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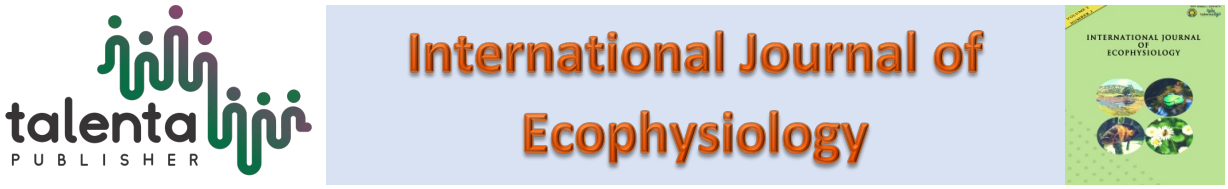


# THE EFFECT OF THE QUALITY OF *Morus cathayana* LEAVES AGAINST NUTRITION INDEX *Bombyx mori* L.

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**Abstract.** The effect of quality mulberry leaf *Morus cathayana* on nutrition index of silkworm *Bombyx mori* L. have been conducted . This research was Completely Randomized Design (CRD) by two treatments. The first treatment was mulberry plant that cultivated on soil with Urea, TSP and NPK fertilizers and the second was the plants were not fertilized l. Each treatment was replicate 20 times. The results showed that the addition of Urea, TSP and NPK fertilizer on mulberry has effect ($p<0,05$) on increasing of the growth rate (GR) of instar III, the consumption rate (CR) of instars III and V, and efficiency of conversion of ingested food (ECI) of instar III and V. In addition, approximate digestibility (AD) of instar III, IV were 20%, 7%, 24%, 40% and then V was 51%, 15%, 21% and 70% respectively .

**Keyword:** chili pepper, dry weight, varieties, water use efficiency, relative water content

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## 1 Introduction

Silk nature in Indonesia capable improve business community as additional income in the late 1960s. But effort to show a downward trend due to technical factors that cannot be resolved [1]. Still low production of silk in the country, the government should promote the cultivation of silkworms. Various operational policies have been carried out by the government in order to increase the production of silk threads, including the opening and expansion of natural silk areas, the development of superior mulberry species, and improvement of silkworm nurseries

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[2]. Efforts to increase silk thread production may be achieved if the use of superior varieties of mulberry and silkworm seeds.

In line with the government's efforts to increase the production of silk thread, it is necessary to make a breakthrough in silkworm cultivation. One of the efforts made is by applying fertilizer to the *Morus cathayana* mulberry plant as silkworm feed to replace a number of essential elements lost from the soil that are absorbed by plants. In this study, inorganic fertilizers were used, namely Urea, TSP and NPK fertilizers. This fertilizer has a very important role in plant growth and production so that it is expected to increase the nutritional index of *Bombyx mori* L. silkworms [3].

**Materials and Methods**

The research model used was non-factor experimental research with a completely randomized design (CRD) with 20 replications. The treatment consists of mulberry *Morus cathayana* that without fertilizer and manure with the following symbols: P0 = Without fertilizer and P1 = P UPUK, fertilization dose can be seen in Table 1.

Mulberry planting land area of 10x3 m which was in front of Sumatra University Forest Tridarma Utara 2 is divided into cultivated land and land without fertilizer each respective area of 5x3 m, depth 30-50 cm. The beds are made 5-10 cm high. Mulberry cuttings were obtained from Kacinambung Village, District Kabanjahe, Karo District, North Sumatra province cut Sepan which 20-25 cm with 4-5 buds of fruit. One end of the cuttings is cut into a ± 1.5 cm taper and the other end is horizontal and planted . Mulberry plant cuttings have been planted, nurtured and fertilization by sprinkling fertilizer on mulberry plants.

Table 1. Dose of Mulberry Fertilization

| Type of Fertilizer | Nutrient Content | Content (%) of Nutrients | Fertilization Dose (kg / ha) | Fertilization Dose Conversion (kg / $m^2$) |
|---|---|---|---|---|
| Urea | N | 46% N | 210 | 0.32 |
| TSP | P | 36% P | 100 | 0.15 |
| N, P, K | N, P, K | 16% N, 16% P, 16% K | 260 | 0.39 |

(Balai Persuteraan Alam [4]).

