The Effect of Shade on Peanut Plant Performance as Fodder, in The ExS Merapi Volcano Eruption Land with Silvopastoral

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ABSTRACT
The aimed of the study was to determine the effects of shade on peanut plant (*Arachis hypogaea*) performace as fodder, planted in the farmland exs Merapi volcano eruption. Peanut seeds were planted in Kepuharjo Village, Cangkringan, Sleman, Yogyakarta. This study was carried out two years after the eruption, in open land and with shade trees in the area of 150 m2 (each) given an organic fertilizer (6.8 t/ha of dry matter) and urea 100 kg/ha). Silvopastoral system in the land with shade (trees along border) among sengon trees (*Paraserianthes falcataria*) as majority trees with shade less than 50%.Data were analyzed using T-test. The results showed that peanut crops in shade land area, significantly had a higher values in vegetative parameters (total root nodules, nodule active, root length and root weight), but did not different significantly in the number of leaves and stems. Production of peanut straw (fresh) in shade land area also showed significantly higher values than in open land, as well as to the value of organic matter, crude protein, and crude fiber. Peanut plant for fodder in the area former Merapi eruption (under the shade less than 50%) resulted better production parameters than in open land.

Keywords: *Fodder, legume, Merapi volcano, production, trees along border*

1. INTRODUCTION

Agroforestry is a common concept in land management systems that combine between trees and crops. Various agroforestry systems had long live and thrive in the life of rural communities. Some examples of existing agroforestry systems arein Cangkringan, Sleman, Yogyakarta. The actual state of the field today is still a lot of land under trees have not been fully utilized, even though land under the trees have a potential to produce food or feed. Nair et al.[1] stated that this practice is categorized as agro-silvopastoral system, a combination of wood components (forest), agriculture (seasonal), and livestock in the same land management unit. While, the combination of wood and crops fodder are called silvopastoral. Treesare provider of feed (biomass) for livestock, while livestock can become a source of income for farmers. Crops and crops fodder are produced to generate food and feed. In general, there are shade plants in Cangkringan area consisting of sengon (*Paraserianthes falcataria* L. Nielsen), Mahogany (*Swietenia macrophylla* King.), Jackfruit (*Artocarpus heterophyllus* Lamk.), and avocado (*Persea americana* Mill.)[2].

Grasses and legumes are a very common material to be developed as a key component for the growth of ruminants production. Suryanto et al.[3] stated that the land in the plantations or forestry is one alternative that can be used for planting forage for land useas optimal as possible. In the certain level, shade can be a limiting factor for plant growth because the incoming light intensity is reduced or not fully to be able to optimally utilized by crops such as peanut crops. On the other hand, the intensity of direct sunlight can also be a factor inhibiting plant growth. Therefore, research is needed related to the effect of shade on peanut crops as fodder on farmlandaffected by Merapi volcano eruption with silvopastoral system.

2. MATERIALS AND METHOD

This research was conducted in farmland affected by Merapi volcano eruption in 2010 in the Pagerjurang, Kepuharjo Village, Cangkringan, Sleman, Yogyakarta, Indonesia. Data was collected from May to December 2012 (two years after the eruption). Kepuharjo village is located at 540 to 1200 meters above sea level (asl), with a temperature of 18^0C to 26^0C, and rainfall is 2000 to 3000 mm per year.

The farmland were used in the research consisting of two blocks namely open land and shade land area, of each about 150 $m^{2.}$ The majority of the trees into the shade was Sengon (*Paraserianthes falcataria*) trees. The shade are along the border line (silvopastoral). The shade still below 50% (light intensity of more than 50%). Peanut crops (*Arachis hypogaea*) were planted in plots, a plots can be planted average 24 peanut seed holes with a spacing of 50 x 25 cm. Basic fertilization was conducted a week before planting. It was used cow manure as much as ± 340 g/hole, equivalent to 6.18 tonnes/ha of dry matter. Urea was given at three and six weeks after planting as much as 100 kg/ha.

Variables were observed such as number of leaves, number of stems, number of root nodules (total and active), root length, root weight, and number of pods (total and contents).Nutritional quality test using the method of proximate analysis [4]. The samples were collected at20% from the total plants, 12 weeks after planting. The data were analyzed using T-test singgle tail with the help of the computer program SPSS version 16.

3. RESULTS AND DISCUSSIONS

3.1. Vegetative Parameters

The observations of vegetative parameters such as number of leaves, number of stems, total root nodules, nodule active, root length, and root weight of peanut crops in open land and shade land area can be seen in Table 1.

