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Agronomic and economic performance of four peanut (*Arachis hypogaea* L.) varieties under Lal-lo, Cagayan, Philippines

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Key words: Peanut, Return on investment, Agronomic and economic characteristics, Cagayan Valley Region

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Abstract

The study was conducted to determine the agronomic and economic performances of four peanut (*Arachis hypogaea* L.) varieties under Lal-lo, Cagayan, Philippines. The four (4) peanut varieties were randomly planted following the Randomized Complete Block Design (RCBD) in three replications. Considering each variety as an experimental treatment. Evaluation of agronomic and economic performances of four (4) peanut varieties (Luna Seeded, BPI Pn 9, NSIC Pn 11, and NSIC Pn 17) was done at the Cagayan State University Lal-lo Campus. Results showed that the agronomic and economic performances of four peanut varieties significantly differ under the Lal-lo Cagayan condition. Luna seeded peanut variety significantly gave taller plants, Length of pods (cm), Number of Seeds of Pods, and least number of undeveloped pods. The results showed that this variety grew best in Lal-lo area as manifested by significantly high economic performance, i.e., heaviest weight of kernels/10 plants (kg), highest survival rate (%) and shelling (%). The variety registered the highest yield in tons.$^{-ha}$ and highest return on investment (ROI).It is recommended that: (a) another trial must be conducted to confirm and give more conclusive results; (b) further research and observations must be performed at different planting season. An attempt to do experiment on farmers' field must be conducted to determine the agronomic and economic performances at farmers' level.

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Introduction

Groundnut (*Arachis hypogea* L.*),* is grown globally for its food and edible oil in about 30 million ha. It is one of the priority products of Ilocos Region and Cagayan Valley. The two regions account for 53% of the national production. Peanut cultivation has become an important livelihood strategy in these two regions especially among smallholders. It is a versatile crop that provides growers with many options to spread risk. With a short growing season, peanut fits well as a cash crop within a diverse range of cropping systems. Peanut production stimulates local food processing industries and adds value to the crop.

The average contribution of the Philippines in the peanut production of Asia (66.2% of global production) is relatively low with only 0.07% minimal share, where the crop is grown mostly by smallholder farmers under rainfed conditions with limited inputs. In 2013, although there are productive regions realizing a production ranging from 1.26-2.8MT/ha, many of the production areas in the Philippines are small and receive low levels of management and farm inputs. Still, the country's production is very small compared to China's yield of about 3.5 MT per hectare, and to United States of about 4.5 MT/hectare. These are because China has a very intensive production method, while high yield in the United States is attributed to the use of high yielding runner varieties, good agronomic practices, and the "mechanization revolution." In the international trade, the total annual production was estimated at 41,308,175 MT. China is the world's largest producer and in 2013 they accounted for 39% of the world production. Other top peanut producing countries are India (17%), Nigeria (8%), United States (5%), and Myanmar (3%). Peanut production in the United States in 2013 went down by 33% over 2012 performance due to drought. On the other hand, production in India in 2013 increased by 5% over 2012 output. World production grew by an average of 3% per year

From nutritional point of view, groundnuts are very important in the lives of the poor as they are very rich in protein (26%) and edible oil content (45-50%). In addition to protein, groundnuts are a good source of calcium, phosphorus, iron, zinc, and boron (USDA, 2009). Under Cagayan State University Lal-lo, four peanut varieties are maintained and cultivated for experimental purposes. These are Luna Seeded, BPI Pn 9, NSIC 11 and NSIC 17. However, these four varieties are not yet subjected to varietal characterization and evaluation. Thus, this study was conducted to determine the agronomic and economic performances of four peanut (*Arachis hypogaea* L.) varieties under Lal-lo, Cagayan, Philippines.

Specifically, it aimed to conduct morphological characteristization, like: growth habit, stem pigmentation, stem hairiness, branching pattern, leaflet shape, leaf color, leaf arrangement, flower color, pod beak, pod constriction, pod reticulation, and seed color and agronomic characteristics of peanut which includes: (a) plant height; (b) length (cm) and width of pods; (c) length and width of kernels; (d) length and width of leaflets; (e) number of seeds per pods; (f) number of developed and undeveloped pods; weight of 100 kernels, (g), weight of pods, pod thickness, survival rate (%), and shelling percentage (%), thus this study..