The silkworm eggs were obtained from the Candiroto Silkworm Nursery, Central Java. Eggs are wrapped in white HVS paper, then carbon paper and arranged in a plastic basket until they hatch. Silkworm newly hatched were divided into two treatment groups that silkworms fed mulberry leaves *Morus cathayana* t anpa fertilizers (P0 ) and fertilizers (P1 ) which each consist of 20 caterpillar and put in a petri dish previously lined with moistened tissue and lining paper.

At the end of the second instar, the caterpillars that have stopped eating are placed separately to replace the cuticles. After changing the cuticle, the caterpillar enters the initial third instar and is weighed. Mulberry without fertilizer and manure before it is given weighed beforehand. At the end of the third instar, which is marked by the caterpillar having stopped eating and changing the cuticle where the silk worm rearing is cleaned of feces and food residue. At the end of the third instar the silkworms are weighed . The feces and feed residue produced by the caterpillars are then collected and dried in an oven at 60°C until constant weight . The same is done at the beginning and end of instar IV to instar V.

The parameters of the nutritional index from Waldbauer [5] as modified by Scriber and Slansky [6] are:

- Larval growth rate (GR) .

  $$\text{GR} = \frac{G}{TW}\,(mg/day)$$

- Larval consumption rate (CR)

  $$\text{CR} = \frac{F}{TW}\,(mg/day)$$

- Digested feed conversion efficiency (ECD)

  $$\text{ECD} = \frac{G}{(F-E)} \times 100\%$$

- Larval- eaten feed conversion efficiency (ECI)

  $$\text{ECI} = \frac{G}{F} \times 100\%$$

- Estimated feed ingested (AD)

  $$\text{AD} = \frac{(F-E)}{F} \times 100\%$$

Note: G = Weight gain of larvae during instar III-V, E = weight of faeces produced by larvae during instar III-V, F = weight of feed eaten by larvae during instar III-V, T = length of feeding period during instar III-V, W = Average weight of larvae during III-V instar . All of the above calculations are calculated in dry weight .

The data obtained from each parameter (variable) of observation are recorded and arranged in tabular form. The quantitative data (dependent variable) obtained were tested for their significance on the effect of the treatment group (independent variable) with the help of a computer statistical program, namely the SPSS release 16 program . The test sequence begins with the normality test, the homogeneity test. If the test results show $p<0.05$ then the data is transformed and continued with a non-parametric test. To see the difference between the 2

treatments (control and treatment), the T test analysis (parametric, for $p>0.05$) or Mann-Whitney (non-parametric, for $p<0.05$) was performed.

## Result and Discussion

From the research results the effect of *Morus cathayana* mulberry leaf quality on the nutritional index of *Bombyx mori* L. silkworms . we will get the results :

### Growth Rate (GR) of Star Silkworm III, IV and V

Figure 1 shows that the growth rate (GR) third instar larvae that consume leaves of *Morus cathayana* without fertilizer of 0.36 mg/day lower than the larvae consume mulberry leaf feed fertilizers was 0.45 mg/day and statistically significantly different ($p<0.05$). The growth rate (GR) of larvae consuming mulberry leaves without fertilizer at IV instar was 0.35 mg / day and instar V was 0.13 mg/day lower than larvae consuming mulberry leaves given IV instar fertilizer of 0.40 mg/day and instar V of 0.14 mg/day were not statistically significant ($p>0.05$).

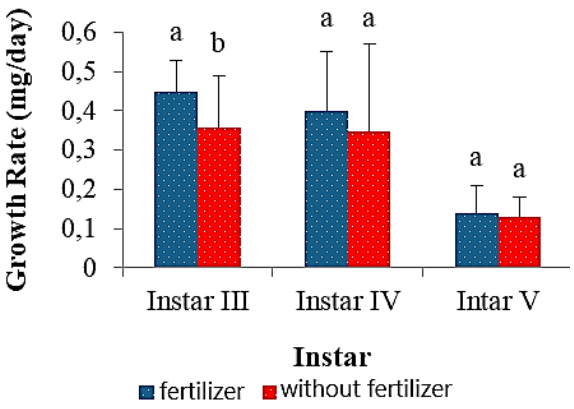


Figure 1. Mean of growth rate (GR) of the silkworm (*Bombyx mori* L.) by the leaves of mulberry (*Morus cathayana*) with a treatment different for instar III, IV and V.

