RESEARCH ARTICLE

SOCIAL ECONOMIC ANALYSIS OF SEEDING AND CULTIVATION OF *Jatropha curcas* Linnaeus AS ALTERNATIVE ENERGY SOURCES (BIODIESEL) WHICH ENVIRONMENTAL FRIENDLY

By :

DR.IR.DRS.H.ISKANDAR MUDA PURWAAMIJAYA, MT
DRA.RINA MARINA MASRI, MP
DRS.H.SUTRISNO TUKIMIN, MT

Funded by
Directorate General of Higher Education
National Education Department
Accorded of Agreement Letter of Grant Research
Number : 003/SP2H/PP/DP2M/III/2007
Date March 29th 2007

CIVIL ENGINEERING DEPARTMENT
FACULTY OF TECHNOLOGY EDUCATION AND VOCATIONAL
INDONESIA EDUCATION OF UNIVERSITY
2007

ABSTRACT

Economic and Social Analysis of *Jatropha curcas* Linnaeus Seeding and Cultivation as Alternative Energy Sources that Environmental Friendly[1]

By :

Iskandar Muda Purwaamijaya[2], Rina Marina Masri[2] and Sutrisno Tukimin[3]

Energy crisis that attacking violently the earth already pushing efforts increased for benefiting energy that not sources from fossil. Efforts that must be done are energy diversification, biofuel included. Agricultural commodities that can be used for biofuel that are palm tree, coconut and *Jatropha* (for substituting solar fuel), sugar cane, timber root, sorgum and sago (for substituting premium fuel). Result of physic, chemical, biologic, social and economic analysis got conclusion that *Jatropha* have better property than others. Goals of research are (1) for knowing locations where feasible and suitable for cultivated *Jatropha* using geographic information system, (2) for getting information of social and economic condition of farmers who doing *Jatropha* seeding and cultivation in the real world, (3) for getting information of cost and benefit components of seeding and cultivation *Jatropha* as vegetable energy sources. Research using descriptive method and supported by survey method. Spatial, physic, chemical and biologic analysis done in Bandung District. Social and economic analysis done in Malingping Banten Selatan, Cidaun Rancabuaya Garut Selatan and Rancah Tambaksari Ciamis. Research started in January 2007 until November 2007. Subjects of research are lecturers of Civil Engineering, Faculty of Engineering and Vocational, Indonesia Education of University. Objects of research are environmental physic condition in Bandung District, farmers who doing *Jatropha* seeding and cultivation and cooperative management who supporting activity of *Jatropha* seeding and cultivation. Research conclusions are : (1) Bandung District have locations where feasible cultivated *Jatropha* that area are 122.950 ha or 41.94 % from region area of Bandung District. (2) Social and economic condition of farmers communities in locations of *Jatropha* seeding and cultivation are low and poor. (3) Cost and benefit component of work activity of *Jatropha* seeding and cultivation from field not enough giving information for feasibility study of finance on effort scale that bigger and more profitable. Research recommendations are : (1) Government of Bandung District has to continue study in locations where feasible cultivated *Jatropha* so that potention of vegetables sources energy can be used as strategy for regional development in Bandung District. (2) National program in presentation of vegetables sources energy are very accurate for quick implemented in real world funded by government, private and public independent institution or non-government organization so that structural poored in rural region can be solved and given problem finnished. (3) Next research about financial feasibity study of *Jatropha* seeding and cultivation must be done so that can be known scale of work that accurate linked with cost benefit components and can be refferenced by stakeholders in *Jatropha* seeding and cultivation.

Key words : crisis of energy, vegetables energy sources, *Jatropha* seeding and cultivation, suitability locations, social and economic condition of farmers, cost and benefit components, financial feasibility study.

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[1] Article is result of Fundamental Research of Indonesia Education of University that funded by Directorate General of Higher Education, National Education Department accorded of Agreement Letter of Grant Research Number : 003/SP2H/PP/DP2M/III/2007 Date March 29th 2007

[2, 3, 4] Fixed Lecturer of Civil Engineering Department, Faculty of Technology Education and Vocational, Indonesia Education of University

INTRODUCTION

Background

Energy crisis that attacking violently the earth already pushing efforts increased for benefiting energy that not sources from fossil. Efforts that must be done are energy diversification, biofuel included. Agricultural commodities that can be used for biofuel that are palm tree, coconut and *Jatropha* (for substituting solar fuel), sugar cane, timber root, sorgum and sago (for substituting premium fuel).

