chemistry and Biology Lab). Comparing the physical and chemical properties of superior generation resulting from multigamma irradiation and careful selection at the purification stage with parent varieties, interpreting and drawing conclusions.

Second stage research procedure

The second stage research procedure for obtaining superior generations through careful purification and selection and other tests is the same as in the first stage, without any further irradiation.

The research design of the first and second stages is shown in Figure 1 and Figure 2. The focus of the first stage of research is genetic engineering of local lurik peanut cultivars from Insana Fafinesu, North Central Timor, utilizing multigamma irradiation to obtain superior generations and direct initial purification and multilocation testing. Other variables observed and measured in the study: Adaptiveness to dry land, pest and disease resistance, growth percentage, water content, production range, average production, and percentage increase in production. The focus of the research in the second stage is further purification and further multilocation testing, as well as other tests that are a continuation of the first stage of research testing.

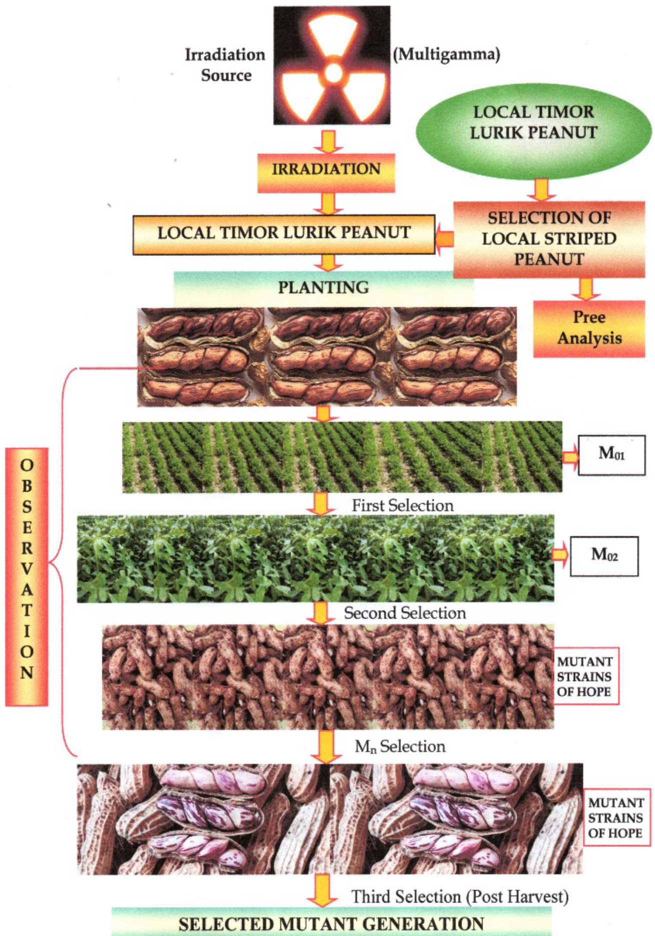

Figure 1. Research flow for obtaining superior mutant generations from multigamma irradiation in the first stage of research

Several mathematical formulations needed include (Malelak et al., 2023; Pasangka & Gorby, 2021; Pasangka & Pasangka, 2023, 2024; Pasangka & Refli, 2016, 2021, 2022; Pasangka & Wahid, 2021). The growth percentage is calculated using Formula 1.

$$PG = \frac{(T_{AS} - T_{SG})}{T_{AS}} \times 100\% \quad (1)$$

where: PG : growth percentage (%), T_{AS} : total number of seeds planted, T_{SG} : number of seeds that did not grow.

