

Dynamics Growth of Soybeans in Agroforestry System with Fertilization of N, P, Micro Nutrient and Organic Manure

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-----ABSTRACT-----

Soybean is one of agriculture commodity which have many of function and have cultivated by farmers. But one of constraint soybean cultivate is decreasing agriculture farm caused displacing farm function, to overcome this farmers in Gunung Gajah, Cawas, Klaten applied agroforestry system. Agroforestry assesed as one of alternative agriculture system to overcome fast height agriculture farm conversion. The aim of the research was to study the fertilization on soybean, specifying appropriate varietas for the system of agroforestry, and specify requirement of hara of organic and inorganic manure of local resource in organic conducting of soy crop in farm of agroforestry. The experiment was conducted in inceptisol soil arranged in group randomized device factorial design with factor 1: soy varietas (Grobogan and of Kaba), and factor 2: manure (inorganic manure and inorganic manure + organic), every re-treatment combination 3 times. Result of research indicate that wide index leaf, wide of specific leaf, and unit rate leaf not yet optimal and affect at result produce that is biomassa which still under standart that is 98,49 g /m².

KEYWORDS - soybean, agroforestry, inorganic fertilizer, organic fertilizer specific location, biomassa

I. INTRODUCTION

Soybeans is one of agriculture commodity which have many of function. People usually consume soybeans directly as boiled soybean or use soybean as basic material on agroindustry like fermented soybean cake (tempe), tofu, tauco, soy sauce, soya milk, and as basic material for livestock food. As one of plant which contains protein, soybeans need a lot of nutrient, especially nitrogene (N) and phosphorus (P).

Many of soybean have cultivated on protection forest that is forest area which considered as area for save the ecological function, although that area not the precise area as cultivate area. But one of constraint soybean cultivate is decreasing agriculture farm caused displacing farm function, to overcome this farmers in Gunung Gajah, Cawas, Klaten applied agroforestry system. Agroforestry assesed as one of alternative agriculture system to overcome fast height agriculture farm conversion.

Beside for save the ecological function, protection forest area have economical function that is for cultivated soybeans, with combination between soybeans with the trees which have high leaf and have deep root system to decrease the competition. But the problems for agroforestry system is have low nutrient on soil, soybeans which cultivated can't optimal grow and produce empty of legumes of various. Constraint from cultivated on protection forest Gunung Gajah was high amount of empty legume various. Empty legume various with fertilization nitrogene (N), phosphorus (P), molybdenum (Mo), and magnesium (Mg). That was need to stable using organic manure specific on location, [1].

II. RESEARCH METHOD

The research start on July 2011 to November 2011, location on Gunung Gajah village, Cawas, Klaten. Situated at 1100 39' 9.54" longitude east and 70 45' 8.77" southern longitude, on altitude between 550-590 m above the sea level (m dpl), with inceptisols. The laboratorium analysis like measure biomass plants do on Ekologi and Manajemen Produksi Tanaman (EMPT), Agriculture Faculty, Sebelas Maret University. The materials are soybean seed Grobogan and Kaba variety, organic fertilizer, micro nutrient, urea fertilizer, and fospat fertilizer. The equipment use like equipment for soil cultivate, analytic scales, lighmeter, thermometer, oven, handsprayer, and perforator.

The aim of the research was to study the fertilization on soybean, specifying appropriate varietas for the system of agroforestry, and specify requirement of hara of organic and inorganic manure of local resource in

organic conducting of soy crop in farm of agroforestry. The experiment was conducted in inceptisol soil arranged in group randomized device factorial design with factor 1: soy varieties (Grobogan and of Kaba), and factor 2: manure (inorganic manure and inorganic manure + organic), every re-treatment combination 3 times.

Research start with cultivated soybean and monitoring variable like leaf area index, specific leaf area, leaf unit value, biomass, amount of nodule, amount of legume various, and biomass legume of various.

III. RESULT

1. Leaf Characteristic

1.1 Leaf Area Index

The research showed that application on inorganic fertilizer have a higher leaf area index than inorganic and organic manure that is 0.73 : 0.34 for Grobogan variety and 0.58 : 0.35 for Kaba variety. (Under hardwood tree (jati;teak) or pine tree, soybeans have low leaf area index that is 1.1-1.8, [1]). Relationship between leaf area index and light interception is leaf area index = 1, 3.3 and 4.3 have light interception about 50, 90 and 95% [2]. For this research have light interception 67.96% which showed that the leaf area index must be larger than 1, but this result not optimized. Larger leaf area index showed that larger light interception have accepted, and contributed to photosynthesis.