Energy sources from fossil, extinct threat, also giving biggest contribution to air pollution. Fuel which used producing emission CO_2, CO, HC, NO_x, SPM and dust that can be causing breath disturbance, cancer even sterillization. Higher Price of energy sources of fossil that presented with not environmental friendly of emission appearing many ideas to develop energy diversification and renewable energy sources.

Idea to find non fossil of energy sources in the form of vegetables energy sources and environmental friendly, biodiesel included, appeared as crisis anticipation of next energy sources. Vegetables energy sources as alternative energy sources can be found from palm tree, timber root, *Jatropha* and etc. Result of physic, chemical, biologic, social and economic got conclusion that *Jatropha* having more excellent property than others.

President Instruction of Indonesia Republic, number 1 of 2006 about supply and benefit of vegetables energy sources (biofuel) as alternative energy sources to 13 linked ministers, governoors and mayors, certainly must be followed up with infrastructures supplied, included land that suitable for developing *Jatropha* cultivation which not disturbing others uses.

Estertification process that is continued process from CJCO being biodiesel better managed by industrial sector. Industrial sector hoped can work together in harmony with farmers or people group in rural where CJCO production. Three objectives in independent development of rural agroindustry in *Jatropha* seeds process, that are :

1. Supply new alternative and renewable energy sources in rural level,
2. Supply CJCO as raw material of biodiesel that marketable,
3. Increasing farmers income through increased of added value of production which accepted by farmers or farmer groups.

Independent development of rural agroindustry for producing CJCO energy sources must be supported by simple technology creation that easy mastered and economical range for rural scale. Big industry has to be directed to develop next industry of CJCO processing to be biodiesel that marketable.

University that having education and learning, research and community services duties certainly bearing responsibility also for giving participate of thingking contribution in infrastructure supply of locations of plants cultivation that biodiesel production. Surveying and mapping, soil science, soil mechanic and environmental engineering included in field study that learnt and developed in Civil Engineering Program, Indonesia Education of University in Bandung. Idea for researching spatial analysis of land suitability of *Jatropha* using Geographic Informantion System in Bandung district so that being a attractive topic and urging to be done.

Problem Formulation and Solution

Land uses that not suitability with land capability causing land destruction, increasing poverty and others social problem. Land capability analysis directed for knowing potential land for many uses of wider agricultural system and everlasting base on uses and treatment ways that very suitable so that can be guaranteed land advantage for unlimited time. Factors classification of land capability limitation can be contained: land slope, soil texture, effective depth, soil drainage, soil erosion, flood threat, rain, rocks and gravels.

Description about analysis of land capability directing problems in this research, that are :

1. What are factors that land capability limitation being inputs for land suitability of *Jatropha* plants cultivation?
2. How are forms of conceptual and functional model for analysis of land suitability of *Jatropha* plants?
3. How is implementation of spatial analysis of *Jatropha* land suitability as alternative energy sources using geographic information system?
4. Where are locations in Bandung District that feasible cultivated *Jatropha*?
5. How are results of verification and field inspection in locations that suitable for cultivating *Jatropha*?

RESEARCH METHOD

Research Design

This research uses descriptive method, that is research which explaining phenomena in field existence view and supported with survey method for physic, chemical, biologic, social and economic components. Data for spatial analysis are secondary data, in the other side, primary data as verification and field control like soil, water, air, social and economic data.

Location and Time

Spatial analysis did in region of Bandung District. Physic, chemical and biologic analysis also did in Bandung District. Social economic analysis did in Malingping plantation South Banten, Cidaun plantation Rancabuaya South Garut and Rancah plantation Tambaksari Ciamis District. Research started in January 2007 and finished in November 2007.

Subject and Object

Subject of the research are lecturers in Civil Engineering Department, Faculty of Technology Education and Vocational, Indonesia Education of University. Object of the research are physic condition of environment in Bandung District, farmers who do seeding and cultivation of *Jatropha* and management of cooperation who supporting activity of seeding and cultivation of *Jatropha*.

