

POTENTIAL AND DEVELOPMENT OF COASTAL SANDY LAND FOR AGRICULTURE AND TOURISM

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ABSTRACT

Utilization and development of coastal sandy land for agriculture and tourism has been started since the farm area decreased year by year for non-agricultural purposes (housing and industry) along with the increasing of population number and development. The potencies of coastal sandy land are their huge area, topography, climate and number of human resources. The weaknesses are their sand texture, porous soil, lack of nutrient and organic matter, and high soil surface temperature due to its open air, besides their heavy winds with salt particles that possible to disturb the plant growth. Those heavy winds also make very interesting sand dunes at certain points, beautify the scenery of the South beach of Java. Therefore, unification of tourism and agricultural potency may open up prospective agro-tourism opportunities. It is likely that after enjoying sound of the South beach waves and fantastic sand dunes, both the foreign and domestic tourists can continue their trip for visiting the farmer activities such as preparing farm, cultivating and harvesting the crops, and they can spending money buying some agricultural products as souvenirs. For agricultural purposes at the coastal land, the farmers should not disturb the existence of sand dunes that is part of the efforts to maintain and preserve the environment. Thus, it is very appropriate if the coastal sandy land development is conducted integrated of both agricultural and tourism purposes in broad sense.

Keywords: potential,development, coastal sandy land, agriculture, tourism

INTRODUCTION

As a country with a group of islands, Indonesia has 17,508 islands with 5.8 million km² area of sea, and 80,791 km length of coast (Anonymous, 1995). The Coast of Java Island has 3,500 km in length. Northern coast of Central Java and East Java has 930 km in length ramp slope, contrast to the Southern coast that has steep slope.

Coastal sandy land is one of important potency in agriculture and tourism development, and is expected to be used as a substitute of land reduction due it conversion to non-agricultural function. There are \pm 1.06 million hectares of coast sandy land in Indonesia. General constraints of such land for agriculture are: coarse texture, low water storage and nutrition, low cation exchange capacity, high power in release of water and air, low organic matter content, very high speed of wind that contain salt particles, extremely high temperature of soil and air during of the day, and land which easily eroded by the wind.

One element of the agricultural sector that has not been optimally improved is agro-tourism. The potential of agro-tourism is showed by its natural beauty and agricultural products. Agro tourism is a series of tourism activities that harness the potential of agriculture as a tourist attraction, both of the potential of natural scenery area as well as the uniqueness and diversity of agricultural production activities and technologies, and their peasant culture. Agro-tourism activities aim to broaden the knowledge, experience of recreation and business relations in agriculture, including food crops, horticulture, plantation, fishery and animal husbandry. Belong to the agro tourism are forestry and agricultural resource. If the unification of natural beauty, life of rural communities and agricultural potency properly organized and seriously managed, it can develop the tourist attraction.

Well designed of agro tourism that presents variety of plants is beneficial in improving the quality of the microclimate, maintaining hydrological cycles, reducing erosion, preserving the environment, and providing an aesthetic design. Development of the agro tourism in a tourist destination will benefit in increasing the income for society and government. In other words, the tourism function can be done as agricultural, rural settlement and conservation functions. Efforts in rural agro tourism development that utilize agricultural potency and involve rural communities, can serve in line with the empowerment of community-based tourism, that including the role and aspirations of rural communities in harmony with empowering their natural and human resources. The problem is how to empower the rural community continuously in order to optimize their potency, so it can bring benefit for the farmers, rural communities, entrepreneurs and become a reliable source of income. It is needed to build a development pattern for the tourism and agriculture actors to arrange an agro-tourism program that profitable for the community, entrepreneur and the government (Gumelar, 2010).

By looking at the potential advantages and problems of coastal sandy land for the development of agriculture and tourism, an integrated development of coastal sandy land either for agriculture in a broader sense as well as tourism is required. The purpose of this paper is to investigate the potency and development of coastal sandy land for agriculture and tourism interests, in order to obtain the benefits for society, entrepreneur and government in realizing the synergy of agriculture and tourism that can generate the growth of social, economic and community organizations.