The growth rate of silkworms consuming *Morus cathayana* mulberry leaves that were fertilized was higher than those without fertilizers. The application of Urea, TSP and NPK fertilizers causes changes in the nutritional content of mulberry leaves. The nutritional content is in the form of protein, carbohydrates, fat, water and ash. Ash is related to the mineral content of mulberry leaves. Protein and water in fertilized mulberry leaves produced relatively higher values than those without fertilizers, while carbohydrates, fat and ash resulted in low values for fertilized mulberry leaves. The relatively higher protein and water content and lower carbohydrate, fat and ash content are consumed by silkworms (Figure 2), resulting in high growth. According to Samsijah and Kasumaputera [7], the main needs of third instar silkworms are water and protein. In IV and V instar silkworms need more protein and carbohydrates, especially for the formation of silk glands.

**Consumption Rate (CR) of Instar Silkworm III, IV and V**

Figure 2 shows that the l aju consumption (CR) third instar larvae that consume mulberry leaves without fertilizer at 2.11 mg/day and larval instar V of 0.86 mg/day lower than larvae that consume mulberry leaves are fertilized by 2 , 28 mg/day and the V instar of 1.14 mg/day were statistically significantly different ($p<0.05$). The consumption rate of IV instar larvae consuming mulberry leaves without fertilizer was 1.18 mg/day lower than larvae consuming mulberry leaves that were given fertilizer, the consumption rate value was 1.39 mg/day and statistically significantly different ($p<0,05$).

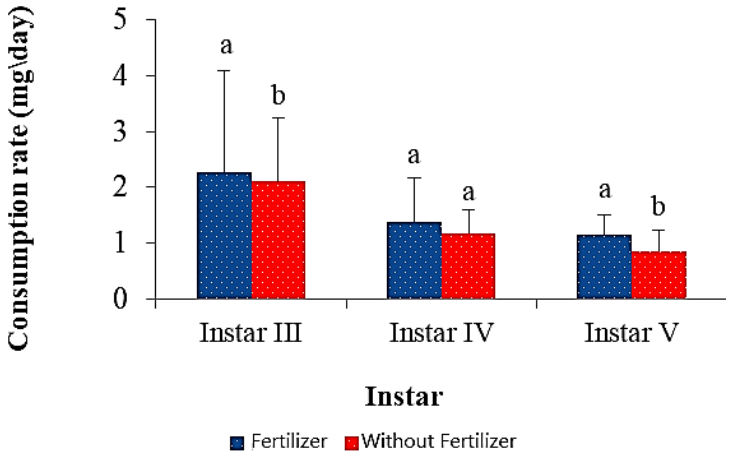


Figure 2 . Mean of consumption rate (CR) silkworm (*Bombyx mori* L.) by the leaves of mulberry (*Morus cathayana*) treated differently during instar III, IV and V.

Consumption rate that consumes silkworms mulberry leaves which plants are fertilized higher than without fertilizer. This is because mulberry plants that are given fertilizer have a higher nutrient content in the form of protein so that the caterpillars consume more mulberry leaf feed which is given fertilizer. According to Tazima [8], good feed in addition to having complete nutritional content or nutrition that is used for larval growth, must also have a good taste so that the larvae will consume a lot of the feed, while the food that lacks a good taste, the larvae consume less then.

**Efficiency of Digestive Feed Conversion (ECD) Silkworm Instar III, IV and V**

Figure 3 shows that the efficiency of conversion of digested food (ECD) of feed ingested larval instar III, IV and V are consuming mulberry leaves without fertilizers amounted to 60.4 % , 47.15 % , and 28.35 % lower than larvae that mulberry leaves consumed by fertilizer value it digests feed conversion of 68.4 % , 54.75 % and 32.15 % was not statistically significantly different ($p>0.05$).