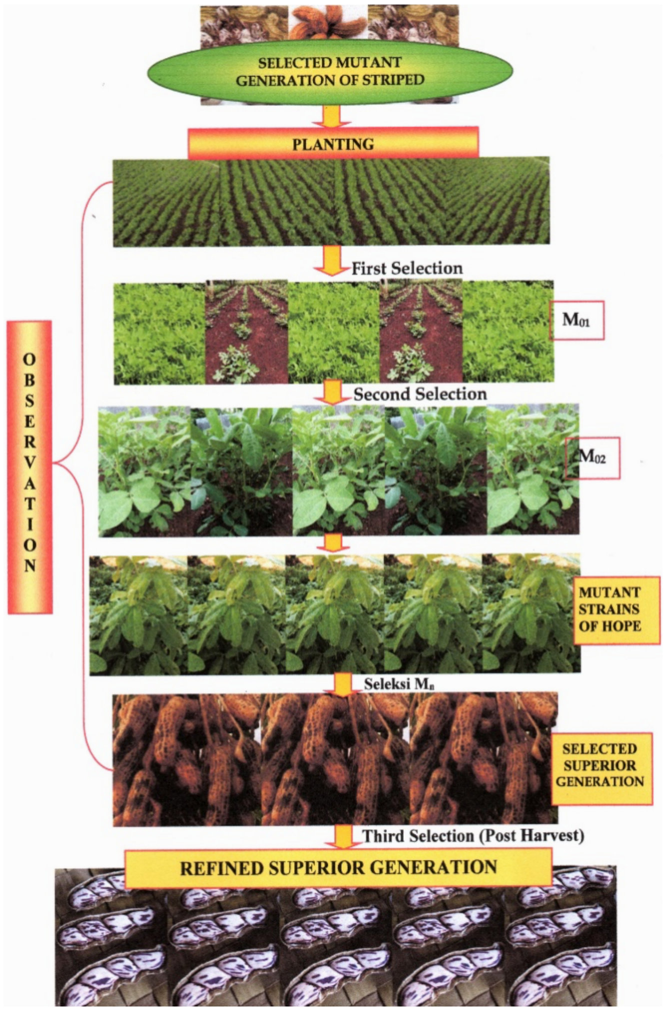

Figure 2. Flow diagram of the second stage of research on obtaining selected superior generations through final purification and widest possible cultivation for commercial purposes.

The percentage increase in average production is calculated using Formula 2.

$$I_{PAP} = \left(\frac{A_{PTS} - A_{PCS}}{A_{PTS}} \right) \times 100\% \quad (2)$$

where: I_{PAP} : percentage increase in average production, A_{PTS} : average production of selected superior generations, and A_{PCS} : average production of control samples (parents).

The average production of superior mutant generations in four planting locations was calculated using Formula 3.

$$A_{PTS} = \left(\frac{P_{L1} + P_{L2} + P_{L3} + P_{L4}}{4} \right) \quad (3)$$

where: P_{L1}, P_{L2}, P_{L3}, P_{L4}: production of superior and control generations in four locations and n = 1…..4, the average production of each selected superior mutant cultivar in four planting locations.

The average production of control samples in four planting locations was calculated using Formula 4.

$$A_{PCS} = \left(\frac{P_{L1} + P_{L2} + P_{L3} + P_{L4}}{4} \right) \quad (4)$$

The percentage increase in production of the selected superior generation was calculated using Formula 5.

$$I_{PAP} = \left(\frac{A_{PTS} - A_{PCS}}{A_{PTs}} \right) \times 100\% \quad (5)$$

Where I_{PAP} is the percentage increase in production of the selected superior generation

Result and Discussion

Observation, Measurement, and Calculation Results

The growth of local lurik peanuts resulting from multigamma irradiation at 32 days after planting (dap) that have started to flower, while Figure 4 shows an example of the parent variety at 47 days after planting (dap) as shown in Figure 3.

Figure 3. An example of the growth of superior generation of local Timor lurik peanuts resulting from mutigamma irradiation at 32 days after planting.

The application of standard multigamma irradiation to local Timor lurik peanut seed samples produced several variations of superior generations, although only one mutant generation was further developed in the second stage of research, namely a mutant that had reliable superior properties. The superior characteristics that were clearly visible in the selected superior generation included leaf color, plant height, number of pods per tree, seed size, and seed color, mass per 200 seeds. The results of observations of the initial growth of seeds in the treatment and control samples to calculate the percentage of growth, various physical and chemical characteristics that were observed, measured, and calculated, and estimated production levels, are listed respectively in Tables 1, Table 2, and Tabel 3.

Figure 4. An example of the growth of local lurik peanuts of the parent variety at 47 dap.

Figure 5. Examples of pods and seeds of superior generation local lurik peanuts resulting from post-harvest multigamma irradiation (75 dap).

