

## Conference Paper

# The Relationship Between Pod Length and the Quality of Indigofera Gozoll Agribun Plant Seeds

Mahyuni K. Harahap\* and R. Hutasoit

Indonesian Goat Research Station, PO BOX 1 Sei Putih, Galang 20585, Deli Serdang, North Sumatera, Indonesia

**ORCID**<https://orcid.org/0000-0001-9912-8685>**Abstract.**

*Indigofera gozoll agribun* is a legume tree plant that has high nutritional quality as animal feed. However, it still has problem with the low seed quality. This study aimed to evaluate the relationship between pod length and the quality of *Indigofera* seeds. This research was designed in a completely randomized design with five treatments of pod length size and four replications, namely: P<sub>1</sub> (3.5 cm), P<sub>2</sub> (4 cm), P<sub>3</sub> (4.5 cm), P<sub>4</sub> (5 cm) and P<sub>5</sub> (5.5 cm). The parameters observed were: characteristics and morphology of pods and the growth of sprouts *Indigofera* seed. The results showed that the percentage of germination, plumule length and radicle length were significantly different at the 5% level, while the number of leaves and sprouts weight were not significantly different. The treatment of P<sub>4</sub> obtained the highest germination percentage (65.5%) and radicle length of 1.05 cm, while P<sub>5</sub> obtained the highest germination weight and plumule length respectively (0.53 and 3.38 cm), as well as the highest number of leaves (1, 26 strands). It can be concluded that the pod length of 5 cm can be recommended to obtain the best quality *Indigofera* seeds.

**Keywords:** *Indigofera gozoll agribun*, seed, pod length, sprouts

## 1. Introduction

Sub-sector in the livestock plays an important role related to food security, particularly in providing meat as a source of animal protein and accelerating the achievement of beef self-sufficiency. Livestock business development has a dependence on the availability of feed. Forage is the main source for feed ruminants, therefore the provision of adequate forage, both in terms of quantity and quality are important matter to be considered seriously in an effort to increase ruminant livestock production. The raising of livestock production in Indonesia is still traditional system, the forage provided is grass and legumes from the natural vegetation, the edge of rice fields, moorlands, roadsides and riverside which are of low quality and limited availability, especially during the dry season.

Corresponding Author: Mahyuni K. Harahap; email: khairiyahharahap85@gmail.com

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In the context of developing ruminants, quality feed should be provided. Nowadays, the popular forage crop is *Indigofera gozoll agribun* a kind of tree legume plant that has high nutritional quality containing 27.9% crude protein, 15.25% crude fiber, 0.22% calcium and 0.18% phosphorus with digestibility reaching 77%, tolerant of dry seasons, puddle and salinity [1]. This plant is very good as a basic feed and as a supplement for protein and energy, especially for livestock in high production status (lactation). Another advantage of this plant is that its tannin content is very low, ranging from 0.6-1.4 ppm (below of the level that can cause anti-nutritional properties). The low tannin content also has a positive impact on its palatability [2].

*Indigofera* plant development is done with seeds. However, the problem currently faced is the low germination rate. Several studies that have been conducted to increase the germination of *Indigofera* seeds include: the treatment of seeds against temperature affects the germination of *Indigofera miniata var leptosepala* resulting in an average shoot growth of 63% [3]. The percentage of *Indigofera* seed germination was 28-35% and increased 67-74% by providing organic matter [4]. *Indigofera* seeds produced 36% germination at the level of 10% CO<sub>2</sub> injection [5]. Comparing 5 different immersion temperatures [6] obtained the highest growth germination of 42% at 100° C treatment.

Following up on previous research [7] who tested different pod colors on *Indigofera* seeds showed that the color of brownish green pods had higher sprouts (62%). Apart from different pod colors according to our observations at harvest time, there are also differences in the size of *Indigofera* pods, including: 3.5 cm, 4 cm, 4.5 cm, and 5.5 cm. From this size there is a high probability that the germination is different. Previous research [8] report the pod dimensions affect the germination capacity of Malpari (*Pongamia pinnata* Merrill) plants. The bigger of fruit/pods used will produce the higher of germination.

