STUDY ON THE USE OF DEKASTAR® FERTILIZER FOR IMPROVING COFFEE PRODUCTIVITY IN AGROFORESTRY SYSTEM IN GUNUNG WALAT EDUCATION FOREST

By

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Abstract

Soils in Gunung Walat Educational Forest (GWEF) are generally not fertile and comprise areas with tree and no tree covers.. Coffee plant is one of the popular agroforestry plants raised under the Aghathis loranthifolia in GWEF.. However, the coffee productivity is not yet satisfied due to lack of tending and application of agroinputs. Previous studies showed that the use of anorganic fertilizer of Urea 250 g + TSP 100 g + KCL 180 g significantly increased the coppice growth but not for the coppice number.

The objective of this study was to determine the effectiveness of Dekastar® fertilizer in promoting the productivity of coffee bean after pruning in Gunung Walat. Three different dosage levels of Dekastar®® were used, namely : (1) Control, (2) 25 g per plant , (3) 50 g per plant. Results showed that the dosage use of 50 g per plant of Dekastar®® fertilizer significantly increased the coffee bean productivity.

Introduction

Since ten years ago agroforestry system was developed in Gunung Walat Educational Forest (GWEF) with aim at maximizing forest land productivity. Various plant species were selected as main agroforestry components, including medicinal plant, foarage plant, horticultural plant as well as woody plant for timber and non timber production. One of the plant species that has been selected and planted under the *Aghatis*

loranthifolia trees is *Coffea robusta*. The reason for this choice was due to its tolerance to shade while economically important for increasing farmer income.

The soil properties in GWEF has been identified to be of low fertility, causing low plant productivity as shown in the recent harvest of coffee beans. Previous study showed that the application of an organic fertilizer of urea 250 g + TSP 100 g + KCL 180 g after pruning significantly increased the coppice growth but not for coppice number. In order to stimulate initial flowering and fruiting after pruning and to increase the bean productivity, an experiment was carried out in which Dekastar® fertilizer was used for improving fruit productivity. Dekastar® 6-13-25 is a trade mark of fertilizer designated for stimulating initial flowering and fruiting of the plant. This is a complex fertilizer containing Nitrogen 6%, Phospate 13% and Potassium 25%.

The objective of this study was to determine the effectiveness of Dekastar® fertilizer application in increasing coffee bean yield after pruning in GWEF.

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Materials and Methods

Study site

Gunung Walat Educational Forests lies geographically between South latitudes of 6° 53' 35" and 6°55' 10", and between East longitudes of 106° 67' 50" and 106°51' 30", with an annual mean temperature range of 22^0C – 30^0C and annual rain fall range of 1600 – 4400 mm. The soils are Latosol red yellow, followed by Latosol brown and Podsolic red yellow which are low in organic matter content and nutrient availability.

The existing *coffee* plants were 9 year old grown under the *Aghatis loranthifolia* trees of 40 year old and 25 m height in average. The coffee plant has been pruned at the age of 7 years in order to stimulate growth of coppices (new branches).

Experimental site preparation

The ground forest floor areas of 0.3 ha were cleared by removing grasses and shrubs. Coffee plants (*Coffea robusta*) with approximately 1.5 m height that have been planted and pruned under the *Aghatis*

loranthifolia stands were fertilized with three different dosages of Dekastar® fertilizer. The experimental site was then divided into three blocks, each of 1000 m^2 (0.1 ha) containing about 40 coffee plants. Fifteen out of 40 relatively uniform coffee plants in term of height, number of coppices and the plant size were selected from each block for receiving the treatments.

Experimental design

A trial in randomized complete block design (RCBD) was used for this experiment. The plants were then fertilized by *Dekastar*® fertilizer at different dosage levels, as follows: (1) Control, (2) dosage of 25 g and (3) dosage of 50 g per plant. Fresh bean weight was recorded at the end of fruiting seasons. Data were then subjected to Analysis of Variance and Duncan multiple range range test (DMRT).

Results And Discussion

Number of fruiting coffee plant

The number of fruiting coffee plant was affected by the application of fertilizer dosage levels as shown in Figure 1. There was a tendency that the coffee fruiting increased along with the increase of fertilizers dosage application. The beans were observed in all of the plants (100%) fertilized with a Dekastar® dosage of 50 g, while the lower numbers of plants bearing beans were observed at dosage of 25 g (98%) and control (88%).