The results of observations of early seed growth in treatment and control samples to calculate the percentage of growth, various physical and chemical properties observed, measured, and calculated, and estimated production levels are presented in Table 1, Table 2, and Table 3, respectively. To calculate the percentage of growth, 5 groups were taken randomly with the number of seeds observed 50 seeds in each group. Treatment samples were taken 5 groups with 5 variations of observations.

Table 1. Number of seeds that did not grow in control and treatment samples

Sample Group	Number of seeds in each group	Control Sample	Selected superior generation 1	2	3	4	5
I	50	11	3	2	4	1	4
II	50	9	2	1	3	2	2
III	50	10	3	4	1	2	3
IV	50	8	1	3	2	4	3
V	50	7	2	2	3	3	2
Average	50	9.00	2.20	2.40	2.60	2.40	2.80
Average total superior generation					2.48		
Percentage growth %		82.00	95.60	95.20	94.80	95.20	94.40
Average total percentage growth %		82.00					95.04

Table 2. Important physical and chemical characteristics observed, measured, and calculated in selected superior generations resulting from multigamma irradiation and parent varieties.

Descriptions	Control Sample	Treatment Sample
Growing time	10 dap	5 dap
Percentage growth	82.00 %	95.04 %
Flowering age range	(32-50) dap	(29-35) dap
Average flowering age	47 dap	32 dap
Leaf color	Green	Green
Flower color	Yellowissh	Yellow
Plant height range	(25-50) cm	(48-76) cm
Average plant height	43 cm	64 cm
Harvest age range	(95-135) dap	(64-90) dap
Average harvest age	125 dap	75 dap
Range of number of pods per tree	(18- 52) pods per tree	(38-94) pods per tree
Average number of pods per tree	32 pods per tree	76 pods per tree
Range of number of seeds per pod	(1-4) seeds per pod	(2-6) seeds per pod
Average number of seeds per pod	2 seeds per pod	4 seeds per pod
Dry pod skin color	Brownish yellow	Off white
Seeds color	Lurik/brownish yellow pattern	Lurik/reddish white pattern
Mass range per 200 seeds	(28.6-39.8) g	(42,5-58,2) g
Average mass per 200 seeds	36,8 g	52.6 g
Adaptation to conditions of low water and high salt content	Less adaptive	Adaptive
Tolerant to pests and diseases	Less tolerant	Specially tolerant of rust, spot and leaf beetles
Water content range	(12-18) %	(9.5-12,6) %
Average water content	15.2%	11.2%
Production range	(2.65-2.82) t ha^{-1}	(4.56-4.75) t ha^{1}
Average production	2.73 t ha^{-1}	4.63 t ha^{-1}
Percentage increase in production	-	41.04%
Maximum production potential	2.82 t ha^{-1}	4.75 t ha^{-1}

Table 3. Production levels at four planting locations in control samples and treatment samples (selected superior generation).

Planting Location	Control Sample (t ha^{-1})	Selected Superior Generation (t ha^{-1})
East Penfui East Nusa Tenggara Province	2.82	4.75
Tinoring Tana Toraja South Sulawesi Province	2.76	4.63
Mamuju West Sulawesi Province	2.68	4.58
Palu Central Sulawesi Province	2.65	4.56
Average production	2.73	4.63
Percentage increase in production %	-	41.04

Figure 6. Example of pods and seeds of local Timor lurik peanuts, parent variety, post-harvest (125 dap).

Statistical calculation

The percentage of seed growth in the control and treatment samples can be calculated based on equation (1) and the data in Table 1. as follows. The number of randomly selected observation seeds was 50 seeds, the average number of seeds that did not grow in the control sample was 9.60 seeds. The average number of seeds that did not grow in the selected superior generation was 2.48 seeds.

