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Identification Of Weight And Size Diversity Of Arbila (*Phaseolus lunatus L.*) Seed As Feed In Amabi Oefeto District, Kupang Regency

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ABSTRACT
This study aimed to identify the diversity of weight and size of Arbila (*Phaseolus lunatus* L.) seeds as feed in Amabi Oefeto District, Kupang Regency. This research was conducted in Amabi Oefeto District on October 2020 - February 2021 using a field survey method in 3 villages, namely Pathau Village, Muke Village, and Oemolo Village. The research variables were 100 air dried seed weight, 100 oven dried seed weight, and the seed size. The results showed that in Amabi Oefeto District, there were 17 accessions of arbila based on seed morphological diversity, with a fresh seed weight was 24.50 g/100 seeds - 47.50 gram/100 seeds, oven dried weight was 23.00 - 44.25 g/100 seeds, 0.60 cm – 1.20 cm, 0.10 cm - 0.40 cm thick, and 0.50 cm - 0.80 cm wide. It can be concluded that in Amabi Oefeto District, there were 17 accessions of Arbila based on seed morphology, with different weights, color patterns, length, width, and diameter.

Keywords: *Arbila (Phaseolus lunatus L.), Morphological Diversity, Weight, Size.*

1. INTRODUCTION

East Nusa Tenggara (ETN) is the province with the highest livestock population with a total population of 1,087,615 cattle, which the highest population is located in Kupang Regency with a total of 225,697 cattle [1]. The potential of the ETN area needs to be supported by the availability of forage feed following the needs of livestock because livestock productivity is determined mainly by the availability of adequate and sustainable qualified feed. The availability of qualified forage feed is still an obstacle, especially during the dry season.

The geographical location of ETN causes fewer rainy days than the other regions in Asia, where this region has an 8-month dry season (April-December) and a 4-month rainy season (January-March) [1]. The ENT region has low rainfall and short rainy days based on rainfall and rainy days. Such conditions will affect the vegetation that grows in the location and impact livestock development, especially regarding the availability of qualified forage feed.

Forage plants will experience drought and die during the dry season since they are not resistant to drought. The limited ability of energy source feed to completely meet livestock needs will decrease livestock productivity and even increase livestock mortality. It is necessary to combine feed sources of energy and protein, especially those from the legume group, to complement each other's nutritional elements needed by the livestock animal. Therefore, it is necessary to introduce the potential of ENT local feed plants, including local legumes, which have high production and are drought tolerant and can survive on marginal lands, especially in the Kupang Regency.

The legume Arbila (*Phaseolus lunatus L.*) is one of the native legumes usually used as qualified forage for cattle in ENT, especially in the Kupang Regency [2]. It grows vines with high adaptability to the environment, grows and produces well in the lowlands to highlands. It is also drought tolerant, can grow in almost all soil types, and is tolerant of acid soils. It is also reported that the vegetative part of this Arbila legume contains 11.67% dry matter (DM), 13.48% ash, 21.21% crude protein (CP),

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3.79% crude fat (CFat), and 24.21% crude fiber (CFiber). The shell of this arbila pea pod contains 18.80% CP, 0.6% CFat, 4% ash, 17.5% CFiber, and 59.1% extract material without nitrogen. The seeds contain even higher nutrients, namely 27.2% CP, 0.9% CFat, 5.5% ash, 5.2% CFiber, and 61.2% extract material without nitrogen [3].

In NTT, this plant is usually used as feed for cattle fattening. This high nutrient value is expected to be a source of protein in increasing the productivity of livestock who consume it. Therefore, arbila can be developed as a source of high quality feed, especially in the dry season and is expected to be a source of protein in increasing the value and benefits of feed gardens in dry land.

In general, the people in ENT classify this Arbila into 2 groups based on the seeds, namely those that can be consumed directly (koto aem) and those which cannot be consumed directly (koto fui) by livestock because it is toxic [4]. Based on interviews in Amabi Oefeto District, Kupang Regency, there are 2 types of Arbila plants, namely the type that can be eaten or used as an animal feed directly, and the type that cannot be directly human consumed or as animal feed. It must be boiled 10-15 times before it can be consumed. Based on interviews, it can be concluded that the darker the color of the seeds, the risk of toxic levels is higher for human consumption. Arbila plants in ENT showed various weights and sizes identified in leaves, stems, roots, flowers, pods, and seeds. This species diversity is a precious primary value for assembling and improving plant varieties. The germplasm of this Arbila plant is a very important asset that must be preserved and developed. The germplasm contains the properties needed to form or improve the desired superior varieties. Therefore, this study was conducted to determine the diversity of weight and size of arbila seeds as feed in Amabi Oefeto District, Kupang Regency.

2. MATERIALS AND METHOD

This research was conducted in Amabi Oefeto District, Kupang Regency with 3 villages as samples and the Animal Feed Technology Laboratory, Agriculture Polytechnic for 5 months, from October 2020 to February 2021.