Research Procedure

Research of social economic analysis of seeding and cultivation of *Jatropha* through phases that are :

1. References collection that linked with seeding and cultivation of *Jatropha* from PT Rajawali Nusantara Indonesia BUMN, PT Pilar Anugrah Karya Utama and PT Energi Hijau Nusantara,

2. Secondary data collection from Agency of Regional Planning and Development (BAPPEDA) in Bandung District,
3. Input, process and output conceptual model creation for spatial analysis of land suitability for seeding and cultivation *Jatropha* in Bandung District,
4. Input, process and output functional model creation for spatial analysis of land suitability for seeding and cultivation *Jatropha* in Bandung District.
5. Digitizing analog maps to digital maps in form of AutoCAD formats,
6. Digital maps data conversion from AutoCAD formats to Arcview formats,
7. Functional model implementation of spatial analysis of land suitability of seeding and cultivation of *Jatropha* in Bandung District,
8. Spatial analysis result verification with doing field test, that are soil, water and air sampling in locations where suitable for seeding and cultivation *Jatropha* in Bandung District,
9. Laboratory analysis for soil, water and air samples that taken from field,
10. Field observation to Dawuan seeding plantation Purwakarta District, Malingping plantation South Banten, Cidaun seeding plantation and cultivation Rancabuaya South Garut and Rancah plantation Tambaksari Ciamis,
11. Conceptual and functional model creation of research instrument that distributed to farmers and management of cooperation of seeding and cultivation *Jatropha*,
12. Identifying amount of farmers and management of cooperation that become research respondents,
13. Field visit for distributing questionnaire through meeting that coordinated by field facilitator who become friendship responsibilities between businessman, farmers communities, management of cooperation and governmental apparatus in region,
14. Meeting between researchers, field facilitator, farmers, governmental apparatus and bussinessman through forum group disccussion for identifying dan knowing strength, weakness, opportunity and threat for activities of *Jatropha* seeding and cultivation that being continue,
15. Records of meeting results that agreed by members who present as base of recommendation to policy decision makers linked with vegetables energy sources supply in the future,
16. Social economic condition analysis of farners who participated in activity of *Jatropha* seeding and cultivation,
17. Financial analysis of work activity of *Jatropha* seeding and cultivation,
18. Resume creation of social economic condition of farmers,
19. List creation of cost and benefit components of *Jatropha* seeding and cultivation activity,
20. Feasibility simulation of work of *Jatropha* seeding and cultivation base on land area, amount of plants and selling value of *Jatropha* seeding and cultivation work scenarios,
21. Conclusion and recommendation for *Jatropha* seeding and cultivation activity,
22. Research creation, publication and surrender to stakeholders,
23. Seminar

Research Instrument

Research instrument for getting locations where are suitable to cultivate *Jatropha* that are hardware of computer system and software of AutoCAD and Arcview. Research instrument for environmental physic samples are environmental physic instrument. Instrument for getting social, economic and financial are questionnaires.

Data Analysis

Data analysis for getting locations where are suitable to cultivate *Jatropha* that are spatial analysis using Geographic Information System computer based. Data analysis for environmental physic samples are soil, water, air analysis. Percentage and financial analysis be done for analyzing social, economic and financial components.

REFERENCES REVIEW

Spatial Analysis Computer Based

Spatial analysis is one of works in planning and developing lands. Data needed for spatial analysis are maps with various scales and themes (Purwaamijaya, 2005a).

Spatial analysis is analysis that focusing to three geographic components, that are distance, interaction and movement (Bintarto dan Hadisumarno, 1982).

Analog maps or conventional maps for spatial analysis needed only capable as storages media of land surfaces, visual presentation and distribution analysis of that maps. Maps that limited by scale reviewed from its information aspects, usually expensive and got a long time in its made if planner want to do changes for updating maps contents. Finally, conventional maps not used again because out of date for short time also (Hakim, 1991).

Model and spatial analysis can be contained (1) model and nearest neighborhood analysis, (2) distance and spatial interaction, (3) network and connectivity and (4) linear equation and location (Bintarto and Hadisumarno, 1982).

Users they are (1) first class user, (2) second class user, (3) third class user. First class user is application programmer who having responsibility in application programs written for exploring data base. Second class user is end user who can access or trace and retrieve contains of data base from a terminal of computer or workstation for special supported communities. Third class user is data base administrator whose are some one or groups of people who have responsibility in data base system controlled at all (Hakim, 1991).