Percentage of growth in the control sample

$$PG = \frac{(T_{AS} - T_{SG})}{T_{AS}} \times 100\% = \frac{(50 - 9.60)}{50} \times 100\% = 82.00\%$$

Percentage growth in treatment samples:

$$PG = \frac{(T_{AS} - T_{SG})}{T_{AS}} \times 100\% = \frac{(50 - 2.48)}{50} \times 100\% = 95.04\%$$

Average production on control samples (parent varieties) at four planting locations equation (4).

$$A_{PCS} = \left(\frac{P_{L1} + P_{L2} + P_{L3} + P_{L4}}{4}\right) = \left(\frac{2.82 + 2.76 + 2.68 + 2.65}{4}\right) = 2.73\, t\, ha^{-1}$$

Average production of treated samples or selected superior generations resulting from multigamma irradiation at four planting locations: equation (3).

$$A_{PTS} = \left(\frac{P_{L1} + P_{L2} + P_{L3} + P_{L4}}{4}\right) = \left(\frac{4.75 + 4.63 + 4.58 + 4.56}{4}\right) = 4.63\, t\, ha^{-1}$$

Percentage increase in production in the selected superior generation resulting from multigamma irradiation: Equation (5)

$$I_{PAP} = \left(\frac{A_{PTS} - A_{PCS}}{A_{PTS}}\right) \times 100\% = \left(\frac{4.63 - 2.73}{4.63}\right) \times 100\% = 41.04\%$$

Growing Time, Growth Percentage, Flowering Age, and Extreme Climate (temperature and humidity) and Water Deficiency Conditions (Drought)

The results of observations, measurements, and calculations on the parent variety and selected superior generation showed that the growth period of the parent variety was 10 days after planting, while the selected superior generation was 5 days after planting. This condition shows that the irradiated local lurik peanut seeds grew faster than the parent variety seeds. This is possible because the dose of 1000 rad exposed to the seeds stimulates the growth of seed germination. The growth percentage of the selected superior generation was 95.04%, while the growth percentage of the parent variety was 82.00%. The average flowering age of the selected superior generation was 32 days after planting and the average flowering age of the parent variety was 47 days after planting. This shows that the selected superior generation resulting from multigamma irradiation has a higher growth percentage and faster flowering than its parent variety.

Figure 3 shows an example of the growth of local lurik peanuts from Timor, a superior generation selected from multigamma irradiation at 32 days after planting with lush and smooth leaves. Figure 4 shows an example of the growth of a local peanut parent variety at 47 days after planting with slightly wrinkled leaves and some of the leaves are seen to have been eaten by pests. Figure 5 shows an example of pods with 4 and 5 seeds per pod in the superior generation selected after harvest from multigamma irradiation which look dense and smooth. Figure 6 shows an example of a pod and seeds of the parent variety with 4 small seeds. This shows that local Timor lurik peanuts from multigamma irradiation can adapt to conditions of lack of water (drought) (planted in the dry season), are tolerant to pests and diseases, and have high production potential.

Range and Average Plant Height, Range and Average Flowering and Harvest Age

Local Timor lurik peanuts of superior generation selected from multigamma irradiation, have a height ranging from 48 cm - 76 cm, while the parent variety is 25 cm-50 cm with an average plant height of 64 cm for the selected superior generation and 43 cm for the parent variety. The range of flowering age for the selected superior generation is (29-35) dap, the parent variety (32-50) dap, with an average flowering age of 32 dap for the superior generation and 47 dap for the parent variety. The range of harvest age is (64-90) dap for the selected superior generation and (95-135) dap for the parent variety. The average harvest age for the selected superior generation is 77 dap, while the parent variety is 125 dap. These results indicate that local Timor lurik peanuts of superior generation have a shorter harvest age than their parent varieties.

Range and Average Number of Pods, Range and Average Number of Seeds per Pod, Range and Average Mass per 200 Seeds

The number of pods per tree in the selected superior generation of local lurik peanuts resulting from multigamma irradiation ranged from (38-94) pods per tree, parent variety (18-52) pods per tree with an average number of pods per tree of 76 pods per tree for the selected superior generation and 32 pods per tree for the parent variety.

The range and average number of seeds per pod for the selected superior generation and its parent variety were respectively: (2-6) seeds per pod, (1-4) seeds per pod, 4 seeds per pod and 2 seeds per pod. The range and average mass per 200 seeds in the selected superior generation and its parent variety were respectively (42.5-58.2) g, (28.6-39.8) g, 52.6 g and 36.8 g. So it can be said that the mass per 200 seeds in the selected superior generation is higher than the parent variety (in other words, the production of the selected superior generation increased significantly).

