Buletin Peternakan 42 (1): 57-61, February 2018

ISSTAP
Indonesian Society for Sustainable Tropical Animal Production

Bulletin of Animal Science

ISSN-0126-4400/E-ISSN-2407-876X Acredited: 36a/E/KPT/2016
http://buletinpeternakan.fapet.ugm.ac.id/

Doi: 10.21059/buletinpeternak.v42i1.28734

Introduction of Dwarf Elephant Grass (*Pennisetum purpureum* cv. Mott) and Annual Legumes in the Disused Limestone Mining in Karst Gombong Area, Central Java, Indonesia

Doso Sarwanto* and Sari Eko Tuswati

Faculty of Animal Husbandry, Wijayakusuma University, Purwokerto, 53152, Indonesia

Article history
Submitted: 4 October 2017
Accepted: 26 January 2018

* Corresponding author:
Telp. +62 821 3838 0220
E-mail: dososarwanto@gmail.com

ABSTRACT

The aim of this research was to revegetate the disused limestone quarry by introducing dwarf elephant grass (*Pennisetum purpureum* cv. Mott) and annual legumes such as peanuts (*Arachis hypogaea* L.), *soybeans* (*Glycine max*), *c*owpeas (*Vigna unguiculata*) *and mung beans* (*Vigna radiata*). The study was conducted experimentally in a disused limestone quarry applying Completely Randomized Design. The research method used was experimental in disused limestone mining in karst Gombong area applying Completely Randomized Design (CRD). Treatment consisted of 6 planting methods with 4 replicates. The 6 treatments research were the followings: RO: Single planting of dwarf elephant grass, R1: Single planting of dwarf elephant grass + 1.5 kg/m^2 goat compost, R2: Mixture Planting of dwarf elephant grass + legume peanuts + 1.5 kg/m^2 goat compost, R3: Mixture planting of dwarf elephant grass + legume soybeans + 1.5 kg/m^2 goat compost, R4: Mixture planting of dwarf elephant grass + legume cowpeas + 1.5 kg/m^2 goat compost and R5: Mixture planting of dwarf elephant grass + legume mung beans + 1.5 kg/m^2 goat compost. The measured response variables were plant's height, fresh yield, dry matter yield and crude protein content of dwarf elephant grass aged 8 weeks. The result showed that the addition of goat compost and the planting method of annual legumes on the disused limestone quarry had highly significant influence ($P<0.01$) on the increase productivity and quality of dwarf elephant grass. The best method of planting dwarf elephant grass (*Pennisetum purpureum* cv. Mott) on disused limestone mining in karst Gombong area is mixture planting with soybean legumes (*Glycine max*) and adding the 1.5 kg/m^2 goat compost.

Keywords: Annual legumes, Disused limestone mining, Dwarf elephant grass, Karst Gombong, Productivity

Introduction

The karst area plays an important role in the ecosystem, such as providing fresh water, lime-based natural materials, and controlling climate change. Despite its important role in the ecosystem, karst areas are vulnerable to disturbance of non-directed socio-economic dynamics of the communities such as limestone mining activities. Limestone mining will alter the landscape significantly and potentially damage the environment in which the losses can even outweigh the benefits derived from mining activities (Utama *et al*., 2016; Purnaweni, 2014). Based on the Decree of the Minister of Energy and Mineral Resources Number: 3043.K/40/MEM/2014 that the karst landscape are karst Gombong, Central Java Indonesia has a unique geological component and to serve as natural regulator of the water system and store added value, thus it is necessary to be preserved and protected its existence in order to prevent damage to support sustainable development and the development of science (Menteri Energi dan Sumber Daya Mineral Republik Indonesia, 2014).

Since 1963 until recently limestone mining in karst Gombong area still continues in line with the increasing demand of limestone. The condition is inseparable from the Indonesian government's policy to focus on infrastructure development in various regions. The negative impact of limestone mining that has lasted for long in karst Gombong area is the formation of open land that can cause ecosystem damage. Sarwanto *et al.* (2015) based on the study in karst Gombong area indicated that the closed or unexplored quarry contains around 20 forage species with fresh feed forage production of 29.75 tons/ha/year. This condition is far different from Sarwanto and Prayitno (2010) study that in Gombong quarry only 9-13 forage species were found with fresh forage production of only 8.4 tons/ha/year. The study showed that limestone mining in karst Gombong area has decreased forage diversity up to 50% and decreased forage

productivity by about 70%. Reduced diversity and forage productivity in the quarry will eventually affect the productivity of goats in the region.