CHARACTERISTIC OF COASTAL SANDY LAND

In fact, the utilization of coastal sandy land by the farmers have been done for long time, but new intensive management began in 1996 with the enactment of coastal sandy land as

an integrated development area. Beside their potencies (wide area, topography, climate and number of human resources), there are also many weaknesses of coastal sandy land, such as sand texture, porous soil, poor organic matter and nutrition and high ground surface temperatures (because of the open condition) and heavy wind carrying salt particles, that is not good for crops growing and livestock. Table 1 shows the characteristics of coastal sandy land at Samas and Bugel. They has sandy texture, low level of organic matter content, low level of nitrogen, low phosphor and potassium, and slightly acidic pH, so the level of soil fertility is low.

Table 1. Characteristics of coastal sandy land at Samas, Bantul and Bugel, Kulon Progo

No	Characteristics of Soil	Coastal sandy land Samas Bantul		Coastal sandy land Bugel Kulon Progo	
		Content	Levels	Content	Levels
1.	Sand (%)	92.4	-	97.31	-
2.	Silt (%)	6.4	-	1.79	-
3.	Clay (%)	1.2	-	0.90	-
4.	Texture		Sand		Sand
5.	Porosity	47.0	High	32.03	Very high
6.	Organic C (%)	0.30	Very low	0.07	Very low
7.	Organic Matter (%)	0.51	Very low	0.13	Very low
8.	Total N (%)	0.04	Very low	0.02	Very low
9.	Ratio C/N	7.5	Low	3.78	Low
10.	pH H ₂ O	5.5	Slightly acidic	6.67	Neutral
11.	Available P (ppm)	8.87	Very low	9.67	Very low
12.	Available K (cmol/kg)	0.13	Low	0.17	Low
13.	CEC (cmol/kg)	4.47	Low	1.61	Very low
Source:		Lagiman <i>et al.</i> , 2005		Sulakhudin <i>et al.</i> , 2009	

Source: the Levels according to the Soil Research (2005)

Physically and chemically it shows that the texture classes of soil particles are sands because sand fraction is dominated between 92.4% to 97.31%, while the fraction of silt is only 1.79 to 6.4% , and the fraction of clay is 0.9 to 1.2%. Soil porosity is very high (32.03 to 47.0%) due to the dominated sand fraction so the soil capability to hold water is very low. Therefore, water from sprayer or rain cannot be stored and unavailable to plants. Very high porosity causes the rate of leaching of nutrients in the soil is very high, this is indicated by very low levels of organic matter (0.13 to 0.51%), very low levels of nitrogen levels (0.02 to 0.04%), very low levels of available P (8.87 to 9.67 ppm), and low levels of available K (0,13 until 0,17 cmol / kg). Very low nutrient content in soil caused by the weakness in binding soil nutrients that reflected from very low cation exchange capacity (CEC 1.61 to 4.47 cmol / kg). Very low CEC is caused by low levels of clay and low organic matter as a source of negative charge. Very low organic matter occurred due to the rapid rate of organic matter decomposition, that is supported by the high temperatures of the soil and the aerobe ambiance (contains oxygen). It is indicated by the low ratio of C and N (3.78 to 7.5).

COASTAL SANDY LAND DEVELOPMENT FOR AGRICULTURE

Coastal sandy land can be used as agricultural land. Years of experiences proved that the local inhabitants could use it as a profitable farm. They have had enough experience to overcome the constraints of those coastal marginal lands by improving it. One of it is to amend its physical properties that could not form clots, porous and low fertility. This low quality can be improved by supplying organic matters that derived from the remains of plants and animals in the form of livestock manure, rice straw and other parts of plant morphology that can be used as green manure. The soil physical properties can be corrected by adding argillaceous matters.