Information about the effect of pod length on seed germination is still minimal especially in *Indigofera* plants. Limited information on obtaining quality seeds is one of the obstacles in implementing its development. The quality of seeds are one of the factors determining the high of germination. Morphological character is an initial selection to get good quality seeds such as pod color and pod size. There is no information yet about the pod size of *Indigofera* seeds that is suitable for harvesting. Therefore, the aim of this study was to evaluate the relationship of pod length to the quality plant seeds of *Indigofera gozoll agribun*.

## 2. Materials and Methods

This activity was carried out in the experimental field and laboratory of the Goat Research Station, Deliserdang Regency, Nort Sumatera, Located at an altitude of  $\pm$  50 m above sea level with an average temperature of 27°C, 70% humidity and 1800 mm/year of rainfall. The time of the research was carried out from January to April 2020. The pods used in this study were brownish green colour in accordance with previous research [7]. The legume seeds used were *Indigofera gozol agribun* as much as 15 g. Materials and tools used in this study include petri dishes, measuring cups, hot plates, thermometers, water and cotton. This research was conducted with a completely randomized design (CRD) consisting of five length levels of pods, namely:  $P_1 = 3.5$  cm,  $P_2 = 4$  cm,  $P_3 = 4.5$  cm,  $P_4 = 5$  cm and  $P_5 = 5.5$  cm. Each treatment was carried out with 4 replications so that there were 20 treatment plates. Indigofera seeds are soaked with water at 100°C and left them for one night (12 hours), then the water is drained and sown into a petri dish which has been covered with a damp cotton ball. Each plate was sown with 50 Indigofera seeds so that the total seed needed was 1000 seeds. The seeds were observed from the second day until to 30th day after seeding.

### 2.1. Parameters observation

The morphological characteristics observed in this study were :

1. Fresh weight of pods. Obtained by weighing the pods used from each treatment
2. Color Pods. Adjusted using a leaf color chart
3. Pod diameter. Measured using a caliper at the center of the pod
4. Number of seed pods. Dry pods are milled using a blender, then filtered, cleaned and selected according to predetermined criteria, then count the number of seeds obtained and divided by the number of pods.
5. Seed weight. The seeds obtained from each treatment were weighed

The parameters observed were:

1. The growth of sprout (Gos)

The growth of sprout was measured by counting the number of sprouts growing on the 30th day, which was estimated no more sprouts were growing, then calculated the percentage of sprouts growing in the formula:

$$Gos = \frac{\sum \text{sprout}}{\sum \text{total seeds planted}} \times 100\%$$

1. The length of plumula.

The length of plumula was measured on the 15th day after planting. the plumules measured from the base of the sprouts to the tip of the sprouts.

1. The length of radicle

The length of the radicle was measured from the base of the sprouts to the tip of the radicle root

1. The number of sprout leaves

To obtain the number of sprout leaves (Nos) was done by the formula:

$$Nos = \frac{\sum \text{sprout of leaves}}{\sum \text{growing sprouts}}$$

## 2.2. Statistical analysis

The data obtained were analyzed with a linear model using SPSS-17 software. Significant differences among treatment means were tested using Duncan's multiple range test (DMRT) at the 5% level of.

## 3. Results and Discussion

### 3.1. Morphological characteristics of indigofera pods and seeds

The effect of pod length treatment on the characteristics, morphology pod and seeds of Indigofera presented in Table 1.

The data shows that the longer pod size indicated the heavier of the pods. The treatment of P<sub>5</sub> (5.5 cm) had more weight (2.10 g) compared to other treatments. The diameter of pod had almost the same size in all pod length treatments (average 4.16 mm). Likewise for the number seed/pods, the average number owned is five seeds/pod, mostly in the P<sub>3</sub> (5.35). This result is higher than that reported by Hutasoit [7] as much as 3.6/pod in a study of color treatment of Indigofera pods. The weight of seed has almost the same weight in each treatment. Although not significantly different, these data indicate that the longer of pod size has the heavier of seed. This is consistent

TABLE 1: Characteristics, morphology pod and seed of *Indigofera gozoll agribun*

Parameters	Length of Pod				
	P <sub>1</sub>	P <sub>2</sub>	P <sub>3</sub>	P <sub>4</sub>	P <sub>5</sub>
The weight of Pod (g)	1.21	1.36	1.54	1.92	2.10
Diameter Pod (mm)	4.3	4.1	4.2	4.1	4.1
Number seed/pod	5	5	5.35	5.03	5.15
The weight of seed (g)	0.25	0.28	0.30	0.35	0.36

with the report by Logo [9], that pod size affects to the characteristics of the seeds in soybean plants.