Based on data from the Central Bureau of Statistics of Kebumen District (Badan Pusat Statistik Kabupaten Kebumen, 2016) goat population in karst Gombong region was as many as 57,091 heads. The decrease in goat productivity will also affect its development in the future and will affect the socio-economic conditions of the community in karst Gombong area. Revegetation through the introduction of dwarf elephant grass (*Pennisetum purpureum* cv. Mott), Dwarf elephant grass was a superior grass that was preferred by goats because it had soft texture of leaves and stems and was resistant to high light intensity. Sollenberger and Jones (1989) stated that the dwarf elephant grass (*Pennisetum purpureum* cv. Mott) has high quality and high production of dry matter and is adaptable to tropical region and can be harvested every 35 days. Kozloski *et al.* (2005) productivity and quality of dwarf elephant grass (*Pennisetum purpureum* cv. Mott) is affected more by age of cutting and climatic conditions at planting time until harvest time. The high adaptation level of the dwarf elephant grass is expected to grow and develop on the former limestone mining in the karst Gombong area.

Study of Sarwanto and Prayitno (2010) in Gombong quarry showed that soil fertility levels in open fields of former limestone mining in karst Gombong are low with total N content of 0.049 - 0.141%, total P_2O_5 of 0.067 - 0.133% and total K_2O of 0.086 - 0.100%. Therefore, the soil fertility on the former limestone mining land needs to be increased by additing organic fertilizers such as goat compost which is widely available in karst Gombong area. According to Nurshanti (2009) goat compost has better effect than cow and chicken compost on soil because it can soften the surface layer of soil, increase the population of microorganisms, increase the soil ability to absorb and retain water so that it can increase the plants productivity. Furthermore Nurshanti (2009) stated that the optimal use of goat compost is as much as 1.5 kg / m^2, whereas according to Zahroh *et al*. (2016) optimal use of livestock compost to increase the productivity of the dwarf elephant grass is about 1 - 2 kg/ m^2.

The addition seasonal legumes such as groundnuts (*Arachis hypogaea L.*), soybeans (*Glycine max*), mung beans (*Vigna radiata*) and cowpeas (*Vigna unguiculata*) in the disused limestone mining area is one of the efforts to improve the productivity, quality and continuity of dwarf elephant grass (*Pennisetum purpureum* cv. Mott) in karst Gombong area. Rusdy (2012) cultivation of seasonal legumes such as peanuts, soybeans, mung beans and cowpeas can add soil fertility levels due to increased availability of soil nitrogen. In addition, seasonal legumes can also be used as a source of food to the community in karst Gombong area.

Materials and Methods

The material used in this research was dwarf elephant grass stem cuttings (*Pennisetum purpureum* cv. Mott) and legume seeds of peanuts (*Arachis hypogaea* L.), soybeans (*Glycine max*), mung beans (*Vigna radiata*) and cowpeas (*Vigna unguiculata*). The research was located in disused limestone mining land that has been abandoned for more than 10 years located in karst Gombong area, Kebumen Regency, Central Java.

The research method used was experimental in disused limestone mining area applying completely randomized design (CRD). Treatment consisted of 6 planting methods with 4 replicates. The 6 treatments research are the followings: RO: Single planting of dwarf elephant grass, R1: Single planting of dwarf elephant grass + 1.5 kg/m^2 goat compost, R2: mixture planting of dwarf elephant grass + legume peanuts + 1.5 kg/m^2 goat compost, R3: mixture planting of dwarf elephant grass + legume soybeans + 1.5 kg/m^2 goat compost, R4: mixture planting of dwarf elephant grass + legume cowpeas + 1.5 kg/m^2 goat compost and R5: mixture planting of dwarf elephant grass + legume mung beans + 1.5 kg/m^2 goat compost. The measured response variables included plant height, fresh production, dry matter production and crude protein content of the dwarf elephant grass at 8 weeks of age of first defoliation. The data obtained was then analyzed by analysis of variance and if the treatment is found to be different the least significant difference (LSD) test was performed according to Steel and Torrie (1993).

Results and Discussion

Plant height

The results showed that the plant height of the dwarf elephant grass on the disused limestone mining area without goat compost (R0) was 84.7 cm, while with the addition of 1.5 kg/m^2 (R1) goat compost was 83.7 cm and with seasonal legumes (R2, R3, R4, R5) the plant height ranged from 87.5 to 95.5 cm. The results of a study by Sirait *et al*. (2015) in the wet and moderate climates of non limestone area of North Sumatra showed that the height of dwarf elephant grass was only about 70 to 96 cm. This result was different from Lasmadi *et al.* (2013) indicating that the height of dwarf elephant grass (*Pennisetum purpureum* cv. Mott) in Faculty of Animal Husbandry Manado of North Sulawesi without organic fertilizer can reach height of up to 108 cm, while the provision of organic fertilizer as much as 1 - 3 kg/m^2 can produce plant height ranging from 114 to 125 cm.

