INCREASING PLANT CROP DIVERSITY IN AGROFORESTRY MODELS AT GUNUNG WALAT EDUCATIONAL FOREST

By

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abstract

This paper presents planting trials of multipurpose plant species for future sources of fuelwood and fodder at Gunung Walat Eduational Forest (GWEF). A trial in randomized complete block design (RCBD) were carried ou in two plots,t inside and outside GWEF, aiming at determining suitable species for agroforests Results showed that three species (Kaliandra, Kopi and R. Gajah) performed better survival rates (more than 90%) than two others (Murbei and Gamal). In this experiment, Murbei showed the lowest survival rates (54%-65%). Selection of suitable species for increasing biodiversity in agroforestry should consider the adaptability of target species in the new environment.

Keywords: fulewood, foder, agroforests, species trials, biodiversity.

INTRODUCTION

The ecological value of agroforests has been increasingly recognized. Nowadays, good agroforests also play important roles as habitat for many useful plant, they protect, to certain extent, soil from erosion and have stabilizing effect on climate. In addition, agroforests are also an essential part of carbon cycle etc.

Maintaining multiple functions of agroforests are now being extended through increasing plant diversity. As a determining factor of on-site productivity, existing biodiversity in agroforests needs to be managed adaptively especially with respect to the local needs. Lessons learned

from the first phase of agroforestry development in Gunung Walat Educational Forest (GWEF) showed that existing agroforestry models in this forest needs to be enriched by fuelwood and forage plant species. In the long run, planting multipurpose species in agroforests will encourage local people to do so.

Introduction of these plant species in agoforestry models has not been really carried out due to lack of information on the species suitability and therefore a planting trial of selected plant species to be carried out. Planting trials were conducted with aims at determining suitable plant species, especially for fuelwood and forage.

METHODOLOGY

Two plots, each inside and outside GWEF, were selected for the trials. Five plant species, consisted of three forage species: R. Gajah (*Penisetum purpureum*); Murbei *(Morus alba*) and Gamal *(Gliricidea sp*), one fuel wood species, Kaliandra (*Caliandra callothyrsus*) and a control species, Kopi (*Coffea robusta*), were planted in three blocks to increase plant crop diversity in Gunung Walat Educational Forest (GWEF) as well as at neighbouring area, a bare land plot belonging to Indocement Ltd.. Two experimental trials in Randomized Completely Block Design (RCBD) were established to monitor the growth and yield of planted species. The planting materials for multipurpose species were prepared via two propagation methods, namely cutting for Murbei, Gamal and R. Gajah and seedling for Kaliandra and Kopi. Initial numbers of planting materials for each species were presented in Table 2. They were planted with distances of 1 m x 1 m except for R. Gajah (0.3 m x 0.3 m) in February 2006 and subsequently maintained, i.e. fertilization, before being assessed in terms of survival (%S) in June 2006. Data were transformed into arcsin √%S and then subjected to anaysis of variance (ANOVA) using Minitab Release 14.

Table 2. Initial number of individuals from each species planted in two agroforestry plots

No	Species	Plot 1 (inside GWEF)			Plot 2 (outside GWEF)		
		Block	Block	Block	Block	Block	Block3
1	Murbei (Morus alba)	70	65	65	70	65	65
2	Kaliandra (*Caliandra callothyrsus)*	70	65	65	112	110	110
3	Gamal (*Gliricidea* sp.)	70	65	65	106	100	100
4	Kopi (*Coffea robusta*)	70	65	65	114	114	114
5	R. Gajah (*Penisetum purpureum)*	500	500	500	834	833	833

RESULTS AND DISCUSSION

Table 2 presents summary of ANOVA analysed based on only one variable (% survival) which was assessed five months after planting. In the two plots, there were no effect of blocks and the significant effect of species was clearly observed ($p<0.05$).