Analog data that digitized are graphic and attribute data. Both of data are different in its data input into environmental computer. Data input can be done through key board, digitizer or scanner. This input media chosen base on its data type and data precision which wanted (Aronoff, 1989).

Technology development of Geographic Information System purposed to realize some analysis function of results from sophisticated digital technology. Function of Geographic Information System analysis can be grouped into 4 categories that are some analytical function (Aronoff, 1989).

Classification analysis function of Geographic Information System that are (1) maintenance and spatial data analysis, (2) maintenance and attribute data analysis, (3) Analysis integration of spatial and attribute data, (4) output format.

Analysis integration of spatial and attribute data contain of 4 groups, that are (1) retrieval, classification, measurement, (2) overlay operations, (3) neighbourhood

operations (search, line in polygon, point in polygon, topographic functions, thiessen polygons, interpolation, contour generation), (4) connectivity functions (contiguity measures, proximity, network, spread, seek, intervisibility, illumination, perspective view).

For designing a Geographic Information System that effective must through phases are (ESRI, 1978):

(1) Analysis of information needs for making decision that are interview, documentation study review, information detailed and real data specification.
(2) Categorization and evaluation of data base existences that are coverage existence, process of data collection, data dictionary and data evaluation / catalog.
(3) Making specification of new data base that containing data classification, scale or resolution, frequency updated and format or form of data.
(4) Making specification of system elements that containing management system, software system, hardware system and institutional structured.
(5) Developing implementation plan that containing assignment detailed, scheduling, financing, management and responsibility.

Land Suitability of *Jatropha curcas* Linnaeus

Land evaluation is assesment process of a land for special uses (Hardjowigeno, 1999). Result of land evaluation described in form of map as base for land use arrangement planning that rationally, so that land can be used optimal and everlasting way. Land use that not suitable with its capability can be causing land damaged, increasing poverty problems and other social problems and can be destroying public culture that already developed like happened in Babilonia and Mesopotamia (Euphrat and Tigris).

Reasons that done evaluation of land are (Hardjowigeno, 1999):

a. Various land characteristic, so that need be grouped into units that uniform and having same potency,
b. Its diversity influencing types of land uses that suitable for land unit itself,
c. This diversity have systematic character so that can be mapped,
d. Land suitability for special land use can be evaluated with high accuracy if data needed for evaluation presented enough and having good quality and knowledge about relationship between land characteristics and land use that planned must also high enough,
e. Decision maker or user can be using map of land suitability as one of base for making decision in land use arrangement planning.

Policy of land use based on various aspects that are (Hardjowigeno, 1999):

a. Technical aspects that linking potency of land resources that gained with doing evaluation of land suitability,
b. Environmental aspects, that is its impact to environment,
c. Law aspect, that must be suitable with regulation and constitution that valid,
d. Social aspect, linking land use for social benefit. Land use not only beneficial to some one but must also beneficial for all of people whom live in that region and around,
e. Economic aspect, that optimally land use that giving highest profit without destroying soil and environment,

f. Politic aspect or government policy.

Plants of *Jatropha* will be grown and optimal produced in dry land of lower land of dry climate with 0 to 500 meter high from mean sea level with rain 300 to 1,000 mm per year and temperature > 20^0 C (PT Rajawali Nusantara Indonesia BUMN, 2005).

Plants of *Jatropha* can grow in marginal lands that poor nutrition but must be having good drainage and aeration. Optimal product will be gained in fertile land with soil that containing 60 % to 90 % sand, soil pH from 5.5 to 6.5 or fertilized with good enough and water supplied in dry season. Plants *Jatropha* need water but sensitive from bad drainage and strict climate condition between rain and dry season (PT Rajawali Nusantara Indonesia BUMN, 2005).

1. Plants of *Jatropha* as Production of Alternative Energy Sources (Biodiesel)

Plants of *Jatropha* in Indonesia which known four types that already recorded and included in *Europhorbiaceae* family (Soerawidjaja, 2005). Four types of *Jatropha*, that are *Ricinus communis*, *Jatropha curcas* Linnaeus, *Jatropha multifida* and *Jatropha gossypifolia*. Four *Jatropha* plants types can be producing raw material biodiesel made. *Ricinus communis* produce biodiesel that less good because too thick, *Jatropha multifida* and *Jatropha gossypifolia* already difficult to found now and only *Jatropha curcas* Linnaeus which easy and possible cultivated to biodiesel production.