2.1. Materials and Equipment

The equipment used in the research were Camry digital scales with a capacity of 5 kg and sensitivity of 1 g, to weigh the obtained seeds, trays as containers, glass jars with a capacity of 2 kg as a storage container for Arbila seeds, drying oven, caliper, and desiccator. The material used was Arbila seeds that are ripe and in good condition, characterized by seeds with minor wrinkle, bright colors, and free from pests and diseases. The samples of Arbila seeds were covered by paper, and plastic sacks were used to store arbila seeds shortly after harvest.

2.2. Observed Variables and Measurement Techniques

The variables observed in this study were:

a. Wilted weight. The Arbila seeds that have been grouped randomly of 100 seeds were weighed (gram) 4 times.
b. Dry matter weight. The Arbila seed was randomly picked 100 seeds and dried in a drying oven at 55ºC for 3 days. The seeds were then weighed (gram) in 4 repetitions.

Seed size. The Arbila seed was picked randomly as many as 100 seeds and then measured its length, diameter, and width (cm).

2.3. Data Collection Method

This study used a direct survey method in the field. Seed samples were collected from 3 villages in Amabi Oefeto District, namely Oemofa Village, Pathau Village, and Oemolo Village. The selection of the three villages as the research locations was using the Non Probability Sampling technique based on the consideration that these three villages have the highest diversity of Arbila seeds (*Phaseolus lunatus L.*) among other villages in Amabi Oefeto District. The data acquisition method was conducted by observing the characteristics of the seeds. The research was conducted by direct morphological observation and documentation. Variable measurements for each type of seed were repeated 4 times.

2.4. Research Procedure

Research procedures include:

a. Arbila seeds were collected from 3 villages, namely Pathau Village, Muke Village, and Oemolo Village in Amabi Oefeto District, Kupang Regency.
b. Seeds collected were identified by its diversity of weight and size according to the variables to be observed.
c. The seeds that have been identified are then be grouped based on the number (100 seeds) in each size group [5]
d. Then the seeds that have been grouped are weighted according to their respective types.

The seeds were then placed in a drying oven at 55˚C for 3 days. After that, the seeds were dried, put it in a desiccator. Later, each seed was weighed.

2.5. Data Analysis

The data obtained was analyzed descriptively and tabulated in a tabular form.

3. RESULTS AND DISCUSSIONS

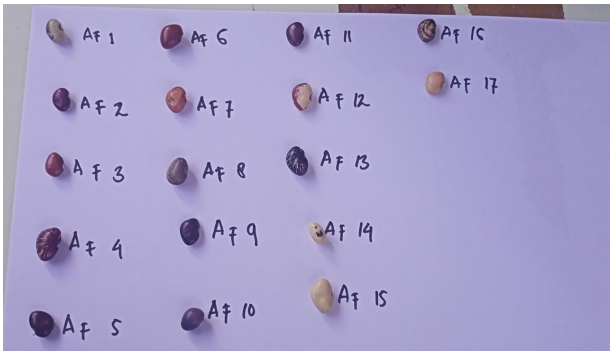

Figure 1. The appearance of 17 Arbila accessions found in Amabi Oefeto District

This research shows that 17 different accessions of Arbila were obtained, grouped based on the diversity of seed morphology. The diversity of weight and size of each group of Arbila seed samples collected were identified during the research. The air dry weight air and the weight after being dried in a drying oven at 55˚C for 3 days were measured to obtain data for calculating the weight difference. The data from this study were then tabulated.

There were 17 accessions of the Arbila found in Amabi Oefeto sub-district. Each accession of the Arbila seeds had morphological diversity reflected in the color pattern of the seeds. The color of the Arbila seeds found in Amabi Oefeto sub-district varied from maroon red, blackish red, dark brown, plain black, black with white patterns, plain white, milky white, a mixture of red and white, purple, and gray with white stripes.

Based on observations, from 17 accessions of the Arbila found in Amabi Oefeto District, 9 accessions belonged to the *koto fui* category (the type of arbila which needs further processing). Due to harmful content in this type of arbila, it needs further processing to be safe consumed. The processing can be done by boiling it approximately 12 to 15 times, while the other 8 accessions belonged to the *koto aem* category (the type of Arbila without further processing).

3.1. Wilted Weight

The average wilted weight seed found in Amabi Oefeto District was 34.53, with the lowest weight 24.5 gram/100 seeds at accession 9. This weight was lower with the lowest weight of 30 gram/100 seeds [5]. The highest weight found in Amabi Oefeto District was 47.5 gram/100 seeds at accession 4. This weight was lower than 126 gram/100 seeds [4]. The weight diversity of the Arbila seeds is caused by many factors, namely genetic factors, cultivation techniques, environment, climate, harvest and postharvest [6].