To cope those unfertile soils problem, farmers have been supplying manure from their cattle, as well as artificial fertilizers. To improve soil physical properties they add clay from other places continuously so fertile soil for plant growth can be realized.

Table 2. Chemical and physical properties of soil after treatment with manure and argillaceous material combination (Lagiman *et al.*, 2005)

No	Soil properties	Dosage combination of manure and argillaceous material (tonnes / ha)						
		0-0	25-30P	25-30G	30-30P	30-30G	35-35P	35-35G
1	Organic matter (%)	0.62 e	0.88 d	0.86 d	1.21 c	1.36 b	1.55 a	1.48 a
2	Organic C (%)	0.32 e	0.51 d	0.50 d	0.71 c	0.79 b	0.90 a	0.86 a
3	Total N (%)	0.16 d	0.26 c	0.30 c	0.34 b	0.38 ab	0.40 a	0.40 a
4	Ratio C/N	2.33 a	2.33 a	2.00 a	2.22 a	2.11 a	2.33 a	2.11 a
5	Available K (%)	14.72 d	31.77 b	23.99 c	39.61 a	38.35 a	39.37 a	37.75 a
6	Available P (%)	8.74 f	23.6 d	16.23 e	23.75 d	27.50 c	35.61 a	33.10 b
7	pH H ₂ O	5.6 a	5.8 a	6.0 a	5.7 a	6.0 a	5.7 a	5.8 a
8	CEC (cmol/kg)	4.47 d	9.12 c	9.77 c	14.58 b	15.05 b	17.24 a	17.88 a
9.	Sand (%)	87.25	80.64	79.64	81.00	81.00	80.00	80.00
10	Silt (%)	3.61	0.64	3.96	1.28	3.28	2.20	4.80
11	Clay (%)	9.14	18.72	16.40	18.72	15.72	17.80	15.20
12	Texture	sand	Loamy sand	Loamy sand	Loamy sand	Loamy sand	Loamy sand	Loamy sand
13	Available water Pore (%)	1.80 c	2.65 abc	3.41 ab	2.75 abc	3.79 a	2.26 bc	2.95 abc

Description: averages followed by same letter in rows indicate no real difference at 5% DMRT test, P = argillaceous material from Patuk (Latosol), G = argillaceous material from Semanu (Grumusol), dosage of manure: 20, 30, 35 tonnes / ha

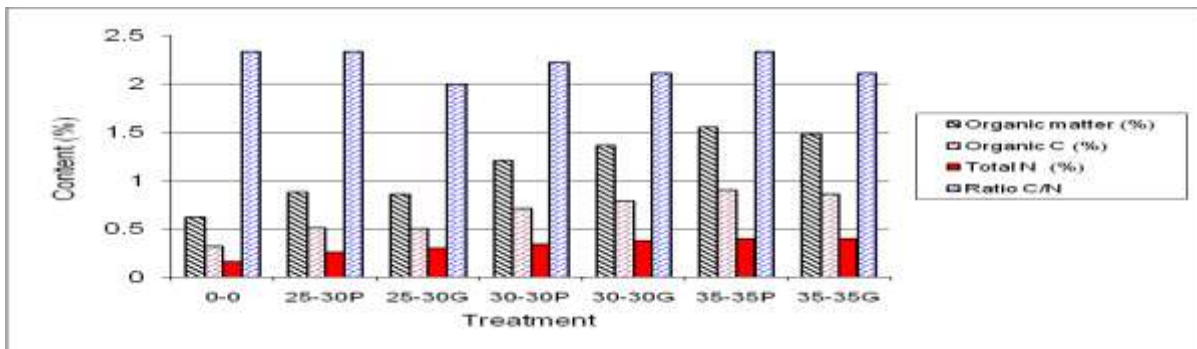


Figure 1. Influence of manure and argillaceous materials to organic matter, organic-C, total N and C/N ratio soil