Jatropha curcas Linnaeus is shrub plant with average height around 6 meters. Plants live in tropical and sub tropical regions scattered in America, Asia and Africa (Prihandana and Manurung, 2005). Name of *Jatropha* because of plants in previous time, used many as plantation borders area or fields. Indigenous people in Japan colonial era (1942-1945) must be planting *Jatropha*.

Jatropha many found as wild plants in Province of Nusa Tenggara Barat and Nusa Tenggara Timur. *Jatropha* are cultivated commercially now by people in Lombok Tengah, Lombok Timur, Sumbawa and Bima. Area of *Jatropha* in NTB districts are 1,999 ha and participating 3,999 farmer families whom processing. Result of *Jatropha* production in NTB gaining 759.81 ton per year (Wirham, 2005).

Jatropha relatively are not needing maintenance and not many needing water. Rain that needed relatively little compared with other plants that potential becoming raw material of biodiesel. Plants of *Jatropha* can be adapted in region with high rain (480 to 2,380 mm per year), but rain that suitable are 200 to 1,500 mm per year.

Plants of *Jatropha* can be having flower after 6 to 8 months. Optimal productivity and stability of *Jatropha* can be gained since old of plants are five years old. *Jatropha* can live until 50 years old. Productivity since five years old can be gaining 400 kilograms to 12 tons seeds per ha per year.

Plants of *Jatropha* like palm tree saving oil element in its seeds. Palm tree recent producing seeds in four years old. Average of oil contain in *Jatropha* around 1,892 liters per ha per year less than palm tree contain 5,950 liters per ha per years. Oil contained (triglycerine) in nucleus of *Jatropha* seeds gaining around 55 % or equal with 33 % from total weight of seed and bigger than oil contained of palm tree that around 20 % from total weight of seed.

Jatropha are more feasible used for biodiesel than palm tree because quicker harvest time, not consumed by peoples and cheaper selling price. *Jatropha* are

environmental friendly, also producing zero waste because its leaves can be used for silk caterpillar food, antiseptic and anti flamed, its resin can be used for wound remedy and others medicine. *Jatropha* fruit or flesh used for energy sources, green fertilizer and biogas production. *Jatropha* seeds can be producing biogas production, energy sources, insecticide and medicines. Seed skin can be used for fertilizer, livestock food and biogas production. Seed rest can be used for energy sources.
Jatropha oil characteristic are not different with diesel oil like presented in table.

Table of *Jatropha* oil characteristic comparison with diesel oil

Parameter	*Jatropha* oil	Diesel Oil
Density 15^{o}C (g/m^{3})	0,917	0,84
Viscosity 30^{o}C (cSt)	50,73	> 2,7
Cetane number	51	> 50
Flash Point (^{o}C)	240	50
Calor value (kcal/kg)	9.470	10.170
Sulphur contained (ppm)	0,13	< 1,2
Iodium Value	97	-

Jatropha oil are not lose with diesel oil and having excellent because environmental friendly in its gain process. *Jatropha* development giving opportunity for annual CO_2 emission decreased naturally. Solar consumption for transportation which increase become 25.5 millions kilo liters in 2005, if 5 % its needs replaced by bio diesel of *Jatropha* oil then will present annual emission decrease amount 3.46 millions tons of CO_2 (Sumarsono, 2005).

2. Benefit of *Jatropha* Cultivation

Jatropha cultivation hoped will be giving benefits (PT Rajawali Nusantara Indonesia BUMN, 2005b):

a. As plants for programs of critical land reforestation/barren/non productive. *Jatropha* plants cultivation will capable decreasing critical lands/barren/non productive in Indonesia $\pm$ 1.5 millions ha area wide if *Jatropha* oil can be replacing solar oil needs amount $\pm$ 5 millions liters.
b. As work field places in poverty pockets in Indonesia. If *Jatropha* cultivation for each ha of lands done by $\pm$ 3 labors then *Jatropha* plants cultivation will be involving labors $\pm$ 4.5 millions peoples. Amount not yet included with skilled labors in *Jatropha* oil processing and other supported activities.
c. As activities for flowing fund from external regions to plantation regions in rural area. If *Jatropha* cultivation assumed will be producing 9 ton seeds per ha per year then for 1.5 millions *Jatropha* plantation will be producing $\pm$ 13.5 millions tons per year to be processed. Price of seeds predicted are 500.00 IDR per kilograms and fund flown from external regions to *Jatropha* plantation regions will $\pm$ 6.75 billions IDR per year.
d. As trigger for living rural economy and producing alternative energy sources that cheaper and will be increasing competitive power of home products to global market and decreasing subsidy load of fossil energy sources by government.