The results in Table 1 shows that shade was significantly affect total peanut nodules, nodule active, root length, and root weight. The growth of peanut crops in shade land area was better than in open land. This is consistent with the theory stated by Purwono and Hartono[5], peanut crops is categorized as C3 plants. Most agricultural crops, such as rice, potatoes, soybeans, beans, and cotton are C3 plants[6].Legumes are low-titled C3 plants that are resistant to shade and are short plants, this can avoid competition in the intercropping system, namely in the canopy (especially light)[7].Thus, plants does not require radiation and temperature extremes. The C3 plants is more adaptable to the conditions of high atmospheric CO_2 content. Photosynthesis of peanut crops will reach a maximum at around 10:00 A.M, High intensity of solar radiation is not desired by peanut crops. Solar radiation affects the growth and reproduction through photosynthesis.

Table 1. Vegetative parameters of peanut crops in open land and shade land area.

Variable Measured	Treatments	
	Open Land	Land With Shade
The number of leaves (sheets)	131.0	150.2
Number of stems / branches	4.1	4.1
The total number of nodules	18.4^{q}	39.7^{p}
Active root nodule	15.5^{b}	28.7^{a}
Root length (cm)	8.4^{q}	16.4^{p}
Weight roots (g)	2.1^{b}	15.0^{a}

Description: ^{pq}superscripts indicate significant differences between treatments (P <0.01).

In general, shaded plants had leaf area index greater than the plants fully illuminated by the sun. It is an adaptation of plants in shade to get and absorb more light and commonly called shade avoidance [8].

3.2. Peanut Plant Production

The observations of production parameters, such as total bean pods, seed pods, and fresh peanut production in open land and shade land area can be seen in Table 2.

Shade did not significantly affect the production of pods and seeds, but affected on the production of fresh peanut straw. Growth of peanut crops was better in the shade area than in open area. It is have consequences that the production of peanut straw was also significantly higher.

Table 2. Production parameters of peanut crops in open land and shade land area.

Variable Measured	Treatments	
	Open Land	Land With Shade
Total peanut pods	15.0	13.8
Pods contained of seed	8.9	8.0
Fresh straw production (tonnes / ha)	1.1^{b}	2.1^{a}

Description: ^{ab}superscripts indicate significant differences between treatments (P <0.01)

The C3 plants undergo photorespiration, which results in lower photosynthetic yields than C4 plants. To overcome the light intensity is too high. Shading is not only needed in the seedling phase, but throughout the plant life cycle [9]. Boote et al. [10], stated that in C3 plant, shade is needed throughout the life cycle of plants. The more mature age of the plant, the more reduced the intensity of the shade. In addition, shade is needed to reduce the intensity of light reaching the staple crop, also used as a method of weed control. The impact of shade will be greatly influenced the microclimate, in addition to reducing the light intensity of approximately 30%-40%, it also reduce air flow around the canopy so that the air humidity around the canopy is more stable (60%-70%). Shade also reduced the rate of evapotranspiration, and maintain balance between the availability of water by transpiration rate of the plants.

The shading did not effect significantly to the production value of pods and seeds of peanut crops. However, production value of peanuts in open land tends to be higher than in the shade land area. Shade will reduce the intensity of the plant irradiation, resulting in lower crop production. Sunlight reduction on peanut crops will affect to the activity of plant physiology, especially photosynthesis that led to the metabolism of plants is also low [11].

Results of nutrition value include dry matter (DM), organic matter (OM), crude protein (CP) and crude fibers (CF) of peanut crops planted in open land and shade land area can be seen in Table 3.

The data in Table 3 shows that the average values of OM, CP , and CF of peanut crops on shade land area weresignificantly higher than peanut crops in open land.The differences mightbe due to several possibilities,

Table 3. The DM, OM, CP, and CF value of peanut crops in open land and land with shade area.

Variable Measured	Treatments	
	Open Land	Land With Shade
Dry matter (%)	10.7	12.1
Organic Matter (%)	8.3^{b}	10.4^{a}
Crude Protein (%)	11.9^{q}	14.7^{p}
Crude fiber (%)	20.0^{q}	29.3^{p}

Description: $^{a, b}$ superscripts indicate significant differences between treatments (P <0.05).
^{p,q} superscripts indicate significant differences between treatments (P <0.01).

which had correlation to the amount of solar radiation received by the plant. Norton et al. [12]stated that fodder crops grown in the shade has a higher nitrogen content compared to plants grown in open land. The high content of nitrogen caused by shade conditions make the availability of nitrogen in the soil is absorbed by plants, which in turn will increase the nitrogen content in plant tissues [13]. Similar result also found by Suwignyo et al. [14], shorgum plant in the initial stage had lower CP content than shorgum planted in the medium and advance shade.

4. CONCLUSIONS

Peanut plant (*Arachishypogaea*) as fodder grown in the farmland affected by Merapi volcano eruption with silvopastoral system obtained different results when planted in the shade and open land. The results showed that peanut crops in shade land area in significantly had a higher values in vegetative parameters (total root nodules, nodule active, root length and root weight), but did not different significantly in the number of leaves and stems. Production of peanut straw (fresh) in shade land area also showed significantly higher values than in open land, as well as to the values of OM, CP and CF.Peanut plant in shade land area resulted better production than in open land.

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