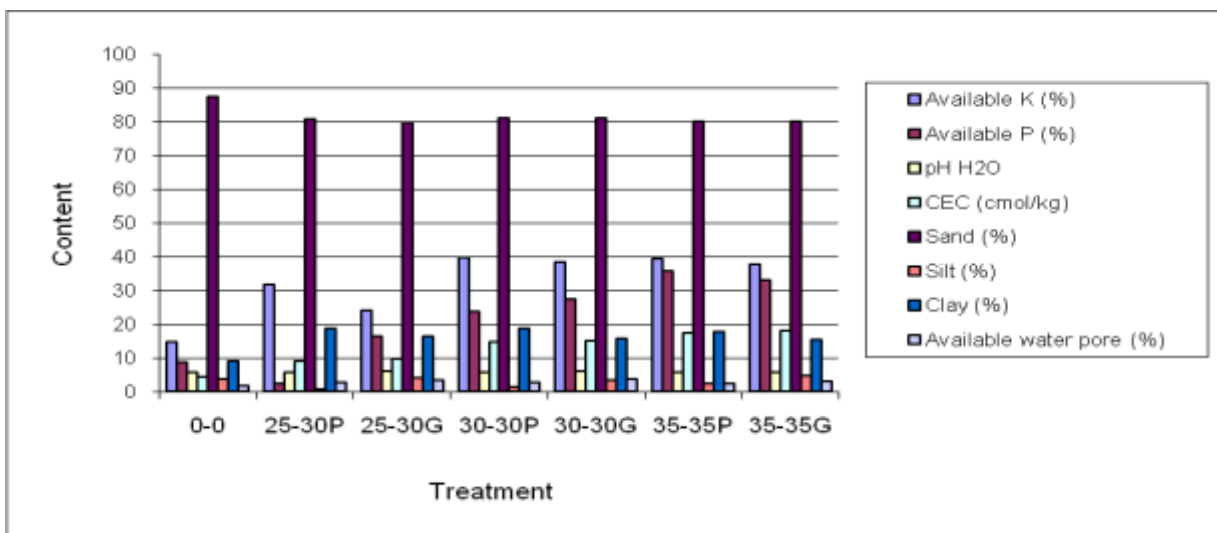


Figure 2. Influence of manure and argillaceous soil to available P, available K, pH H₂O, KPK, fraction of sand, silt, clay, available water pore

From Table 2, Figures 1 and 2 showed that supplying manure and soils (grumusol and latosol) can raise the level of organic matter, total nitrogen, available phosphorus, available potassium, cation exchange capacity, and available pore water. Those are due to the addition C-organic and nutrient N, P, K from manure, as well as the addition of clay from soil that increase the cation exchange capacity and pore available. They indicate an increase of soil fertility of coastal sandy land. Partoyo (2005) described, that the treatment in coastal sandy land at Tegalrejo Bulak, Samas, Bantul by adding clay and manure into the farm can improve the soil quality. Those farms have been used for 19 years and 11 years, and based on soil quality index the treated farms have shown better soil quality than the untreated ones.

Irrigation system for agriculture at coastal sandy land has been very distinctive, besides relying on rainfall (rainfed irrigation), it is also supplied from groundwater and surface water accommodated by the ponds. Using pumps, water is distributed to reservoirs and joint-wells, and from each well, the farmers collect water with pail for watering plants and other purposes. The development and management of irrigation water through the ponds, reservoirs and joint-wells have been work out with deep considerations, especially related to the environment balance (hydrology and irrigation). Notwithstanding that at the bottom of the coastal sandy land lie a kind of plate that prevents leakage / intrusion of seawater, so groundwater used for agriculture and other purposes are not mixed with seawater. Meanwhile, to prevent water loss from direct soil surface evaporation, farmers use the mulch/litter as soil cover with a certain thickness to maintain the stability of soil surface temperature. Soil moisture contents under some vegetation is higher than in soil without vegetation, this is due to the roots and other plant parts that can hold and store water through evaporation (Wardoyo, et al. 2009).