### 3.2. The growth sprouts of indigofera seed

The results of research on the growth sprouts of *Indigofera* seed are shown in Table 2. The average germination rate obtained in this study was 52.6%. The sprout growth increased in line with increasing of the pod size, the highest was in P<sub>4</sub> treatment with pod length of 5 cm (65.5%) but decreased again at 5.5 cm pod length. Statistical analysis showed that P<sub>4</sub> treatment was not significantly different from the treatment of P<sub>2</sub>, P<sub>3</sub> and P<sub>5</sub> respectively obtained 49.5, 56 and 52.5. However, significantly different from treatment P<sub>1</sub> which is the shortest size (3.5 cm) by 39.5 cm. The germination test in this study was still below from the SNI standard. According to the Directorate General of Food Crops [10], the standard (SNI = Indonesian National Standard) seeds that can grow must be a minimum of 75% and plants must be able to grow normally under optimal conditions.

The germination weight was not significantly different in each treatment. The heaviest sprouts (0.53 g) were found in the P<sub>5</sub> treatment, this indicated that plants with higher germinating weight would show better plant growth than those with lighter sprouts. That heavy and large seeds have the potential to produce better growth than small and light seeds [8].

Based on statistical analysis, plumule length differed significantly in each treatment. The longest plumule was found at P<sub>5</sub> (3.38 cm) and the shortest at P<sub>3</sub> (2.62 cm). These results indicate that the size of the long pods has long plumules as well. This is most likely the effect of the size of the seeds obtained in the P<sub>5</sub> treatment (Table 1) which could affect the characteristics of the *Indigofera* seed sprouts. The large size of the seeds is very influential in germination because there is a food reserve (endosperm) in

TABLE 2: The growth of sprouts Indigofera seed.

Parameters	Length of pod				
	P <sub>1</sub>	P <sub>2</sub>	P <sub>3</sub>	P <sub>4</sub>	P <sub>5</sub>
Growth of sprouts (%)	39.5 <sup>a</sup>	49.5 <sup>ab</sup>	56 <sup>ab</sup>	65.5 <sup>b</sup>	52.5 <sup>ab</sup>
Weight of sprouts (g)	0.35	0.30	0.36	0.51	0.53
Length of radicle (cm)	0.95 <sup>c</sup>	0.76 <sup>a</sup>	0.87 <sup>b</sup>	1.05 <sup>e</sup>	1.00 <sup>d</sup>
Length of Plumula (cm)	3.18 <sup>c</sup>	2.96 <sup>b</sup>	2.62 <sup>a</sup>	3.34 <sup>d</sup>	3.38 <sup>d</sup>
Number of leaves (strands)	1.41	1.10	1.17	1.18	1.26