The result of variance analysis showed that the planting methods with the addition of 1.5 kg/m^2 goat compost and seasonal legume cultivation had highly significant effect ($P<0.01$) on the plant height of dwarf elephant grass. The results of LSD post hoc test showed that the method of planting without fertilizer (R0) resulted in the same plant height as R1 and R2, but different from R3, R4 and R5

treatments. The method of cultivating the dwarf elephant grass with the addition of 1.5 kg/m^2 goat compost and soybean legume planting (R3), cowpeas (R4) and mung beans (R5) had strong positive effect on the height of dwarf elephant grass. Height average of the dwarf elephant grass on various methods of planting can be seen in Figure 1.

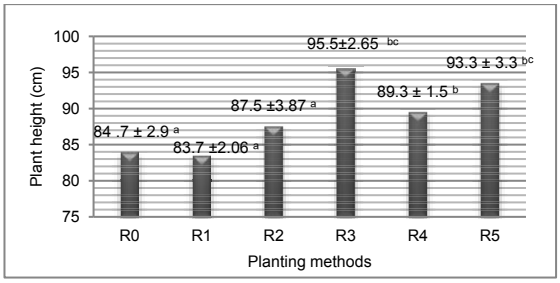

Figure 1. The average plant height of the dwarf elephant grass (*Pennisetum purpureum* cv. Mott) on a disused limestone mining in karst Gombong area with various planting methods.
[a,b,c] The different letters on diagram shows highly significant different (P<0.01).

Fresh production

The fresh production of the dwarf elephant grass in the disused limestone mining area with various methods of planting ranged from 4.43 to 8.38 tons/ha. Purwawangsa and Putera (2014) showed that the production of fresh dwarf elephant grass (*Pennisetum purpureum* cv. Mott) in non-productive land area can reach up to 10 tons/ha. The difference of about 2 - 5 tons/ha is due to the low level of soil fertility of the disused limestone mining area. The result of Sarwanto and Prayitno (2010) research showed that the fertility of open land of disused limestone mining in karst Gombong area is low because it contains nitrogen (N) total of 0.049 – 0.141%, P_2O_5 total of 0.067 – 0.133%, and total K_2O content of 0.086 - 0.100%. The results also showed that the production of fresh dwarf elelphant grass (*Pennisetum purpureum* cv. Mott) is much lower with the production of fresh elephant grass (*Pennisetum purpureum* Schum) which is 15 tons/ha (Jamaran, 2006) and even the production of elephant grass can reach up to 38 tons/ha when fertilized with 1 kg/m^2 of bokashi (Kusuma, 2013).

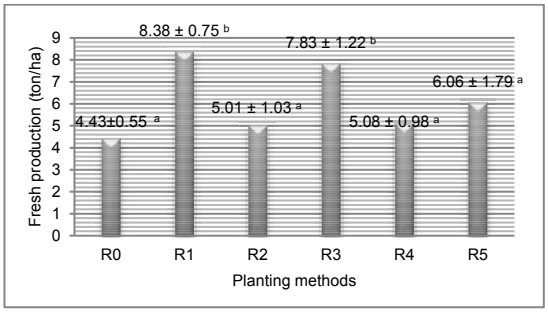

Figure 2. The average of fresh production of dwarf elephant grass (*Pennisetum purpureum* cv. Mott) on disused limestone mining in karst Gombong area with various planting methods.
[a,b] different letters in diagram show highly significant different (P<0.01).

The result of variance analysis showed that the planting methods has highly significant effect (P<0.01) on the fresh production of dwarf elephant grass in the open field of limestone mining. Results of the post hoc test showed that the highest fresh production of dwarf elephant grass was obtained on R1 and R3. The average productions of the dwarf elephant grass on various methods of planting are presented in Figure 2.

Dry matter production

The dry matter content of dwarf elelphant grass in the open field of disused limestone mining area with various methods of planting was relatively the same i.e. about 7 - 10%. The low dry matter content is due to the ideal proportion between stems and leaves of the dwarf elephant grass and its soft texture. In addtion, the study was conducted during rainy season. The further results of the study indicated that the dry matter production of dwarf elephant grass in the open field of disused limestone mining area with various planting methods only ranged from 0.36 to 0.57 tons/ha or 0.036 – 0.057 kg/m^2 (Rengsirikul *et al.,* 2013). Dry matter production of dwarf elephant grass in the Central Thailand rich up 6,6 ton/ha or 0,66 kg/m^2. This dry matter production of dwarf elephant grass representing short type is different from the dry matter production of elephant grass tall type (*Pennisetum purpureum* Schum) which can reach up to 0.19 kg/m^2 (Jamaran, 2006), 1,72 kg/m2 in Central Thailand (Rengsirikul *et al.,* 2013).

