Production and quality of forage alfalfa (Medicago sativa L) with organic and inorganic fertilization

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Abstract. The effect of organic and inorganic fertilizer on the quality of forage alfalfa (Medicago sativa L). The material used are alfalfa seed, land used for the research are area of 324 m², KCl and urea fertilizer as basic fertilizer, P fertilizer as a treatment is SP 36, BP and organic fertilizers. Organic fertilizer derived from cow and goat manure, with each dose of 35 tons/ha. The research design is a randomized block design with 9 treatments and 3 replications as follows: P0: control (without P fertilizer, without organic fertilizer), P1: Manure A (cow), P2: Manure B (goat), P3: Manure 'plus' A, P4: Manure 'plus' B, P5: Manure A + BP, P6: Manure B + BP, P7: Manure A + SP-36, P8: Manure B + SP-36. The observed parameters were forage dry matter production, crude protein content and crude fiber content. The data was analysed by analysis of variance, followed by Duncan test. The results showed that manure 'plus' produce higher dry matter production than manure and manure A/B + SP 36 in the second cutting. Manure A/B + SP 36 fertilizer produce equal crude protein and crude fiber content to manure 'plus' both in the first defoliation and second defoliation.

1. Introduction

Alfalfa is a leguminosa known as forage that has the most complete nutritional content. Alfalfa belongs to the family fabaceae and the genus medicago is perennial, can survive several years with harvest many times a year. High ranges from one meter, and roots enter the soil to a depth of 2–4 meters. compared to other leguminosa, alfalfa is more resistant to drought.

Fertilization as an effort for soil nutrient provision to increase soil fertility. According to Agus (2012) fertilizer grouped based on its chemical structure to be organic and anorganic fertilizer [1]. Organic fertilizer or compost composed from mixed farm land waste, household waste, and the byproduct of raising livestock (composing of feces, urine, and remaining feed). Besides, anorganic fertilizer composed from one or combination of few chemical element components processed through factory process. Provision of anorganic fertilizer giving contribution in repairing soil chemical because could increase nutrient which is not provided inside body of soil [2]. Most necessary nutrient growing grass plant is N element for leaves, stem and shoot growing, meanwhile P element established to root forming, and K element for protein and carbohydrate forming [3]. The nutrient gain from soil as a growing medium or from fertilizer.
Alfalfa growing fertile soil giving benefit in production and high-level nutritional value to use as forage, growth and thriving phase become main factor in determining quality and production of alfalfa [4]. Quality of forage is based on moment and precisely cutting plant frequency and as well as could be seen from plant growth phase. Alfalfa plant to be cut at end phase of vegetation consisting high crude protein content. Defoliation phase of alfalfa more affected by thriving phase other than plants age [5]. Crude fiber content increasing continuously started from early vegetation until fully blooming and shall be decreasing after fully blooming phase. Increasing of side cell component and decreasing of cell substance will causing decreasing of crude protein content and will increasing crude fiber content [4]. Level of rough fiber increasing simultaneously up with age of plant [6].

This research aims to find out the effect of organic and inorganic fertilization on the production and quality of alfalfa forage (Medicago sativa L).

2. Materials and method
The research was conducted in Mrunten Kulon village in West Ungaran sub-district, Semarang regency and laboratory of the Faculty of Animal Husbandry Diponegoro University, Semarang. The research material used is alfalfa seed (Medicago sativa L) which is the seed of America, Land used for research covering an area of 324 m², divided into 27 plots each measuring 4 m × 3 m. Fertilizer that fertilizer KCl and urea as basic fertilizer, with a dose of 100 kg K₂O/ha (83 kg K/ha) and 50 kg N/ha. P fertilizer as a treatment is SP 36, BP (27% P₂O₅) with a dose of 200 kg P₂O₅/ha (88 kg P/ha) and organic fertilizer. Organic fertilizer comes from cow manure and goat manure, with a dose of 35 tons/ha each.