Vegetative soil conservation applied to the coastal sandy land is to combine the crops as wind barrier with crops as agricultural product in rows. This pattern has a double function as a conservation effort to control the rate of sand erosion by wind and as the local community agri-business through cultivation (Sukresno et al., 2000). It has been explained that wind barrier permanent crops is sea pine (*Casuarina equisetifolia*), while for wind barrier temporary crops are: pandanus, glyricideae, corn and sorghum. Ecologically, cultivation on coastal sandy land may keep the land covered with the plant longer (6-8 months), so the sand erosion can be controlled more.

At southern coast that formed of limestone hills (karst), the land utilization is for conservation agricultural land and agroforestry, with selected commodities such as: teak, rosewood, mahogany, mango, melinjo, cashew and guava (Sutardi et al., 2000). Development of crop cultivation that has been done at Samas Bantul DIY shows that the suitable type of crop planted between the barrier wind crop are: watermelon, eggplant, tomatoes, corn, onion, chili, beans (Sukresno et al, 2000).

COASTAL SANDY LAND DEVELOPMENT FOR TOURISM

The existence of strong winds across the coastal land led up very interesting sand dunes that complement the panoramic beauty of the beach. This could open up a prospective agro-tourism when it combined with the agricultural potency (Anonymous, 1999). The foreign and domestic tourists who visiting those fantastic sand dunes and enjoying the sound of the beach wave can continue their trip to see the activities of farmers such as preparing the farm, cultivating, maintaining the crop / livestock and harvesting. They also can spend their money for buying agricultural products. For agricultural purposes at the coastal land, the farmers should not disturb the existence of sand dunes that is part of the efforts to

maintain and preserve the environment. Thus, it is very appropriate if the coastal sandy land development is conducted integrated of both agricultural and tourism purposes in broad sense. Similarly, facilitation from local government and the involvement of relevant parties should not only be continued but be expanded as well, especially in encouraging the emergence and development of services. Therefore, farmers can easily access to production service institution, agricultural marketing agency services, and service institutions that strengthening the business capital. Besides optimizing the potential of sandy coastal land physically, it is also very important to empower the local farmers in the framework of improving their incomes and welfare.

One of Agro-tourism program that has been done in the sand coastal land of Kuwaru Pandansimo Bantul DIY is "Nature Tourism Education" (Arinto *et al.*, 2010). This program is to educate public and students from play group to college levels. It is implemented in several packages, those are:

1. Educational outbound package, locations at sandy coastal land with available fruit and vegetables. Activities: horticultural fruits picking: *Melon, Cucumber, Tomato, Eggplant, Long Beans, Chili*, etc., horticulture leaves picking: *mustard, Swamp Cabbage, Lettuce*, etc., horticulture bulbs picking: *Peanuts*, etc. and tree fruits picking: *Longan (seasonal), Lime, Sapodilla*, etc.
2. Agricultural tour program, is visiting farm activities to see variety, type and utilization of herbs, practices on collecting herbs, fruits and vegetables.
3. Agricultural training program of cultivation technology on sandy coastal land, from land preparation, plant media modification, planting, plant protection, fertilizing, and harvesting.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

The potencies of coastal sandy land are their huge area, topography, climate and number of human resources. The weaknesses are their sand texture, porous soil, lack of nutrient and organic matter, and high soil surface temperature.

Coastal sandy land can be developed for agricultural benefit by improving the physical, chemical, biological and environmental properties. The method is to add clay material and

organic matter. Vegetative conservation is done by planting pine as permanent barrier wind plant and horticultural crops as temporary barrier wind plants.

Land development for tourism purpose is made by maintaining and preserving the beautiful sand dunes. To increase land productivity and economic value, cultivation technology is applied.

RECOMMENDATIONS

It is necessary to optimize the development of coastal sandy land by involving the community, employers and government in integrated system. The utilization of technology for effective and efficient works is also important to increase agricultural product, especially for horticultural crops (vegetables, fruits and flowers) that have high economic value and potency to attract the tourists to visit the beach.

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