Materials and methods

Experimental Designa and Treatment

Varietal characterization and evaluation through morphological and agronomic characterization of four (4) peanut varieties were done at the Cagayan State University Lal-lo Campus. The seeds of four different peanut varieties (BPI Pn 9, Luna Seeded, NSIC Pn 17, NSIC Pn 11) and seed inoculants were secured at Cagayan Valley Research Center, Department of Agriculture, San Felipe, Ilagan City, Isabela. From the prepared area, 731 square meters were laid out before planting consisting of three (3) equal blocks. Each block has a dimension of 5m x 43m having a one meter alleyway between blocks and one (1) meter between plots. Each block was further subdivided into four (4) plots measuring 5m x 10m. The experimental treatments were randomly allocated in the different plots following the Randomized Complete Block Design (RCBD). The different treatments used in the study were the following: (a) Luna Seeded; (b) BPI Pn 9; (c) NSIC Pn 11; and (d) NSIC Pn 17.

Planting preparation, maintenance and Thinning

The study was conducted at the experimental area of Cagayan State University at Sta. Maria, Lal-lo, Cagayan. It has a relatively flat topography with clay-loam type of soil having an organic matter content of 3.30%, pH 5.46, phosphorus 3.20 ppm, potassium 180 ppm respectively (Soil Analysis, 2017). The area was cleared from grasses and other foreign materials, plowed and harrowed two times at one (1) week interval to keep the soil loose and fine. After the last harrowing, lay-outing was done according to the design. Furrows at a distance of 50 cm were set in every treatment. The seeds were planted 50cm between furrows and 25cm between hills in a row. The proper rate of seeding was 2-3 seeds per hill at sowing depth of 5cm. The seeds were dropped along the furrows and were covered with fine soil and slightly pressed to have an easy absorption of soil moisture and to ensure a proper contact of seeds with the soil for good germination. Thinning was done two weeks after planting maintaining two (2) healthy plants per hill to minimize overcrowding and to avoid too much competition.

Weeding, Harvesting and Data Gathering

The weeds visible in the area were eliminated by hand weeding as the need arose and hilling-up was done at 10 days after planting to provide aeration for the plants and to suppress the growth of the weeds. Watering the plant was done as the need arose while frequent field monitoring was done for possible damage of insect pest and diseases.

Ten representative sample plants were randomly taken at the middle portion of each plot using white-painted bamboo sticks the four peanut varieties reached its maturity stage at about 90 days to 110 after planting. Maturity was indicated by the normal yellowing of the foliage and shedding of the dry leaves. The presence of reticulation of pods and darkening of the veins of the inner wall of the shell husk was also used as basis. Sample plants were separated according to treatments. Harvested pods were sundried for three days depending on the weather condition.

Data Gathered

Data on plant height; (b) length (cm) and width of pods; (c) length and width of kernels; (c) number of seeds per pods; (f) number of developed and undeveloped pods; weight of 100 kernels, (g), weight of pods, pod thickness, survival rate (%), and shelling percentage (%) and Return on Investment (ROI) were gathered, tabulated and analysed following the Analysis of Variance for the Randomized Complete Block Design (RCBD).

Results and discussion

Agronomic Characteristics

Plant Height at 30, 60, and 90 Days after Planting (DAP).

Plant height of Luna seeded variety gave a highly significant height from the other varieties at 30 DAP with a mean value 33.63cm., followed by BPI Pn 9, and NSIC 17, which produced comparable mean value of 28.83 and 25.13cm. Shortest plants were observed in NSIC 11 which obtained a mean value of 23.13cm. However, the height of the peanut varieties became comparable after 60 and 90 DAP. However, the height of the plant at 60 and 90 DAP revealed no significant differences among variety means. Consistently, Luna seeded exhibited the tallest plants with a mean value of 86.30cm. Inoculation of seeds with rhizobium significantly increased plant height, leaf area, fresh weight, photosynthetic rate and dry matter production of the legume crops RAO N.K. AND BRAMEL P.J. (2000) as cited RAO C.N. *et al.* in 2005. These results conformed to the findings of Adams Frimprong, (2004) who reported that seed inoculated plants, exhibited significantly greater root and plant height as compared to uninoculated control plants.

Length and Width of 10 Pods (cm).

The length of pods exhibited significant differences (Table 2). The longest pods were produced by Luna Seeded with a mean of 4.33cm. This was followed by BPI Pn 9 and NSIC 17 having a comparable mean of 3.0cm and 3.07cm, respectively. Similar results were obtained by Borkar, V. H. and V.M. Dharanguttikar, 2014, Kyei-Boahen *et al.* (2002) and Anjum *et. al.* (2002) as cited by Rao C.N 2006.