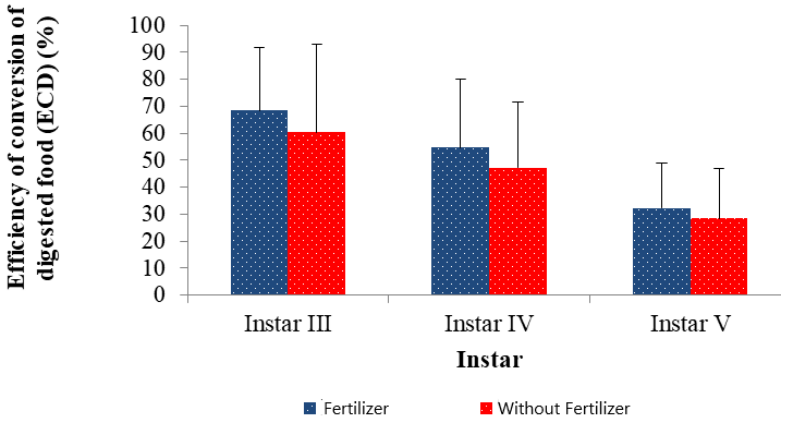


Figure 3 . The average value of efficiency of conversion of digested food (ECD) silkworm (*Bombyx mori* L.) were given leaves of mulberry (*Morus cathayana*) with a treatment different for instar III, IV and V.

According to Ahmad et al ., [9] silkworm mulberry leaves consumed with protein and high water will yield higher growth and easily absorbed by the body for growth. The efficiency of food use can be used to determine the best food for *Bombyx mori* L. silkworms .

**The Eaten Feed Conversion Efficiency (ECI) Silkworm instar III, IV and V**

Figure 4 shows that the conversion efficiency of feed eaten (ECI) larval instar III and V are eat mulberry leaves without fertilizers amounted to 28.30% and 14.25% lower compared to larvae consume mulberry leaf fertilizers amounted to 47.88% and 29.35% were not statistically significant ($p<0.05$). ECI fourth instar larvae were eating the leaves of mulberry without fertilizer by 26.74% lower than larvae that consume mulberry leaf fertilizers amounted to 39.30%, how statistically significantly different ($p>0.05$).

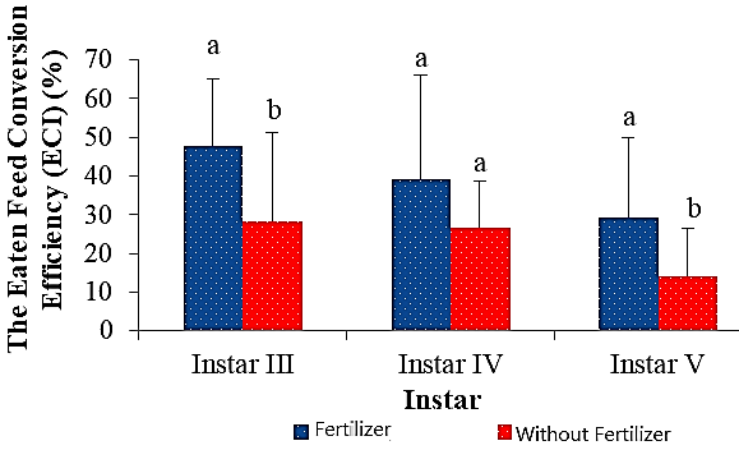


Figure 4 . Mean of the Eaten Feed Conversion Efficiency (ECI) silkworms (*Bomby mori* L.) Were given leaves of mulberry (*Morus cathayana*) with different treatment during instar III, IV and V .

The value of the edible feed conversion efficiency (ECI) of *Morus cathayana* mulberry leaves which was given fertilizer was higher than that of mulberry leaves without fertilizer . The application of urea, TSP and NPK fertilizers to mulberry plants causes the nutrient content in the form of carbohydrates and protein in mulberry leaves to be high so that the silkworms consume more mulberry leaves that are given fertilizer. With the large number of caterpillars consuming mulberry leaves that are given fertilizer, the caterpillar growth is getting bigger so that the caterpillars are more efficient in utilizing the food seen from the growth . K onsumsi caterpillar bes ar going piled into Fat body for use as a food reserve at the time of pengokonan [10].

e. Estimated Feed Digest (AD) Silkworm Instar III, IV and V

Figure 5 shows that the estimated feed ingested (AD) of instar III , IV and V larvae consuming mulberry leaf feed without fertilizer is 46.03%, 41.82% and 14.96% lower than the third, IV and third instar larvae . V who consumed mulberry leaf feed which was given fertilizer was 54.32%, 52.96% and 50.30% which was statistically significant ($p<0.05$).