Range and Average of Production, Percentage of Production Increase, and Water Content

The production of local Timor lurik peanuts for the selected superior generation resulting from multigamma irradiation ranged between (4.56-4.75) t ha^{-1} and the parent variety (2.65-2.82) t ha^{-1}. The maximum production potential was 4.75t ha^{-1} for the selected superior generation and 2.82 t ha^{-1} for the parent variety. The average production of the selected superior generation was 4.63 t ha^{-1} and 2.73 t ha^{-1} for the parent variety. The percentage increase in production of the selected superior generation was 41.04%. The range and average water content of the selected superior generation resulting from multigamma irradiation and the parent variety were (9.5-12.6) %, (12-18) %, 11.2%, and 15.2%, respectively. These results indicate that the production of superior generations selected from multigamma irradiation significantly increased with the percentage of water content according to the standard (tandard = 11%).

Conclusion

Based on the description in the discussion section, the following conclusions can be put forward. The development of local Timor lurik peanuts through genetic engineering (irradiation) with multigamma irradiation and careful selection obtained superior generations that are adapted to drought conditions, tolerant of pests and diseases, and high production. The production range of superior generations selected from multigamma irradiation was (4.56-4.75) t ha^{-1} with an average production of 4.63 t ha^{-1}. The percentage increase in production of superior generations selected from multigamma irradiation was 41.04% with an average water content of 11.2%.

Acknowledgments

This research was supported and funded by Decentralization Research, Directorate of Research and Public Service, Department of Education and Culture of Indonesia Government and Technology Research Through University of Excellence Applied Research of Nusa Cendana University with grant number: 161/UN15.22/PL/2025 (Professor's Research). Especial thanks to authorized officials who had funded this research and special thanks to all colleagues in the research who have worked well together to write this manuscript. Publication fee of the manuscript was included in this financial.

Author Contributions

For research articles with several authors, a short paragraph specifying their individual contributions must be provided. The following statements should be used "Conceptualization, BP. and R.; methodology, BP.; software, BP.; validation, BP., R. and IGP.; formal analysis, IGP.; investigation, BP.; resources, BP.; data curation, BP.; writing—original draft preparation, BP.; writing—review and editing, BP, R.; visualization, BP.; supervision, BP.; project administration, R, IGP.; funding acquisition, XX, R. All authors have read and agreed to the published version of the manuscript." Please turn to the CRediT taxonomy for the term explanation. Authorship must be limited to those who have contributed substantially to the work reported.

Funding

This research funded by Decentralization Research, Directorate of Research and Public Service, Department of Education and Culture of Indonesia Government and Technology Research Through University of Excellence Applied Research of Nusa Cendana University with grant number: 161/UN15.22/PL/2025 (Professor's Research).

Conflicts of Interest

There is no role and conflict of interest "The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript; or in the decision to publish the results"

References

Abidin, Z., Jati, H., Harini, T. S., & Jutom, L. (2023). Training and Assistance Processing of Corn and Peanut Based Food Product. *Community Impowerment*, *8*(1), 36–44. https://doi.org/10.31603/ce.7934

Asis, R., Ismail, & Pakpahan, L. E. (2022). Increasing the Growth and Productivity of Peanuts in Dry Land Through the Application of Dolomite and NPK Fertilizer. *Indonesian Journal of Agriculture Science*, *24*(2), 88–94. https://doi.org/10.31186/jipi.24.2.88-94

Balitkabi. (2016). *Description of Superior Peanut Variety, KT.45*. Retrieved from https://123dok.com/document/q04djk9z-deskripsi-varietas-unggul-kacang-tanah-kt.html#google_vignette

BPS. (2019). *Luas Panen, Produksi, dan Produktivitas Kacang Tanah Menurut Kabupaten/Kota di Provinsi Jawa Tengah, 2018*. Retrieved from https://jateng.bps.go.id/id/statisticstable/1/MTczOSMx/luas-panen-produksi-dan-produktivitas-kacang-tanah-menurut-kabupaten-kota-di-provinsi-jawa-tengah-2018.html

BPS, N. T. T. (2020). *Provinsi Nusa Tenggara Timur Dalam Angka 2020*. Retrieved from https://ntt.bps.go.id/id/publication/2020/04/27/080aa7bde0454f07e7848b49/provinsi-nusa-tenggara-timur-dalam-angka-2020.html