Table 1. Height (cm) of four peanut (*Arachis Hypogaea* L.) varieties at 30, 60 and 90 Days after Planting (DAP) under Lal-Lo, Cagayan, Philippines[1].

Variety	Plant Height (cm)		
	30 DAP	60 DAP	90 DAP
Luna Seeded	33.63a	68.83	86.30
BPI Pn 9	28.83b	64.07	79.53
NSIC 11	23.13c	58.47	74.83
NSIC 17	25.13bc	58.83	81.73
	*	ns	ns

[1]Means with the same letter are not significantly different at 5% level of significance.

However, significant result was due to the structure of the four varieties. Morphologically, Luna Seeded has 4-5 seeds and lead to longer pods compare to other treatments. In terms of width, significant difference was obtained in the width of pods as shown by NSIC 17 peanut variety with a mean of 1.40 cm followed by BPI Pn 9, Luna Seeded, and NSIC 11 having a comparable mean of 1.27, 1.23, 1.23 cm, respectively. The economically important part of groundnut plant is the pod which encloses the seeds. Groundnut is an unpredictable crop due to the development of pods underground (Zaman *et al.,* 2011). Pods containing seeds are produced below ground, they vary in shape, size and texture and may contain up to five seeds per pod; only after pods attain full size, the seeds inside start to develop; a seed consists of two large cotyledons (does not contain endosperm), a stem axis and leaf primordial (plumule), hypocotyl and primary root (radicle) and seed coat; cotyledons comprise about 96% of the seed weight and are the major storage tissue for the developing seedlings.

Length and width of kernels (cm)

The length of kernels shows a significant difference among the treatment means. The NSIC 17 produced the longest kernels with a mean value of 1.592cm, followed by NSIC 11, Luna Seeded with a mean value of 1.545cm and 1.438cm and the lowest was BPI Pn 9 with a mean value of 1.233cm. The size of the seed and the number of seeds per pod are important criteria that determine the market value of groundnut in general. In addition, the pod and seed characteristics (yield components) are important in selecting parent plants before a hybridization experiment is performed with an objective to get improved varieties with heterosis (Adams Frimprong and 2004 and Borkar, V. H. and V.M. Dharanguttikar, 2014). However, the average width of kernels shows no variation among the varieties evaluated. The NSIC 17, Luna Seeded, NSIC 11and BPI Pn 9 peanut varieties produced a comparable kernel width with a mean ranging from .73mm to 76cm, respectively.

Table 2. Average mean of length (cm) and width (g) of pod and kernel and number of seeds per pod; and number of developed and undeveloped pods of four peanut (*Arachis Hypogaea* L.) varieties under Lal-Lo, Cagayan, Philippines[1].

Variety	Lengthof pods (cm)	Width of pods (cm)	Length of kernels (cm)	Width of kernels (cm)	Number of Seeds of Pods	Number of Developed Pods	Number of Undeveloped Pods
Luna Seeded	4.33a	1.23b	1.438 b	7.48	3.87a	22.37	4.00b
BPI Pn 9	3.0b	1.27b	1.233c	7.30	2.37b	24.27	7.33a
NSIC 11	2.80c	1.23b	1.545a	7.35	2.00b	28.67	6.20a
NSIC 17	3.07bc	1.40a	1.592a	7.60	2.00b	19.27	5.93ab

[1]Means with the same letter are not significantly different.

Number of Seeds of Pods

Significant differences were obtained in the number of seeds of pods. Luna Seeded garnered the highest number of seeds with a mean value of 3.87. This was followed by BPI Pn 9, NSIC 11 and NSIC 17 with a comparable mean number of 2.37, 2.00 and 2.00, respectively. The plant crop yield is a dependent variable, relies upon all other growth and yield contributing character (Borkar, V. H. and V.M. Dharanguttikar, 2014). The maximum yields of a legume crop depend upon its yield components, such as the number of branches per plant, pods per plant.

Seeds number per pod and seed weight, however density of the plant is an important agent that affect yield and yield components of legumes (Ibrahim M, *et al.* 2012).

Number of Developed and Undeveloped Pods

The number of pods shows that NSIC 11 produced the most number of developed pods with a mean value of 28.67. This was followed by BPI Pn 9, Luna Seeded and the least was NSIC 17 with their means of 24.27, 22.37, and 19.27, respectively. Each plant produces between 25 to 50 peanut. However, statistical analysis on the number of undeveloped pods shows that the differences among the peanut varieties evaluated were significant.