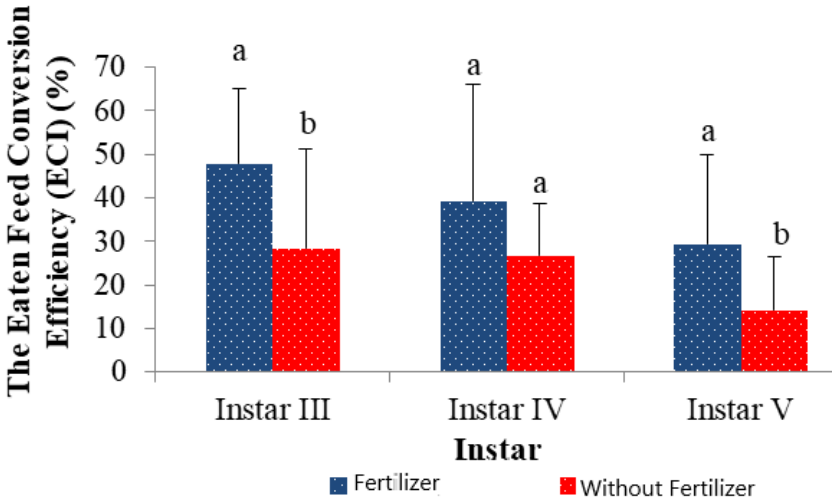


Figure 5 . Mean estimate of feed ingested (AD) silkworm (*Bombyx mori* L.) were given leaves of mulberry (*Morus cathayana*) with a treatment different for instar III, IV and V.

The estimated value of ingested feed (AD) on *Morus cathayana* mulberry leaves that were given fertilizer was higher than that of mulberry leaves without fertilizer. The digestibility value of each caterpillar was above 50%, this indicates that the leaves treated with Urea, TSP and NPK fertilizers and without fertilizers were easily digested by the silkworms. This is in line with the research conducted by Ahmad et al., [9] that mulberry leaves with different protein and carbohydrate contents are easily digested by silkworms as indicated by AD values ranging from 53-87%. Total digested food cannot all be converted into body weight but there used to maintain the survival of larvae and for the formation of the cocoon.

The larger the instar stage, the higher the feed conversion value, which means that the silkworms are less efficient in using feed to gain body weight. This is thought to be due to the lower digestibility of the feed. The cause of the lower digestibility of the feed is that the mulberry leaves which are given as larvae feed have high nutritional content .

**Pattern Value of Instar Silkworm Nutrition Index III, IV and V**

The relationship between the nutritional index values of instar III, IV and V silkworms fed with *Morus cathayana* mulberry plants treated with fertilizers and without fertilizers can be seen in Figure 6 and 7 the following.