RESULT AND DISCUSSION

Research Result

Research result about social economic analysis of *Jatropha* seeding and cultivation that are :

1. Digital maps of thematic input (7 themes) in Bandung District in AutoCAD and Arcview formats about land slope, erosion, soil drainage, floods, soil texture, rocks and graves, effective depth of soil. Output maps that spatial analysis result of locations where suitable to be done activities of *Jatropha* seeding and cultivation in Bandung District,
2. Description of social economic condition of *Jatropha* farmers in *Jatropha* seeding and cultivation in Rancah plantation, Tambaksari, Ciamis District.
3. Cost and benefit components of *Jatropha* seeding and cultivation activities in plantations of Malingping South Banten, Cidaun Rancabuaya South Garut, Rancah Tambaksari Ciamis District as simulation base of financial feasibility of *Jatropha* seeding and cultivation activities.

Maps of thematic input in AutoCAD and Arcview formats contained:

a. Map of land slope in Bandung District.
b. Map of drainage in Bandung District.
c. Map of soil texture in Bandung District
d. Map of effective depth of soil in Bandung District.
e. Map of soil type in Bandung District.
f. Map of rocks and graves in Bandung District.

Discussion

Output map that result of spatial analysis of locations where suitable to be done *Jatropha* seeding and cultivation activities in Bandung District having functional model, that are :

Table of functional model map of land suitability of *Jatropha* seeding and cultivation in Bandung District

Number	Zone	Total (Weight x Rating)	Zone Area (ha)
1.	Cultivation	24 – 29	39,550
2.	Limited Cultivation	18 – 23	130,675
3.	Conservation	12 – 17	122,950
		Land Area of Bandung District	293,175

Description of social and economic condition of *Jatropha* farmers in plantation of seeding and cultivation, Rancah Tambaksari, Ciamis District that are:

A. Respondents identity.

Research which be done in Mekarsari Village Tambaksari Sub District, Rancah Banjar Ciamis District done to 92 respondents who are 86 respondents of *Jatropha* farmers and 6 respondents cooperation management. Respondents of farmers are 64 respondents of *Jatropha* farmers and 6 respondents of cooperation management. Respondents of farmers are 64 men (74.41%) and 22 women (25.58%). Respondents who

10 to 40 years old are 16 respondents (18.60%), who 41 to 60 years old are 46 respondents (53.48%) and who 61 to 90 years old are 24 respondents (27.90%).

Respondents of farmers who also as head of family are 67 respondents (77.90%) and members of family are 19 respondents (22.09%). Respondents of farmers who as workers of farmers are 61 respondents (70.93%) and land owners of farmers are 25 respondents (29.06%).

Average income per month of respondents of farmers from non agriculture is 123,430.00 IDR (58.53%) and from agricultural production is 87,441.00 IDR (41.46%). Average expense per month for food is 60,406.00 IDR (49.36%), education is 20,465.00 IDR (16.72%), light is 19,360.00 IDR (15.82%), health is 10,058.00 (8.21%), clothing is 9,302.00 IDR (7.60%), communication is 1,570.00 (1.28%), housing and entertain is 814.00 IDR (10.33%) and clean water is 395.00 IDR (0.32%).

B. Land Information.

Respondents of farmers who renting *Jatropha* agricultural lands from governmental institution are 55 respondents (64%), who working lands of theirself are 25 respondents (29%) and who renting from personal owners are 6 respondents (7%). Area of *Jatropha* agricultural lands which worked by 86 respondents are 128,900 m^2 (12.890 ha) and average of land ownership area are 1,498.837 m^2. Land price of respondents highest is 70,000.00 IDR per m^2 and lowest is 3,000.00 IDR per m^2 with average price of land is 10,900.00 IDR per m^2.