The result reveals that BPI Pn 9 and NSIC 11 garnered the highest number of undeveloped pods with a comparable mean of 7.33 and 6.20, respectively. This was followed by NSIC 17 and Luna Seeded varieties with a mean value of 5.93 and 4.00. Peg with positive geotropic behavior and a length of up to 15cm bears the ovary with the fertilized ovules at it tips; Once peg enters the soil and penetrates to a depth of 2-4cm, the tip becomes Diageo tropic and the ovary develops into a pod; Pod first attains full size and then the kernel inside starts developing; Under normal growing conditions of temperature, moisture and nutrition, mature seeds formed 40-60 days after fertilization (Borkar, V. H. and V.M. Dharanguttikar, 2014).

Economic Performance of Peanut Variety

Pod and kernel weight (kg) of ten peanut plants and average pod thickness. Table 3 reveals the weight of pods of 10 plants per variety and average thickness of pods. Result shows that NSIC 17 produced the heaviest pods with a mean of 3.477kg, followed by BPI Pn 9, Luna Seeded and NSIC 11 with an average mean ranging from 2.55 to 3.30kg, respectively. The table further reveals that Luna Seeded produced the heaviest pods with a mean 1.17kg, followed by BPI Pn 9, NSIC 11 and NSIC 17 with an average mean ranging from 0.93 to 1.17kg, respectively. However, the differences among treatments for these two parameters were not statistically significant.

Table 3. Economic Performance of four peanut (*Arachis Hypogaea L.*) varieties under Lal-Lo, Cagayan, Philippines.

Variety	Weight of Pods/10 plants (kg)	Weight of kernels/10 plants (kg)	Survival Rate (%)	Shelling (%)	Computed Yield /ha (tons/ha)	Cost and Return on Investment			
						Cost of Production (P)	Gross Income (P)	Net Income (P)	ROI
Luna Seeded	2.55	1.17	97.83	45.5	5.8	13,420	29,000	15,580	1.16
BPI Pn 9	3.30	1.07	96.92	32.84	5.3	13,420	26,300	12,880	9.6
NSIC 11	2.37	1.07	93.67	46.49	3.71	13,420	18,540	5,120	3.82
NSIC 17	3.47	0.93	93.50	27.24	4.06	13,420	20,310	6,890	5.13

[1]Means with the same letter are not significantly different.

For pod thickness, comparable results were obtained among the four varieties peanut varieties. NSIC 11 gave a pod thickness of 1.07mm, followed by NSIC 17, Luna Seeded and BPI Pn 9 with an average mean of 1.03mm, 0.93 mm and 0.57mm, respectively. In terms of survival rate, the table reveals that Luna Seeded garnered the highest survival rate of 97.83% followed by BPI Pn 9, NSIC 11 and NSIC 17 with 93.50% and 96.92% survival rate, respectively. Interesting to note that NSIC 11obtained the highest shelling percentage with46.49 %, followed by, Luna Seeded, BPI Pn 9 and NSIC 17with an average shelling percentage of 45.5%, 32.84% and 27.24%, respectively. However, statistical analysis shows comparable results. A higher shelling percentage indicates less seed case weight (pod) and more seed weight and so, it is economically preferable. The computed yield per hectare of four peanut varieties under Lallo condition revealed also that Luna Seeded registered 580kg (5.8 tons), followed by BPI Pn 9 with 526kg (5.6 tons), then NSIC 17 with 406.2kg (4.06 tons), and NSIC 11 with 370.8kg (3.71 tons). Among the four peanut varieties evaluated Luna Seeded gave the highest return on investment for one-hectare of 1.16, followed by BPI Pn 9 with 9.6 ROI then NSIC 17 and lastly the NSIC 11 with 5.135% and 38.2% respectively.

Conclusions and recommendation

Peanut (*Arachis hypogaea* L.) or ground nut has been a popular crop in the Philippines due to its importance. It contains 25-30% protein, 46-50% oil,

and B-complex vitamins; and (2) a soil-enriching legume that can fix about 45kg Nitrogen/ha and responds to residual soil fertility better than direct application of fertilizers. At present, no attempt has been made to determine the agronomic and economic performances of four peanut (*Arachis hypogaea* L.) varieties under Lal-lo, Cagayan, Philippines.