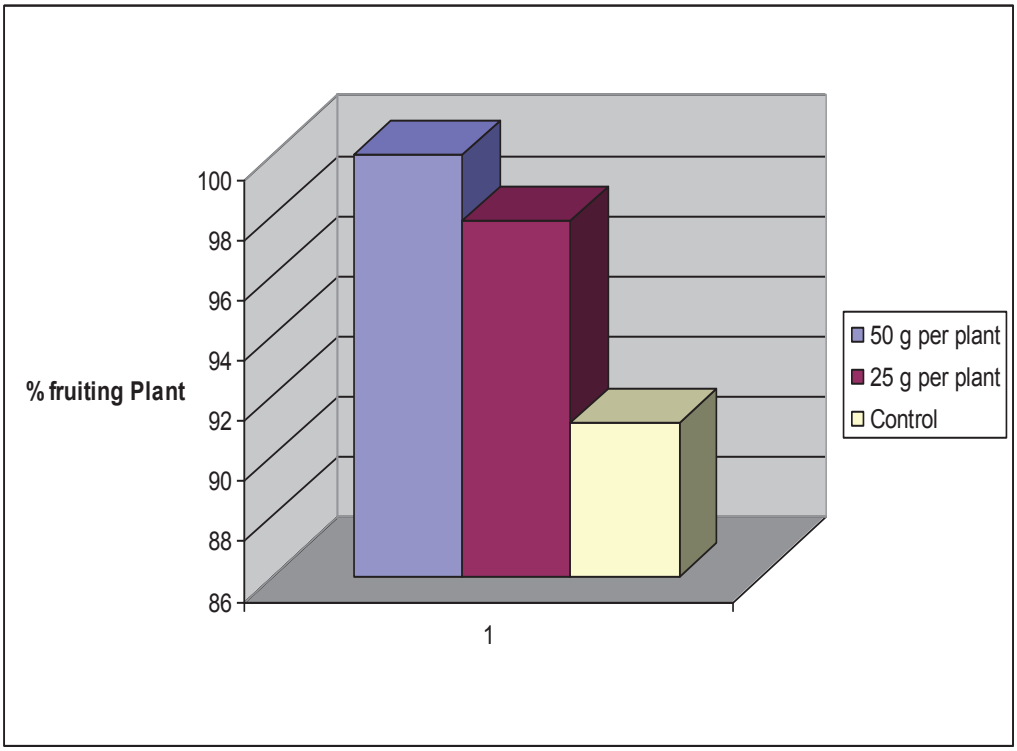

Figure 1 Effects of Dekastar® fertilizer dosages on the fruiting of coffee plants

Fresh coffee bean yield

The results of ANOVA, based on only one variable (% fresh bean yield) that was recorded five months after treatments, is presented in Table 1. There were no effects of blocks and the significant effects of coffee fresh bean weight was clearly observed ($p<0.05$).

Table 1 Summary of ANOVA (p values)

No.	Source of Variation	p < 0.05
1	Coffee fresh bean weight	0.000**
2	Blocks	0.041ns

*Numbers followed by the same letter are not significantly different

The coffee bean yields treated by dosages of 25 g and 50 g per plant were higher than that of the control and was significantly different (Figure 2 and 3)