The research design used was a randomized design of a group with 9 treatments and 3 replays. Fertilization treatment is given as follows: P0: control (without fertilizer P, organic fertilizer), P1: manure A (cow), P2: manure B (goat), P3: Manure ‘plus’ A, P4: manure ‘plus’ B, P5: Manure A + BP, P6: Manure B + BP, P7: manure A+ SP-36, P8: manure B+ SP-36.

Research is conducted through three stages, (1) preparation stage including soil processing, preliminary soil analysis, manure production (2) implementation including seeding alfalfa, fertilization treatment, and observation of plant growth (3) The last stage of forage sampling with the first cut is carried out after the plant is 12 weeks old, the second cut is carried out 8 weeks after the first defoliation is then analysed laboratory. The observed parameters are the production of forage dry matter, crude protein levels, crude fiber levels. The data obtained is processed statistically according to the variety analysis procedure to find out the effect of the treatment. Duncan's test is used for comparison of middle grades between treatments [7].

3. Results and discussion
3.1. Dry matter production
Result of dry material production research data through organic and inorganic fertilization could be find at table 1. Table 1 shows that the treatment of organic and inorganic fertilizers was not significant (P>0.05) on the dry matter production of alfalfa on the first defoliation, but was significantly (P<0.05) on the second defoliation.

Dry matter production at preliminary cutting showed that at organic and an organic provision treatment giving affect that is not factually different for dry matter production of alfalfa. This condition caused by low response of plant preliminary growing made response towards fertilization does not factually different, and manure is slowly available (slow release) at preliminary cutting, this causing nutrient issued gradually in small amount, then in consequence at the preliminary cutting process still not showing factual response. Similarly, according to Ariyanti et al (2017) that organic fertilizer has slow response in providing process, but the existence could make soil preserved [8]. As added by Lukiwati et al (2012), that manure including organic fertilizer be able to repair nature of soil or soil fertilization, but otherwise slow response in providing process [9]. The manure, even though, consist nutrient which relatively low, at the other side exercising in towards farm land could affecting long time
fertilization level, caused by content of organic material which has no anorganic fertilizer. Gradually nature in releasing nutrient made manure very effective to be used at farm land for annual crop [10].

**Table 1.** Dry matter production, crude protein and crude fiber with organic and inorganic fertilization.

| Treatment          | Dry matter production | Crude protein | Crude fiber |
|--------------------|-----------------------|---------------|-------------|
|                    | I         | II         | I         | II         | I         | II         |
| P0 (control)       | 72.26     | 96.23a     | 17.47a    | 15.28c     | 28.78b    | 21.09b     |
| P1 (manure A)      | 96.68     | 142.57b    | 18.20b    | 15.81c     | 30.84b    | 21.96b     |
| P2 (manure B)      | 100.00    | 133.22bc   | 18.65d    | 13.93c     | 29.77bc   | 21.19b     |
| P3 (manure 'Plus' A) | 113.90   | 166.67bc   | 16.96d    | 16.23bc    | 30.80b    | 21.32b     |
| P4 (manure 'Plus' B) | 108.70   | 201.52bc   | 19.36bc   | 16.24bc    | 30.55b    | 21.21b     |
| P5 (manure A + BP) | 79.20     | 144.66bc   | 19.36bc   | 17.38ab    | 31.66b    | 21.36ab    |
| P6 (manure B + BP) | 85.17     | 168.73bc   | 18.73ad   | 17.61a     | 29.73bc   | 21.62bc    |
| P7 (manure A + SP-36) | 78.36   | 139.34bc   | 20.18a    | 17.86a     | 31.75a    | 20.58a     |
| P8 (manure B + SP-36) | 110.10  | 135.49bc   | 19.81ab   | 17.69a     | 30.66ab   | 22.57ab    |

Different superscripts in the same column show a noticeable difference (P<0.05).