Table 2. Summary of ANOVA in two plots (P values)

No.	Source of Variation	Plot 1	Plot 2
1	Plant species	0.000**	0.013**
2	Block	0.662ns	0.352ns

Note: ** = significant at 5% level of confidence; ns = not significant at 5% level of confidence

Table 3. Average survival (%) of plant species in two plot trials

No.	Species	Plot 1	Plot 2
1	Murbei (Morus alba)	65.4	54.3
2	Kaliandra (*Caliandra callothyrsus)*	96.9	91.8
3	Gamal (*Gliricidea* sp.)	87.0	81.5
4	Kopi (*Coffea robusta*)	99.5	98.2
5	R. Gajah (*Penisetum purpureum)*	91.7	91.3

Figure 1. Field conditions after land preparation (left) and performance of Rumput Gajah (*P. purpureum*) five months after planting outside GWEF (right).

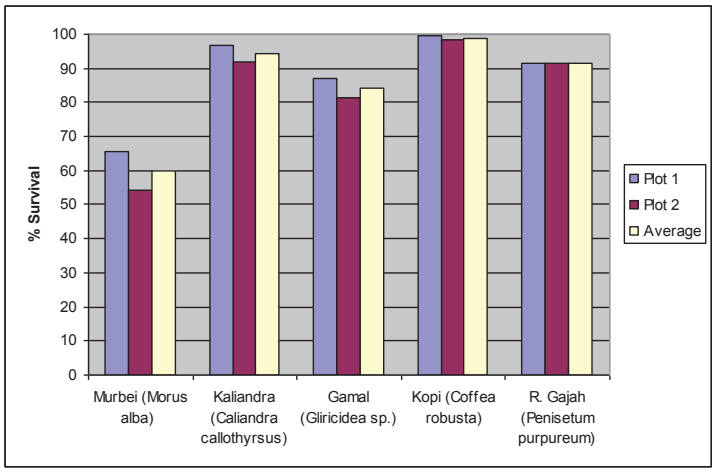

Figure 2. Average survival rates of species trial (%) in Plot 1 and Plot 2

In general, survival rates of plants in Plot 1 were better than that of those of Plot 2 (Figure 2). It is clear that initial conditions of site may influence the plant survivals. Plot 2 outside GWEF was bareland dominated with *Imperata* grass, while Plot 1 inside GWEF was an abandoned agroforest with low plant density and diversity.

Three species (Kaliandra, Kopi and R. Gajah) performed better survival rates (more than 90%) than two other species (Murbei and Gamal). Murbei had the lowest survival, 65.4% and 54.2%, in Plot 1 and Plot 2, respectively, while Gamal showed actually much better that Murbei, that is around 81-87% survival. Examples of field performance of plant species is presented in Figure 1 and 3.

Figure 3. Performances of Gamal and Kaliandra inside GWEF (above row) and Murbei and Kaliandra outside GWEF (below row) five months after planting.

In this experiment, the good performance of Kaliandra and Rumput Gajah is interesting to be noted. In particular, Kaliandra is very promising since it can serve both function as future fuelwood and fodder sources in GWEF. It is known that Kaliandra is a versatile leguminous shrub or tree well known and widely used in Indonesia, because it is easy to cultivate and has multiple uses. This statement has been proven in this experiment. More than 170 000 ha of eroded, poor or abandoned lands have been planted with *C. calothyrsus* in Java (Hermawan *et al*., 1996). Advantages of using tree fodders such as *Calliandra calothyrsus* in Indonesia is its ready availability on farms (Devendra, 1988).

With regards to the function as forage species, the high production potential and high crude protein (CP) content of *C. calothyrsus* makes it a ready source to cheaply satisfy ruminant protein requirements

CONCLUSION

Kaliandra, Rumput Gajah and Kopi showed better survival compared to Murbei and Gamal. In particular, Kaliandra in combination with Rumput Gajah seems promising to be future sources for fuelwood and fodder in area around GWEF.

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