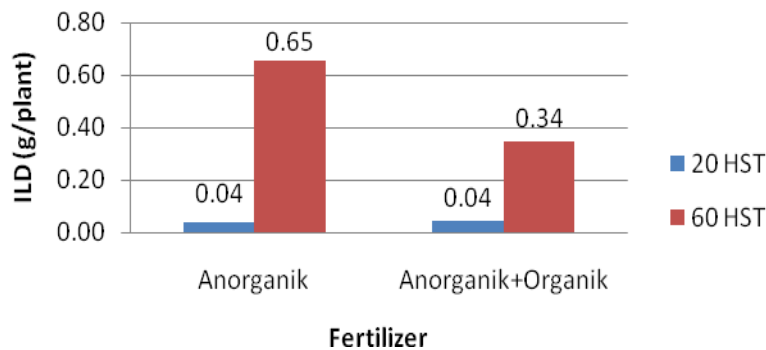


Fig. 1. Histogram of Leaf Area Index on 20 and 60 day with different application of fertilizer

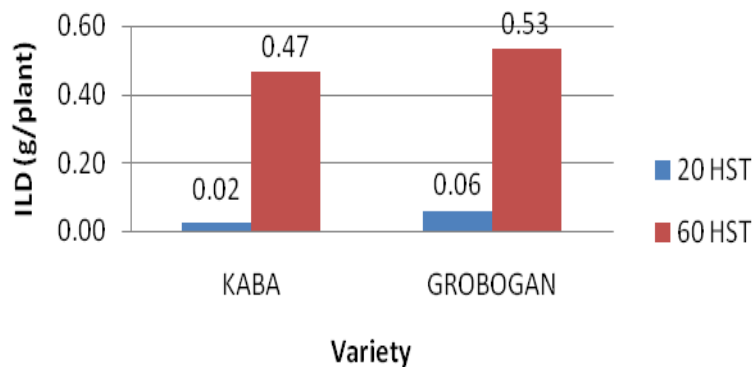


Fig 2. Histogram of Leaf Area Index on 20 and 60 day with different variety (Grobogan and Kaba)

1.2 Specific Leaf Area

Specific leaf area use to study the leaf thickness which showed the chloropil content and protein to formation a wide of leaf. Specific leaf area on age 20 and 60 day is 3.925 cm²/g and 4.74 cm²/g. The specific leaf area higher with inorganic fertilizer application, from 3.49 to 5.16 cm²/g. But with inorganic and organic manure application showed the constant of specific leaf area that is 4.66 cm²/g. Specific leaf area will be low when the leaf accept low light interception, on low light interception leaf can strengthen.

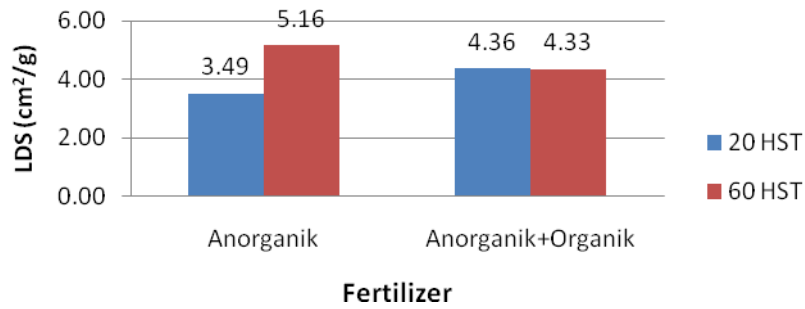


Fig 3. Histogram of Specific Leaf Area on 20 and 60 day with different application of fertilizer

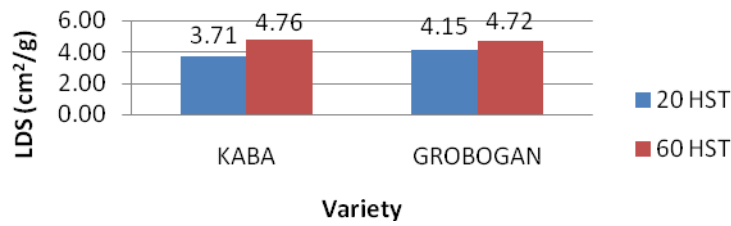


Fig 4. Histogram of Specific Leaf Area on 20 and 60 day with different variety (GroboGAN and Kaba)

1.3 Unit Rate Leaf

Unit rate leaf is ability from leaf to produce biomass from [3]. Unit rate leaf soybean on age 20 and 60 day was 1.90 and 2.22 g/cm² for Kaba variety. For GroboGAN variety was 2.13 and 2.68 g/cm². Based on Fig 5., inorganic fertilizer application increasing unit rate leaf.