Economic and agronomic evaluations of four (4) peanut varieties were done at the Cagayan State University Lal-lo Campus. The seeds of four different peanut varieties (BPI Pn 9, Luna Seeded, NSIC Pn 17, NSIC Pn 11) From the prepared area, 731 square meters were laid out before planting consisting of three (3) equal blocks. Each block has a dimension of 5m x 43m having a one meter alleyway between blocks and one (1) meter between plots. Each block was further subdivided into four (4) plots measuring 5m x 10m. The experimental treatments were randomly allocated in the different plots following the Randomized Complete Block Design (RCBD). The different treatments used in the study were the following: (a) Luna Seeded; (b) BPI Pn 9; (c) NSIC Pn 11; and (d) NSIC Pn 17. The study was conducted at the experimental area of Cagayan State University at Sta. Maria, Lal-lo, Cagayan. It has a relatively flat topography with clay-loam type of soil having an organic matter content of 3.30%, pH 5.46, phosphorus 3.20 ppm, potassium 180 ppm respectively (Soil Analysis, 2017).Agronomic and economic data on (a) plant height; (b) length (cm) and width of pods; (c) length and width of kernels; (c) number of seeds per pods; (f) number of developed and undeveloped pods; weight of 100 kernels,(g), weight of pods, pod thickness, survival rate (%), and shelling percentage (%) and Return on Investment (ROI) were gathered, tabulated and analysed following the Analysis of Variance for the Randomized Complete Block Design (RCBD).

Results showed that the agronomic and economic performances of four peanut varieties significantly differ under the Lal-lo Cagayan condition. Agronomically, Luna seeded peanut variety significantly better than the other varieties and grew best in Lal-lo area as manifested by significantly high economic performance, i.e., heaviest weight of kernels/10 plants (kg), highest survival rate (%) and shelling (%). The variety registered the highest yield in tons.$^{-ha}$ and highest return on investment (ROI). It is recommended that: (a) another trial must be conducted to confirm and give more conclusive results; (b) further research and observations must be performed at different planting season. An attempt to do experiment on farmers' field must be conducted to determine the agronomic and economic performances at farmers' level.

References

Asibuo JY, Akromah R, Adu-Dapaah HK, Safo-Kantanka O. 2008. Evaluation of Nutritional Quality of Groundnut (*Arachis hypogaea* L.) from Ghana. African Journal of Food Agriculture Nutrition and Development **8(2),** 133-50.

Borkar VH, Dharanguttikar VM. 2014. "Evaluation of Groundnut (*Arachis hypogaea* L.) Genotypes for Physiological Traits." Department of Agricultural Botany, Mahatma Phule Krishi Vidyapeeth, Rahuri-413 722, Dist.: Unpublished MS Thesis. India.

Frimprong A. 2004. Characterization of Groundnuts (*Arachis hypogea* L.) in Northern Ghana. Pakistan Journal of Biological Sciences **7,** (Source: URL: http:// scialert. net/ abstract/?doi= pjbs.2004.838.842.

Ibrahim M, Florkowski W, Kolavalli S. 2012. The Determinants of Farmer Adoption of Improved Peanut Varieties and Their Impact on Farm Income: Evidence from Northern Ghana. Presented at the Agricultural and Applied Economics Association Annual Meeting, Seattle, WA.

ICRISAT. 1985. Description for groundnut (Revised). International Board for Plan Genetic Resources, Rome and International Crop Research Institute for the Semi-Arid Tropics, Patancheru, India.

Oswalt FS. 1995. "Groundnut Production Practices." International Crop Research Institute for semi-Arid Tropics, Patancheru, Andhra Pradesh 502-324, India.

Proceedings No ACIAR. 122. (printed version published in 2006).

Rao CN, Rachaputi GW, Lastus and Ramakrishna K. 2005. Improving yield and economic viability of peanut production in Papua New Guinea and Australia. In Proceedings of a workshop held in Lae, Papua New Guinea 18-19 October 2005.

Rao NK, Bramel PJ. 2000. Manual of genebank operations and procedures. ICRISAT, Technical Manual no **6,** pp 190.

USDA. 2009. Ghana: Food and Agriculture Import Regulations and Standards – Narrative. USDA Foreign Agricultural Service Global Agricultural Information Network Report number GH9004. Washington, DC: USDA.

Zaman AT. 2011. Technoserve. Outgrower Schemes-Enhancing Profitability. Technical Brief. Washington, DC: Technoserve.