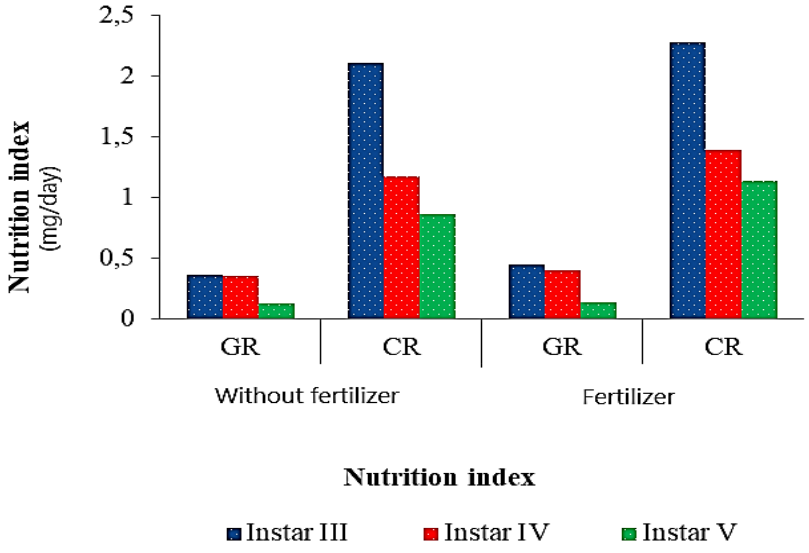


Figure 6. Mean of relationship nutritional index instar III, IV and V consisting of the GR and CR without fertilizers and fertilizer

Figure 6 shows that the i Index This nutrition in *Bombyx mori* L. consisting of GR and CR on larval instar III, IV and V with the provision of *Morus cathayana* without fertilizer and higher fertilizer consumption rate (CR) compared to the growth rate (GR), especially on instar III. Third instar silkworms require a large consumption rate as a source of energy to use the silkworms to the next stage of development, while the IV and V instar silkworms which will enter the cocoons phase and pupa experience a lot of resting phase so that the caterpillars do not consume much mulberry leaves which are given which resulting in a reduced consumption rate. According to Rustini [11], the greater the instar stage, the smaller the consumption rate.

Figure 7 shows that index this nutrition in *Bombyx mori* L. larva instar III, IV and V by administering *Morus cathayana* fertilizers is higher than without fertilizer. In general, it can be seen that the nutritional index consisting of ECD, ECI and AD is higher in 3rd instar larvae than IV and V instar larvae. This is because III instar larvae require more optimal growth than IV and V instar larvae, so that third instar larvae need more food.

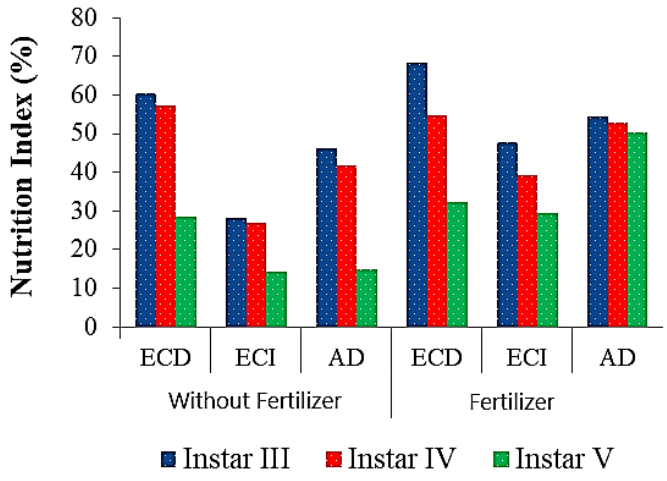


Figure 7. The average relationship of the III, IV and V instar nutritional indices consisting of the values of ECD, ECI and AD without fertilizer and given fertilizer

According to Samsijah and Kusumaputra [7], efficiency digested feed conversion shows the feed is assimilated to grow as energy metabolism. Third instar silkworms, which are classified as small caterpillars, still require relatively small metabolic energy to turn into large caterpillars, resulting in a large feed conversion efficiency value, while IV and V instar silkworms which are classified as large caterpillars require relatively large metabolic energy to achieve the cocoons and pupa phases resulting in a small feed conversion efficiency value. Silkworms that consume mulberry leaves with high nutritional content will produce high growth and will be easily absorbed by the silkworm's body for their survival.

According to Ahmad et al ., [9], the amount of food that can be digested is not all converted into body weight but some are used to maintain larval survival and also for cocoon formation. The larger the instar stage, the higher the feed conversion value, which means that the silkworms are less efficient in using feed to gain body weight. This is thought to be due to the lower digestibility of the feed. The cause of lower feed digestibility is the mulberry leaves which are given as larvae feed, the higher the fiber content.

## Conclusion

Based on the results of research and discussion, it is concluded that the varieties of chili pepper showed a significant effect on shoot and root dry weight, shoot-root ratio, relative water content and on water use efficiency. The interaction of both variables showed a significant effect on water use efficiency as well as root dry weight.

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