The result of variance analysis showed that the planting methods has highly significant effect (P<0.01) on the production of dry matter of dwarf elephant grass on the disused limestone mining area. The result of post hoc test showed that R1 and R3 have more dry matter production compared to R0, R2, R4 and R5. The average dried matter production of dwarf elephant grass on various methods of planting can be seen in Figure 3.

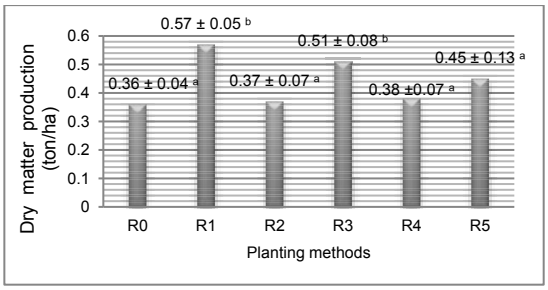

Figure 3. The average dry matter production of dwarf elephant grass (*Pennisetum purpureum* cv. Mott) on disused limestone mining in karst Gombong area with various planting methods.
[a,b,c] different letters in diagram show highly significant different (P<0.01).

Crude protein content

The results showed that the dwarf elephant grass cultivated in the open field of disused limestone mining area with various methods had crude protein content of 14.4 - 15.9%. Anonymous (2016) explains that the content of crude protein content of dwarf elephant grass is about 14-17%,

meanwhile Purwawangsa and Putera (2014) reported that crude protein content of dwarf elephant grass in West Java area is around 17-19%. The results of the Urribarri *et al.* (2005) study in venezuela showed that the crude protein of the dwarf elephant grass is 10-15%. Nevertheless, the crude protein content of the dwarf elephant grass in the open field of disused limestone mining area is still higher than the crude protein content of elephant grass (*Pennisetum purpureum* Schum) which is only 12.75% (Jamaran, 2006).

Result of variance analysis showed that the planting methods had highly significant effect (P<0.01) on crude protein content of the dwarf elephant grass in the open field of disused limestone mining area. The results of post hoc test showed that the highest crude protein content of the dwarf elephant grass protein was obtained on R3 and R5. The average crude protein content of dwarf elephant grass in various planting methods are presented in Figure 4.

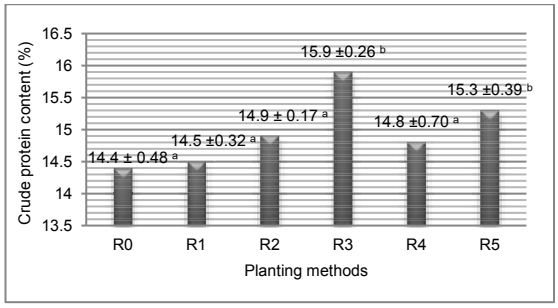

Figure 4. The average crude proteint content of dwarf elephant grass (*Pennisetum purpureum* cv. Mott) on disused limestone mining in karst Gombong area with various planting methods [a,b] different letters in diagram show highly significant different (P<0.01).

Conclusion

The results indicated dwarf elephant grass (*Pennisetum purpureum* cv. Mott) was still able to grow in the open field of disused limestone mining area abandoned for more than 10 years. The best planting methods of dwarf elephant grass (*Pennisetum purpureum* cv. Mott) in the open field of disused limestone mining area was mixed with legume soybean (Glycine max) + 1.5 kg/m^2 goat compost.

References

Anonymous. 2016. Rumput Odot, hijauan pakan kambing domba tinggi nutrisi. http://www.suksesternakkambing.com. Accessed 4 September 2017.

Badan Pusat Statistik Kabupaten Kebumen. 2016. Kebumen dalam Angka 2016. Badan Pusat Statistik Kabupaten Kebumen, Jawa Tengah.

Jamaran, N. 2006. Produksi dan kandungan nutrien rumput gajah dan rumput raja yang ditumpangsarikan dengan tanaman Jati. Jurnal Peternakan Indonesia 11: 151-157.

Kozloski, G. V., J. Perottoni, and L. M. B. Sanchez. 2005. Influence of regrowth age on the nutritive value of dwarf elephant grass hay (*Pennisetum purpureum* Schum. cv. Mott) consumed by lambs. Anim. Feed Sci. Technol. 119: 1-11.