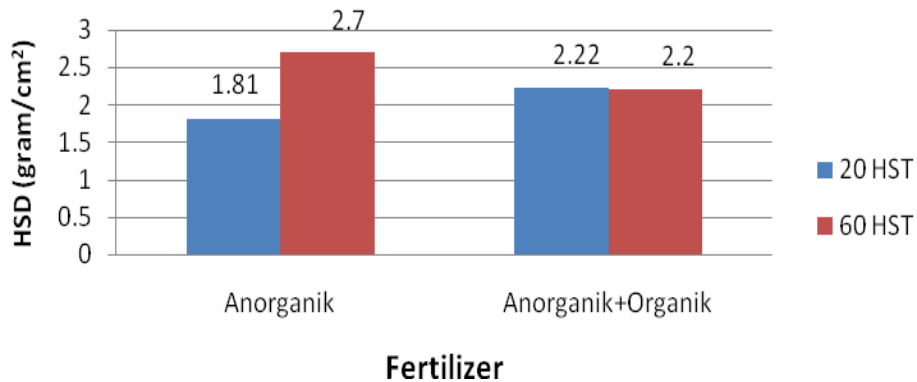


Fig 5. Histogram of Unit Rate Leaf on 20 and 60 day with different application of fertilizer

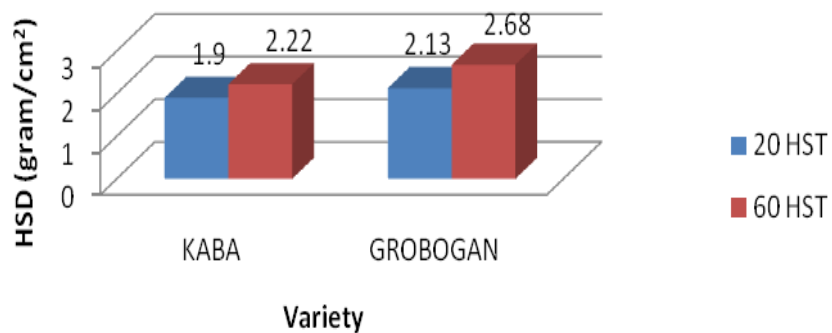


Fig 6. Histogram of Unit Rate Leaf on 20 and 60 day with different variety (GroboGAN and Kaba)

2. Nodule of Legume Various

Nodule was a part of legume plant use for symbiosis between root and the held nitrogen bacteria that is Rhizobium, who can fixation N direct from air, and use it to completed nitrogene needed by plant from fixation N₂ [4].

The research showed that nodule on Kaba variety better than Grobogan variety on fertilizer application. It is identification that Kaba can absorp nutrient better than Grobogan. Beside that characteristic from organic manure that is slow release, can absorp by plant which have long age about 80 day, but age of Grobogan just 76 days, and Kaba 85 days [5].

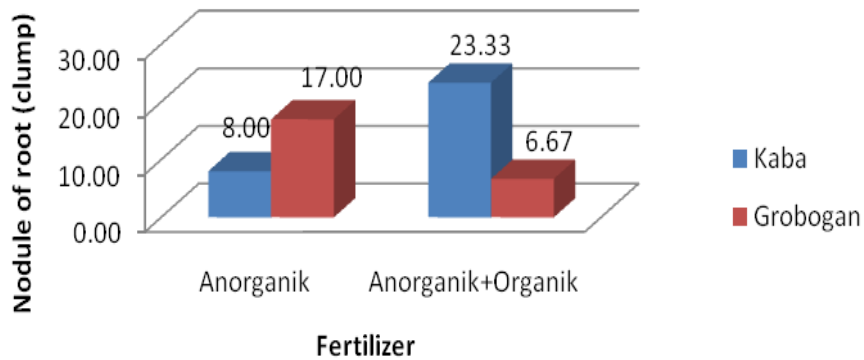


Fig 7. Histogram Nodule of Legume when harvesting between two variety (Grobogan and Kaba) with different application fertilizer

3. Biomass

Biomass made from result of photosynthesis (photosyntat) organized as carbohydrate which use to grow and development plant. Soybeans plant biomass increasing along with add of age (Fig 8). This is cause of more higher accumulation of photosyntat. Soybeans biomass on age 20, 40, 60, and harvest was 0.57 g, 1.97 g, 6.15 g, and 9.17 g. On this research biomass about 98.49 g/m², whereas usually soybeans biomass about 120-175 g/m² [6].