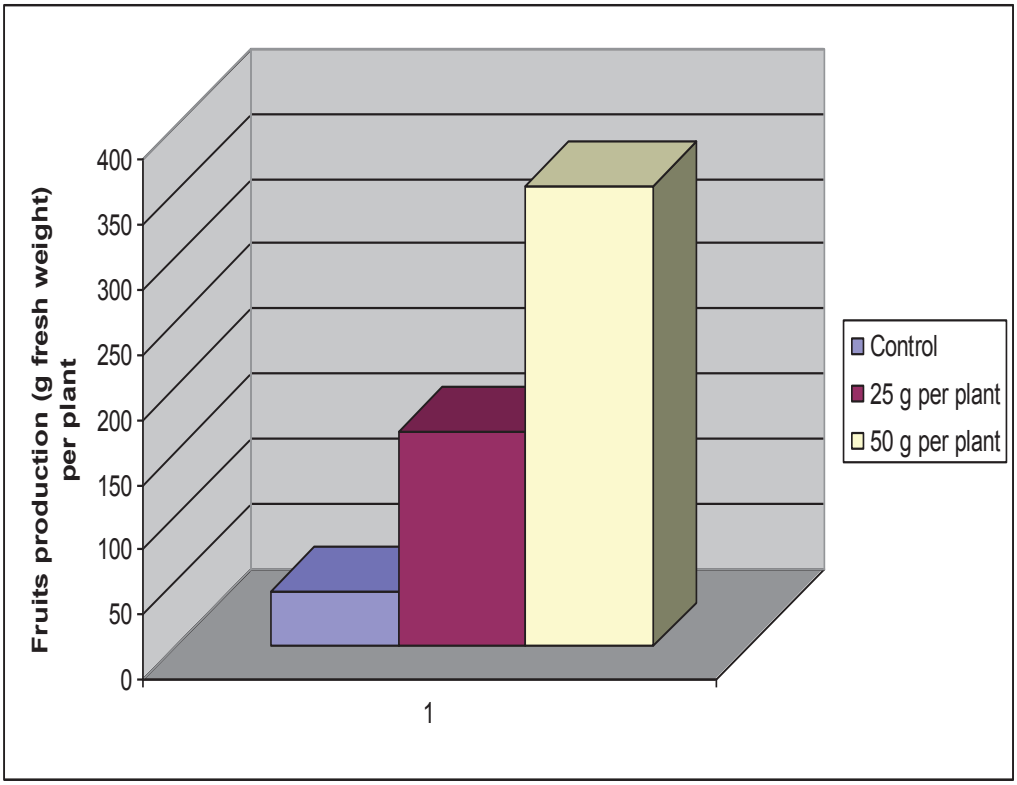

Figure 2 Fresh coffee bean weight as influenced by fertilizer dosage

Figure 3 Coffee bean yields (Control (*left*) , 25 g (*middle*) and 50 g (*right*) Dekastar®)

Discussion

The initiation of flower primordial is a major event in the life cycle of a plant in that it involves a shift in the pattern of growth and development from vegetative to reproductive processes. Before floral primordial can be initiated, the plant must complete a period of vegetative growth or attain some minimal leaf number (Nogle and Fritz, 1983). Ripeness to flower is not recognizable by any external characteristics, but it can be determined empirically by subjecting plants of varying age to environmental conditions known to induce flowering. Both temperature and light are involved and the availability of some essential elements in the soil is also considered to contribute to the flower initiation and fruit production.

Figure 1 shows that the fertilizer dosages influenced the number of fruit (bean) producing plant, indicating fertilizer dosages as critical level for flower stimulation in the plant. The fruit production was also affected by fertilizer dosages as shown in Figure 2 and 3. The dosage of 25 g and 50 g of Dekastar® fertilizer significantly increased fruit production by 297% and 730%, respectively as compared to the control treatment.

Dekastar® 6-13-25 contains Nitrogen (N) 6%, Phosphate (P) 13% and Potassium (K) 25%. N is an essential element for plant growth and development. The role of this element in the plant is through its presence in the structure of the protein molecules. In addition, N is found in such important molecules as pirin, pyrimidines, prophyrines and coenzymes. P is found in plants as a constituent of nucleic acid, phospholipids, the coenzymes NAD and NADP, and most important, as a constituent of ATP. The coenzymes NAD and NADP are important in oxidation-reduction reaction in which hydrogen transfer takes place. Such important plant processes as photosynthesis, glycolisis, respiration and fatty acid synthesis are depend on the action of theses enzymes. The Potassium is essential as an activator for enzymes involved in the synthesis of certain peptide bond and also can act as an activator for several enzymes involved in carbohydrate metabolisme (Devlin and Whitam, 1983). All of those processes were required as prerequisite for reproductive growth of the plant including flower initiation and fruit production. In some instances, critical levels of either single element of N, P, K or its combination seem necessary and the interaction between those element with light or temperature is highly contribute to the flower stimulation and fruit production.

Conclusion

Fertilizer dosages significantly increased coffee bean yields with different efficacies. Dosages of 25 g and 50 g of Dekastar® fertilizer stimulated coffee bean yields by 297% and 730%, respectively over the control.

References

Devlin, RM and FH. Witham. 1983. Plant Physiology, Fourth Edition. Willard grant Press, Boston.

Etherington, 1976. Environtment and Plant Ecology. Wiley Eastern Limited. New Delhi.

Noggle, GR and GJ. Fritz. 1983. Introductory Plant Physiology. Prentice Hall, Inc. New Jersey