Harahap, F. S. (2021). Evaluasi Kesesuaian Lahan Untuk Tanaman Kacang Tanah Di Kelurahan Pardamean Kecamatan Rantau Selatan. *Agroplasma Journal*, *8*(1), 11–17. https://doi.org/10.36987/agroplasma.v8i1.1956

Hasmawati., A., & Risal, M. (2018). Prospek Pengembangan Usahatani Kacang Tanah (Studi Kasus Desa Limampoccoe Kecamatan Cenrana Kabupaten Maros). *Agribusiness Journal*, *8*(2), 1–13. Retrieved from https://shorturl.asia/PhVGC

Ibrahim, H., Amalia, R., & Kasirang, A. (2023). Prospects For Developing Peanut Farming in Bijawang Village, Ujung Loe Sub-District, Bulukumba District. *Journal Agroecotech Indonesia*, *2*(1), 60–68. https://doi.org/10.59638/jai.v2i01.37

Leonita, S., Harta, G. D. M., Rosyidta, A., & Irianto, H. (2020). Analisis kelayakan tekno-ekonomi produk agroindustri kacang lurik sangrai di Kota Tangerang Selatan. *Jurnal Ilmu Pengetahuan Dan Teknologi*, *4*(1), 33–39. https://doi.org/10.31543/jii.v4i1.156

Malelak, N. D. M. O., Pasangka, B., & Mbiliyora, M. (2023). Breeding of Jumbo Local Peanuts of Upright Type Rote Ndao Using Multigamma Irradiation Method to Obtain Superior Seed Varieties. *Journal of Physics. Physics Science and Its Applications*, *8*(1), 50–55. https://doi.org/10.35508/fisa.v10i1

Marwiyah, S., Purnamawati, H., & Sembiring, P. (2017). Physical Mutation Induced by Gamma Ray Irradiation on Kidney Bean. *Journal Comm. Hort. J*, *1*(1), 49–55 10 29244 1 1 49–55. https://doi.org/10.29244/chj.1.1.49-55

Murdolelono, B. (2017). *Legume Plant Technology for Farmers in East Nusa Tenggara, Proceedings of Research Results on Various Legume and Tuber Plants*. Retrieved from https://adoc.pub/teknologi-tanaman-kacang-kacangan-untuk-petani-di-nusa-tengg.html#google_vignette

Novianti, F. (2021). *Effect of Dosage of P Fertilizer and Arbuscular Vesicular Mycorrhiza on Growth and Yield of lurik Peanut (Arachis Hypogaea L Merr* [Thesis: Siliwangi University]. Retrieved from http://103.123.236.3/5202/

Novianto, A., & Daryono, B. S. (2018). *Phenotypic Characters and Ploidy Degree of lurik Peanut (Arachis hypogaea L. 'Lurik') Resulting from Selection and Colchicine Induction*. Retrieved from https://etd.repository.ugm.ac.id/home/detail_pencarian/162159

Pasangka, B., & Gorby, I. P. (2021). Continuous Development and Cultivation of Soybean as a Result of Multigamma Irradiation through Final Purifying Method. *Jurnal Penelitian Pendidikan IPA*, *7*(2), 156–166. https://doi.org/10.293030/jppipa.v7i2.611

Pasangka, B., & Pasangka, I. G. (2023). Improvement of Local Purple Corn (Zea mays) Variety with Multigamma Irradiation (Nuclear) Technique. *AIP Conference Proceedings*, *2619*, *0500*, 1–10. https://doi.org/10.1063/5.0122784

Pasangka, B., & Pasangka, I. G. (2024). Breeding of Local Glutinous Corn (Zea mays ceretina L) with Multigamma Irradiation Methods to Obtain Superior Mutant Cultivars. *International Journal of Advanced and Applied Sciences*, *11*(8), 127–134. Retrieved from https://www.science-gate.com/IJAAS.html

Pasangka, B., Pasangka, I. G., & Ilic, Z. M. S. (2021). Cultivar Repair of Local Vigna radiata L to Use Multigamma Irradiation Technique (Nuclear) that Tolerant to Dry Condition, Rainy Season, Germ, and High Production. *Jurnal Penelitian Pendidikan IPA*, *7*(4), 508–518. https://doi.org/10.29303/jppipa.v7i4.859