Kusuma, M. E. 2013. Pengaruh pemberian bokashi terhadap pertumbuhan vegetatif dan produksi rumput gajah (*Pennisetum purpureum* Schum). Jurnal Ilmu Hewani Tropika 2 : 40-45.

Lasmadi, R. D. S., S. Malalantang, Rustandi, dan S. D. Anis. 2013. Pertumbuhan dan perkembangan rumput gajah dwarf (*Pennisetum purpureum* cv. Mott) yang diberi pupuk organik hasil fermentasi EM4. Jurnal Zootek 32: 158-171.

Menteri Energi dan Sumber Daya Mineral Republik Indonesia. 2014. Surat Keputusan Menteri Energi Sumber Daya Alam Republik Indonesia Nomor : 3043. K/40/MEM/2014 tanggal 4 Juli 2014 tentang Penetapan Kawasan Bentang Alam Kars Gombong. Menteri Energi dan Sumber Daya Mineral Republik Indonesia, Jakarta.

Nurshanti. 2009. Pengaruh pemberian pupuk organik terhadap pertumbuhan hasil tanaman sawi caisin. Agronobis 1: 89-98.

Purnaweni, H. 2014. Kebijakan pengelolaan lingkungan di kawasan Kendeng Utara Provinsi Jawa Tengah. Jurnal Ilmu Lingkungan 12: 53-65.

Purwawangsa, H. and B. W. Putera. 2014. Pemanfaatan lahan tidur untuk penggemukan sapi. Risalah Kebijakan Pertanian dan Lingkungan 1: 92-96.

Rengsirikul, K., Y. Ishii, K. Kangvansaichol, P. Sripichitt, V. Punsuvon, P. Vaithanomsat, G. Nakamanee and S. Tudsri. 2013. Biomass yield, chemical composition and potential ethanol yields of 8 cultivars of napiergrass (*Pennisetum purpureum* Schumach.) harvested 3-monthly in Central Thailand. Journal of Sustainable Bioenergy Systems 3: 107-112. http://dx.doi.org/10.4236/jsbs.2013.32015.

Rusdy, M. 2012. Produksi bahan kering, kompatibilitas biologis dan kualitas tanaman campuran rumput Benggala (*Brachiaria decumbens*) dan centro (*Centrosema pubescens*). Pastura 2: 17-20.

Sarwanto, D., S. E. Tuswati, and P. Widodo. 2015. Keragaman dan produktivitas hijauan pakan i*ndigenous* pada berbagai tingkat kerapatan vegetasi di pegunungan kapur Gombong Selatan. Biosfera 32: 147-153.

Sarwanto, D. and C. H. Prayitno. 2010. The Diversity and productivity of indigenous

forage in former limestone mining quarry in karst mountain of Southern Gombong, Central Java Indonesia. J. Anim. Prod. 17: 69-75.

Sirait, J., A. Tarigan, and K. Simanihuruk. 2015. Karakteristik morfologi rumput gajah kerdil (*Pennisetum purpureum cv. Mott*) pada jarak tanam yang berbeda di dua agroekosistem di Sumatera Utara. Prosiding Seminar Nasional Teknologi Peternakan dan Veteriner : 641-649.

Sollenberger, L. E. and C. S. Jones. 1989. Beef production from nitrogen – fertilized Mott dwarf elephan grass and pensacola bahiagrass pastures. Tropical Grasslands 23: 129-134.

Steel, R. G. D. and J. H. Torrie. 1993. Prinsip dan Prosedur Statistika : Suatu pendekatan biometrik. PT Gramedia Pustaka Utama, Jakarta.

Urribarri, L., A. Ferrer and A. Colina. 2005. Leaf protein from amonia treated dwarf Elephant grass (*Pennisetum purpureum* Schum cv Mott). Appl. Biochem. Biotech. 121-124: 721-730.

Utama, W., K. Wijaya, R. Aldi, H. Farida, Budi, and Suto. 2016. Inventarisasi potensi kawasan karst Pamekasan Madura Utara. Jurnal Geosaintek 02: 201-212.

Zahroh, F., Muizzudin, and L. Chamisijatin. 2016. Pengaruh jenis dan dosis pupuk kandang terhadap tinggi tananam, luas daun dan berat basah rumput Gajah Odot (*Pennisetum purpureum* cv Mott). Prosiding Seminar Nasional II Tahun 2016 Kerjasama Prodi Pendidikan Biologi FKIP dengan Pusat Studi Lingkungan dan Kependudukan (PSLK) Universitas Muhammadiyah Malang, Malang.