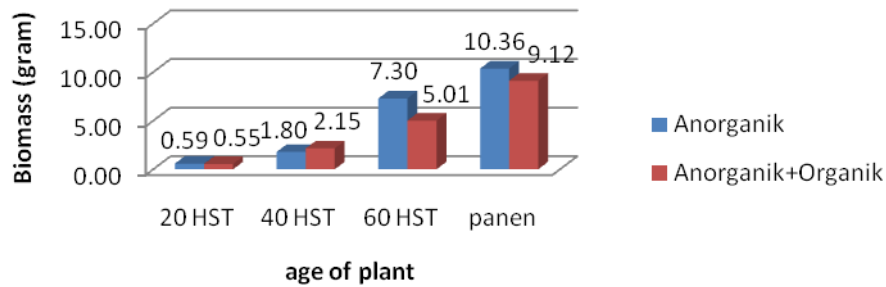


Fig 8. Histogram of Biomassa on 20, 40, 60 day and harvest with different application of fertilizer

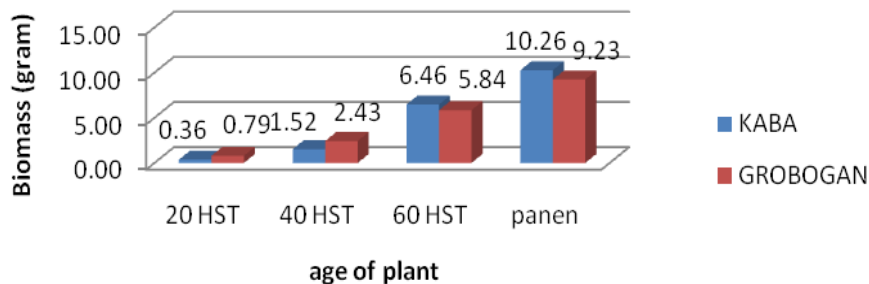


Fig 9. Histogram of Biomassa on 20, 40, 60 day and harvest with different variety (Grobogan and Kaba)

4. Production Component (Amount of Legume Various)

Kaba has many legume various than Grobogan with percentage 60.71% : 39.39% (Fig 10). Amount of legume various from this research in great quantities (25-50 various every plant), but that legume various was empty.

Based on research soybeans need nitrogen 60 kg to production 1 ton of soybeans with 1 hectare area, whereas nitrogen added 40 kg from organic manure (goat manure) and 23 kg from urea fertilizer. But nitrogen will be lost about 25%, and amount of available nitrogen about 47.25 kg causing plant deficiency nitrogen nutrient about 12.75 kg (look enclosure) [7]. Deficiency nitrogen will decreasing photosyntat, then will decreasing food for make a seed and resulted empty legume various.

Decreasing photosyntat have a correlation with magnesium (Mg) nutrient. On this research magnesium (Mg) nutrient didn't enough, less 3.99 kg (look enclosure). Magnesium nutrient have the function to make chloropil, chloropil use on photosynthesis. Decrease magnesium nutrient will decreasing photosynthesis rate and decrease photosyntat. It will consequence empty legume various.

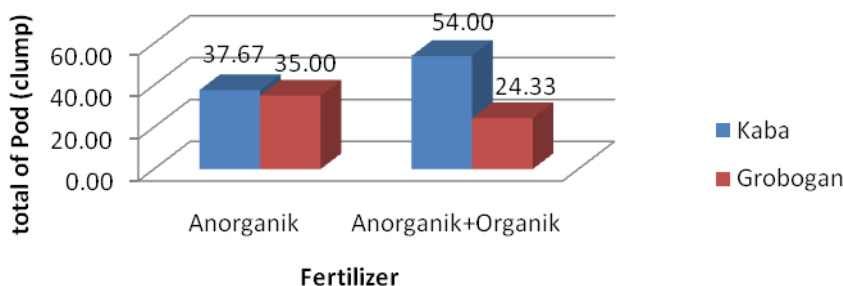


Fig 10. Histogram of amount of legume various when harvesting with different variety (Grobogan and Kaba) and different fertilizer application

IV. CONCLUSION

1. Organic manure application didn't decreasing amount of empty legume various.
2. Grobogan variety appropriate to cultivate on agroforestry system.
3. Inorganic manure needed on soybeans cultivate with composition 75 kg/Ha urea, 100 kg/Ha SP₃₆, 1.5 l/Ha micro manure contains magnesium and sulphur, and organic fertilizer 5 ton/Ha.

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