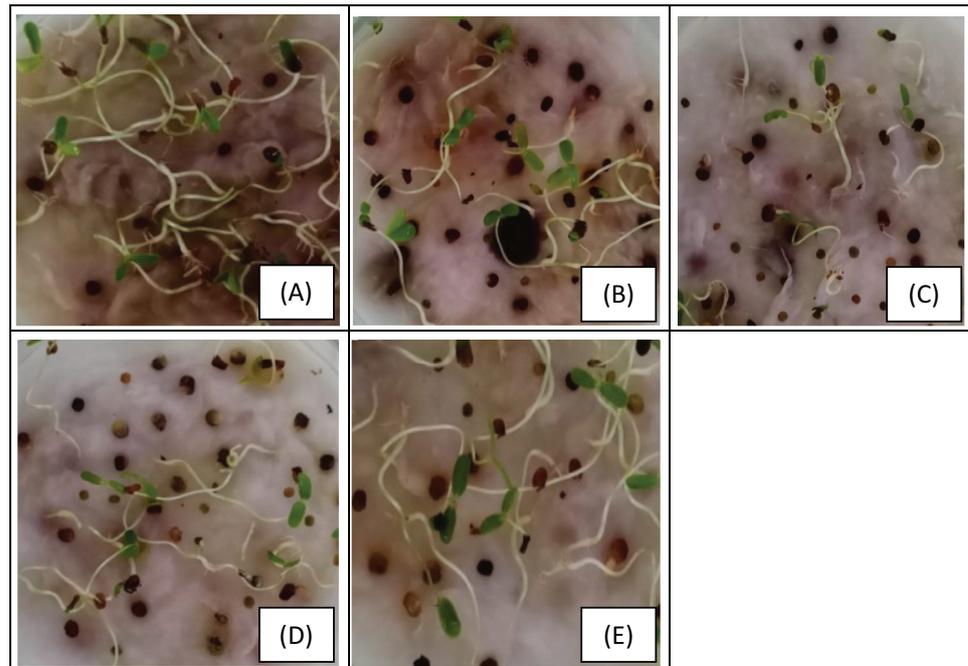
Note: Values with different superscripts are significantly different ( $P < 0.05$ )

the seeds which functions to supply food for the seeds during the germination process [11].

The effect of pod size on the length of radicle obtained showed that the longest size was in treatment P<sub>4</sub> of 1.05 cm and the smallest in treatment P<sub>2</sub> (0.76 cm). Significantly different for all treatments. This will affect the growth and production of Indigofera plants. Previous research stated that the longer roots will have higher growth and production [12]. The length of the plumule will be in line with the length of the radicle. Likewise, if the seeds grow faster followed by the rapid growth of radicles as well, and produced the longer plumules.

The observation parameter on the number of leaves was different with other parameters in this study, the highest number of leaves was in treatment P<sub>1</sub> which was in the shortest pod (3.5 cm) as many as 1.41 strands. In the P<sub>2</sub> of treatment the number decreased to 1.10 strands, but again increased followed by pod lengths in P<sub>3</sub>, P<sub>4</sub>, and P<sub>5</sub>, respectively obtaining 1.7, 1.8 and 1.26 strands. Even numerically not really different, it is likely that Indigofera seeds derived from short pods have a higher gibberellin content. The concentration of gibberellin (GA3) is able to stimulate plant growth by increasing plant height and leaf area [13]. Added the gibberellin not only promotes stem elongation, but also the growth of all plant parts including leaves and roots [14]. In addition, gibberellin will stimulate auxin synthesis which is needed for root growth. Synergistically, the increase in gibberellin in a plant is always accompanied by an increase in auxins and cytokinins. So that gibberellins, auxins, and cytokinins work together in the process of plant growth and development even though the phases they affect are different.

In the Figure 1, the best sprouts of Indigofera plants at 15 days after planting were found in the P<sub>5</sub> treatment (the longest of pod size). This can be seen from the many sprouts growth, heavier germination weight and longer, uniform plumules and germination medium. Not covered by fungi in contrast to the P<sub>1</sub> treatment and other treatments



A): Sprouts of pods 3,0 cm;  
 B): Sprouts of pods 4 cm;  
 C): Sprouts of pods 4,0 cm;  
 D): Sprouts of pods 0 cm;  
 E): Sprouts of pods 0,0 cm

**Figure 1:** The growth of sprouts Indigofera plant at the age of 15 days after planting.

the sprouts that grew had a lot of fungi on the growth medium, it could be seen from the color of the cotton turning blackish brown.

## 4. Conclusions

From the results of this study, it could be concluded that the pod length affected to the growth of Indigofera seed sprouts. The treatment of pod length 5 cm gave a high percentage of germination, weight of sprouts and long plumules. Thus the pod length of 5 cm can be recommended in the selection process to obtain quality Indigofera seeds

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