Pasangka, B., & Refli. (2016). Development and ultivation of Local Kidney Bean (Phaseolus Vulgaris L) Through Breeding to Use Multigamma Irradiation Technique (Nuclear. *American Journal of Agricultural and Biologycal Sciences*, *11*(ue. 3), 117–127. https://doi.org/10.3844/ajabssp.2016.117.127

Pasangka, B., & Refli. (2021). Genetic Improvement of Local Red Peanut with Using Nuclear Technique (Multigamma Irradiation) for Obtaining Superior Variety". *Journal of Agricultural Science*, *14*(1), 94–103. https://doi.org/10.5539/jas/v14n1p94

Pasangka, B., & Refli. (2022). Genetic Improvement of Local Red Peanut With Using Nuclear Technique (Multigamma Irradiation) for Obtaining Superior Variety. *Journal of Agricultural Science*, *14*(1), 94–103. https://doi.org/10.5539/jas.v14n1p94

Pasangka, B., & Wahid, A. (2021). Genetic Engineering of Local Cayenne Pepper (Capsicum frustescens L) Through Breeding with Multigamma Irradiation Methods to Obtain Superior Offspring". *Journal of Agricultural Science*, *13*(2), 81–90. https://doi.org/10.5539/jas.v13n12p81

Pujiastuti, E. S., Siahaan, F. R., Tampubolon, Y. R., Tarigan, J. R., & Sumihar, S. T. T. (2021). Response of Soil and Peanut on the Application of Several Local Microorganism and Manures. *Journal of Agrotechnology and Plantation: Agrinula*, *4*(1), 1–12. https://doi.org/10.36490/agri.v4i1.107

Purnomo, J., Nugrahaeni, N., Sundari, T., & Harnowo,

D. (2020). *Technical Instructions for Peanut Seed Production Technology, Agricultural Research and Development Agency, Ministry of Agriculture*. Retrieved from https://balitkabi.litbang.deptan.go.id

Rahmianna, A. A., Pratiwi, H., & Harnowo, D. (2017). Peanut Cultivation, Research Institute for Various Legumes and Tuber Crops. *Balitkabi Monograph*, *13*, 133–169. Retrieved from https://adoc.pub/budidaya-kacang-tanah.html#google_vignette

Ratunggading, F., Jawang, U. P., & Nganji, M. U. (2020). Evaluasi Potensi Lahan Pengembangan Komoditas Kacang Tanah (Arachis hypogaea L.) di Kecamatan Haharu, Sumba Timur, Nusa Tenggara Timur. *Journal of Agricultural Sciences: AGRILAND*, *8*(3), 261–266. Retrieved from https://journal.uisu.ac.id/index.php/agriland.

Rohmah, D. I., Mulyani, M., Janah, L. N., Pancoro, A., Miftahudin., W., T., A., & Daryono, B. S. (2021). The Effectiveness of Bio-catharanthine on Peanut (Arachis hypogea L.) Lurik Cultivar. *Advances in Biological Sciences Research*, *22*, 383–387. https://doi.org/10.2991/absr.k.220406.054

Rosyidi, I. N. (2018). *Phenotypic Characters and Genetic Variance of Striped Beans (Arachis hypogaea L. var Lurikensis) with Inter Simple Sequence Repeat*. Retrieved from https://etd.repository.ugm.ac.id/penelitian/detail/165742

Rosyidi, I. N., & Daryono, B. S. (2020). Phenotypic characters and genetic variations of lurik peanuts (Arachis hypogaea L. var. lurikensis) with Inter Simple Sequence Repeat. *BIODIVERSITAS*, *21*(2), 629–635 10 13057 210227. https://doi.org/10.13057/biodiv/d210227

Rosyidi, I. N., Yusuf, A. F., Sahroni, M., & Daryono, B. S. (2023). Detection of Transposon Gene in Lurik Peanuts (Arachis hypogaea var. lurik L.) with AhMITEs Analysis. *International Journal on Advanced Science Engineering Information Technology*, *3*(5), 1349–1354. Retrieved from https://www.researchgate.net/publication/373493354

Rozi, F., Sutrisno, I., & Rahmianna, A. A. (2016). Opportunities for Peanut Development in Dry Land of East Nusa Tenggara. *Palawija Bulletin*, *14*(2), 71–77. Retrieved from https://www.academia.edu/104961546/Peluang_Pengembangan_Kacang_Tanah_DI_Lahan_Kering_Nusa_Tenggara_Timur