Table 1. The characteristic of Arbila seeds

Accessions	Air Dried Seed Weight (g/100 seeds)	Oven Dried Seed Weight (g/100 seeds)	Size of seed		
			Length (cm)	Diameter (cm)	Width (cm)
AF 1	34.00	31.00	0.94	0.31	0.55
AF 2	26.75	25.25	0.91	0.22	0.68
AF 3	33.00	31.00	0.91	0.39	0.65
AF 4	47.50	44.25	1.22	0.40	0.79
AF 5	28.25	26.75	0.89	0.26	0.63
AF 6	31.75	29.75	0.89	0.38	0.66
AF 7	31.75	30.25	0.82	0.33	0.65
AF 8	43.00	40.25	0.74	0.47	0.69
AF 9	24.50	23.00	0.89	0.20	0.57
AF 10	42.75	40.00	0.87	0.37	0.63
AF 11	26.50	24.75	0.94	0.18	0.68
AF 12	37.50	35.00	0.65	0.35	0.59
AF 13	44.25	41.50	1.07	0.39	0.85
AF 14	33.00	30.00	0.85	0.43	0.59
AF 15	35.71	33.30	1.09	0.28	0.67
AF 16	38.00	34.00	0.91	0.22	0.65
AF 17	28.81	25.42	0.87	0.35	0.57

3.2. Dry Mattet Weight

The Arbila seeds experienced a weight loss of 6.98%. The weight of arbila seeds before being put into the oven ranged from 15 gram - 47.5 gram with an average weight of 32.61 gram, but after being dried in an oven at 55˚C for 3 days, the weight of arbila seeds decreased with a weight range of 14 to 44.25 grams/100 seeds. This is because, during the drying process in the oven, there is a process of evaporation of water from the Arbila seeds. During the drying process, there was a reduction in the weight of the material due to the evaporation of water [7]. The water content in the seeds was slightly reduced due to the heat received during the drying process in an oven at 55ºC.

The weight of seeds after oven ranged from 23 - 44.25 gram/100 seeds with an average weight of 32.08 gram. The weight of this seed is higher than 9.50-36.10 gram [8]. This is due to differences in temperature and the environment where the seed grows. This weight range is

relatively the same as the weight of Arbila seeds found in Nekamese, which was 11.43-103.29 gram/100 seeds [5].

3.3. Length of Seeds

The most extended Arbila seeds are found in accession 4 with a size of 1.22 cm and the shortest is in accession 12 with a size of 0.65 cm. There are 3 accessions with a length above 1 cm (17.64%) in accessions 4, 13 and 15. The other 13 accessions have a length ranging between 0.70-1.00 cm (76.47%) that is accessioned 1, 2, 3, 5, 6, 7, 8, 9, 10, 11, 14, 16, 17 and 1 accession that has a length below 0.70 cm (5.88%) that is accession 12. The length of the Arbila seeds in this study ranged between 0.65 to 1.22 cm. The length range of the Arbila seeds is smaller than that was reported by [4], which is 0.91-2.09 cm.

3.4. Diameter of Seeds

The thickest seeds are found in accession 8 with a diameter of 0.47 cm and the smallest are found in accession 11 with a diameter of 0.1 cm. There are 11 accessions (64.70%), accession 1, 3, 4, 6, 7, 8, 10, 12, 13, 14, and 17 that has diameter range > 0.30 cm. Accession 2, 5, 15 and 16 (4 accessions 23.52%) have in diameter of 0.20 - 0.30. Accession 9 and 11 (2 accessions, 11.76%) have in diameter of < 0.2 cm. The diameter of Arbila seeds in this research ranged from 0.17-0.47 cm. It is shorter than what was found in Fatuleu District, which is 0.22-0.57 cm [4].

3.5. Width of Seeds

The widest seed was found in accession 13 with a size of 0.84 cm and the smallest width was found in accession 1 with a size of 0.5 cm. There were 2 accessions (11.76%) that have a seed width size > 0.07 cm that is accessions 4 and 13. There were 10 accessions (58.82%) with a width size ranging between 0.6-0.7 cm that is accession 2, 3, 5, 6, 7, 8, 10, 11, 15, and 16. There were 5 accessions (29.41%) have a width size <0.6; it was accessioned 1, 9, 12, 14 and 17. The width of Arbila seed in this research ranged between 0.55-0.85 cm. This seed width was lower than that reported by [4], which ranged between 0.46 - 1.20 cm. Arbila beans have high genetic diversity.

Morphological diversity can be come fromm genetic aberrations, genetic isolation and changes in reproductive behavior involving high levels of parenting breeding and selfing [9]. In addition, there are environmental factors that can affect the growth and productivity of Arbila seed, which can be sunlight, air temperature, rainfall, soil water content, pH, nutrient content and soil aeration [10].

4. CONCLUSIONS

It can be concluded that in Amabi Oefeto District, there were 17 Arbila accessions based on seed morphology. Fresh weight 24.5 grams/100 seeds 47.5 grams/100 seeds, oven dry weight 23 grams/100 seeds to 44.25 grams/100 seeds, arbila seeds length ranged from 0.65 cm to 1.22 cm, thick 0.17 cm 0.47 cm, and 0.55 to 0.85 cm wide.

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