Result of analyzing variety to dry matter production of alfalfa at the second defoliation was real significantly (P<0.05) by treatment of organic and anorganic fertilization. This is caused by manure to be used has different structure then absorption of nutrient could be more to get. Combination of manure and P Fertilizer could serve plant necessary then continuously affect in increasing of dry matter production of alfalfa. This occurred by BP fertilizer at sulfate soil could providing P element to serve plant necessity then it could be equal with utilization of SP fertilizer. Research of Lukiwati et al (2005), said that fertilization BP in sulfate acid condition resulting of dry matter production of forage Pueru equal with utilization of SP fertilizer [11]. Research result of Sajimin (2011) that production of alfalfa plant by delivering different manure is factually affecting, because given manure at this research is 35 ton/ha, have making stable production, this is simultaneously working with the age of plant and nutrient served in medium that absorbed by the plant. This concept similar with Sajimin (2011) that in order to increasing forage production could be done by fertilization, delivering of manure could be useful to increase substance of soil’s organic material, repairing structure of soil, and increase the availability of nutrients [12].

3.2. Crude protein content

Research data of crude protein content through organic and anorganic fertilization could be seen at table 2. The results of the analysis variety of the crude protein of alfalfa levels at the first and second defoliation were was significantly (P<0.05) by treatment of organic and inorganic fertilizers.

This caused by nutrient at the manure to be used is different. Goat’s manure has nutrient higher than cow’s manure, moreover preceded by decomposition process by adding P (BP). Combination between organic and anorganic fertilizer resulting fulfilled nutrient element for plant. According to Lukiwati et al (2012) utilization of BP mixed with manure while recompositing could be able to increase P solution [9]. Decomposition process towards manure fabrication effecting organic acids which could be saluting P to the phosphate rocks become provided then delivery to the plant would be easily absorbed [13]. Combination of organic and anorganic fertilizer creating high term effect because there occurred synergically connection sustaining each other. Manure to be used has enough nutrient element and provided for plant, added as well P fertilizer which is quickly to serve P element, could increasing the function of N element existed at plant medium to arrange protein at alfalfa forage. Providing of N nutrient has strong connection with protein. This is supported by Seseray et al (2013) [14]. Nitrogen element utilized to the growing of vegetative phase, beyond that, used too for protein reform. The
phosphor as component of enzyme and protein needed in photosynthesis. Enough P nutrient providing at preliminary growing period will affected to the reformation reproductive part of plant which is eventually would be utmost determining quality of plant [15].

3.3. Crude fiber content
Research result data of crude protein content by organic and anorganic level could be seen at table 3. Analysis result of variety crude fiber content of alfalfa showed that organic and anorganic delivery treatment was significantly (P˂0.05) towards crude fiber content of alfalfa neither at preliminary cutting process nor second cutting process. These are showed that manure working in repairing soil structures then make absorption of nutrient to the plant easily, SP-36 has soluble nature in water. As according to Hasanuzzaman et al (2010), that organic fertilizer in terms energy resource and food for soil microbe [16] and as manure will getting faster at its nutrition service for soil microorganisms [17]. Therefore, when phosphate rock mixed at early making manure, it would make manure quality increasing and be able to increase corn production equal with fertilization SP-36 [18].

According to [19] SP-36 Fertilizer is soluble in water and its physiologic reaction is neutral. Therefore, P element be provided and has function in root development so that have effect increasing ability for P absorption. Manure could form nutrient in soil, repairing soil structure and adding content of soil organic material, then in consequence could increasing nutrient provide to the plant. Combination of organic and anorganic fertilizer resulting better effect, because occurred synergically connection and sustain each other. This concept supported by Samosir (2000), faster organic material decomposing makes nutrient substance provided by the plant [20].

4. Conclusion
Manure 'plus' produces higher production of dry matter than manure and manure A/B + SP 36 at second defoliations. Manure A/B + fertilizer P (SP 36) produces crude protein content and crude fiber content equivalent to manure 'plus' in both first defoliation and second defoliation.

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