Seran, A. H., & Raharjo, K. T. P. (2018). Study of Drought Stress After Flowering Period of Red Bean Plants (Phaseolus Vulgaris L) on Entisol Soil. *Journal of Dryland Conservation Agriculture*. Retrieved from https://media.neliti.com/media/publications/527369-study-of-drought-stress-after-the-flower-a5e89675.pdf

Sinaga, A. O. Y., Lindayanti, M., Aunila, S. L., & Marpaung, D. S. S. (2021). Identification of Peanut Seed Quality (Arachis Hypogaea L.) Local Tuban Variety Using Tetrazolium Test and Germination Test. *Journal of Tropical Agricultural Engineering and Biosystems*, *9*(3.p), 208–215. https://doi.org/10.21776/ub.jkptb.2021.009.03.02

Siswanti, D. U., Pangestiti, N. H., & Wulansari, N. (2022). Growth and Productivity of Lurik Peanuts (Arachis hypogaea L. var. Lurikensis) after Biofertilizer-Sludge Biogas Application. *Advances in Biological Sciences Research*, *22*, 505–512. https://doi.org/10.2991/absr.k.220406.071

Sutrisno, I., & Rozi, F. (2015). *Local Wisdom as the Basis for Optimizing Food Crop Cultivation in East Sumba, Development of Local Resources Potential with Environmental Insights to Strengthen National Agricultural Products with Global Competitiveness*. Research Center for Various Legumes and Tuber Crops. Proceeding. Retrieved from https://digitallibrary.ump.ac.id/597/2/31.%20%20%20Imam%20Sutrisno.pdf

Tabean, E. (2021). *Promising Market, Dekrimindo North Central Timor Encourages Farmers to Develop Lurik Peanuts*. Retrieved from https://voxntt.com

Tamonob, A., Solichatun., & Suratman. (2024). The Effect of Seed Priming Using Giberlic Acid on Growth of Groundnut (Arachis hypogaea L) and Lurik Groundnut (Arachis hypogaea L var. *Lurik), Bioscientist: Jurnal Ilmiah Biologi (Scientific Journal of Biology*, *12*(2), 583–2594. https://doi.org/10.33394/bioscientist.v12i2.13774

Udang., S., & Anugrah, M. (2020). Characterization of Red Bean Seeds (Phaseolus Vulgaris L) as a Provider of Superior Varieties. *Jurnal Agrosintesa*, *3*(1), 1–11. https://doi.org/10.33603/jas.v3i1.3545

Wicaksana, Y. (2018). *Lurik Peanuts, Superior Peanut Varieties that are Resistant to Disease, AgrotechnologyUniv. Mury Kudus*. Retrieved from https://paktanidigital.com/artikel/kacang-lurik-varietas-unggul/

Widiastuti, T., Rizali, N., Anatayu, S., & Waluyo, S. N. (2017). Line and Color Composition in Lurik Cawas Weaving: Idea from Traditional Lurik Patterns. *International Research Journal of Management, IT & Social Sciences*, *4*(1), 1–7. Retrieved from https://sloap.org/journals/index.php/irjmis/article/view/389

Yuan, X., Li, S., Chen, J., Yu, H., Yang, T., Wang, C., Huang, S., Chen, H., & Ao, X. (2024). Impacts of Global Climate Change on Agricultural Production: A Comprehensive Review. *Agronomy*, *14*(7).

https://doi.org/10.3390/agronomy14071360

Yulifianti, R. B. A., Santos, S., & Widowati, S. (2020). Processing Technology and Processed Peanut Products, Research Center for Various Nuts and Tubers, Malang, and the Center for Agricultural Postharvest Research and Development. *Bogor, Monograph, Balitkabi*, *13*, 376–393. Retrieved from https://adoc.pub/teknologi-pengolahan-dan-produk-olahan-kacang-tanah.html

Zulchi, T., & Puad, H. (2017). Keragaman morfologi dan kandungan protein kacang tanah (Arachis hypogaea L.). *Plasma Nulfah Bulletin*, *23*(2), 91–100. https://doi.org/10.21082/blpn.v23n2.2017.p91-100