Flat land slope (0-3%) worked by 1 respondents (1.16%) is 840 m^2 area (0.65%), Rather flat land slope (3-8%) worked by 8 respondents (9.30%) are 15,700 m^2 (12.18%) and aslant land slope (8-15%) worked by 77 respondents (89.53%) are 112,360 m^2 (87.17%). Fertile level of land fertility are worked by 42 respondents (48.84%) are 71,300 m^2 (55.31%) and medium level are worked by 44 respondents (51.16%) are 57,600 m^2 (44.69%).

Lands where are near to rivers worked by 1 respondent (1.16%) are 1,400 m^2 (1.09%), near to mountain foot worked by 33 respondents (38.37%) are 61,260 m^2 (47.53%), near to valley worked by 9 respondents (10.47%) are 16,340 m^2 (12.68%) and near to hill worked by 43 respondents (50%) are 49,900 m^2 (38.71%).

Respondents who very agree about water need for worked lands in dry season are 63 respondents (73.26%) and agree are 23 respondents (26.74%). All respondents are 86 respondents (100%) declaring that water supplied for worked land less easy got. Large opportunity of agricultural land function changes becoming non agriculture declared by 1 respondent (1.16%) is 840 m^2 (0.65%), less opportunity of agricultural land function changes becoming non agriculture declared by 84 respondents (97.67%) are 126,660 m^2 (98.26%) and small opportunity of agricultural land function changes becoming non agriculture declared by 1 respondent (1.16%) is 1,400 m^2. All respondents are 86 farmers (100%) declaring not sure to successfully of *Jatropha* cultivation in their worked lands.

Productivity of worked land of farmers before planted *Jatropha* is 1.00 kg/m^2 for timber root with 12 months harvest time on 9,650 m^2 of lands and 0.792 kg/m^2 for corn with 4 months harvest time on 107,200 m^2 of lands.

Average gross income of farmers from timber root and corn commodities before planted *Jatropha* is 272,442.00 IDR for 5.058 moths. Average expense of farmers for timber root and corn cultivation before planted *Jatropha* is 127,511.63 IDR for 5.058

months. Average net income of farmers from timber root and corn commodities before planted *Jatropha* is 155,407.00 for 5.058 months.

C. Information about *Jatropha* seeding and cultivation.
Amount of plants which present in Rancah plantation, Banjar, Ciamis District are 34,990 trees that planted on 128,900 m^2 area of lands or 3.684 m^2 / tree. All respondents of farmers are 86 farmers (100%) declaring that information about *Jatropha* seeding and cultivation source from industrial partnership and knowing about *Jatropha* seeding and cultivation, theirs planting and maintenance.

D. Information about invest plantation cost of *Jatropha* seeding and cultivation.

Respondents of farmers are accepting seeds from *Jatropha* cooperation Mitra Sejahtera. *Jatropha* planting distances are 2 x 5 meters with planting hole are 40 cms. Average of holes that made by farmers are 407 holes per farmer.

E. Information about sprayer cost of *Jatropha* seeding and cultivation.

Respondents of farmers are using NPK BASF 15:15:15 are 10 kgs to 350 kgs or 103.37 kgs per farmer or 0.069 kg/m^2 with price between 1,500.00 IDR per kg to 1,600.00 IDR per kg. Respondents of farmers are using compost amount 120 kgs to 700 kgs or 251.63 kgs per respondent or 0.168 kg/m^2 with price between 300.00 IDR per kg to 350.00 IDR per kg.

Respondents of farmers are using pesticide amount 0.25 liter to 1 liter or 0.4 liter per farmer or 0.0003 liter per m^2 with price between 10,000.00 IDR per liter to 20,000.00 IDR per liter. Respondents of farmers are using herbicide amount 0.25 liter to 1 liter or 0.49 liter per respondent or 0.00033 liter per m^2 with price between 10,000.00 IDR per liter to 20,000.00 IDR per liter.

F. Information about pay cost of labors, production and selling price of *Jatropha* seeds.

Respondents of farmers are ejecting base fertilization cost amount 30.00 IDR per tree and second advanced fertilization cost amount 30.00 IDR per tree. Respondents of farmers ejecting clearance and sprayed cost of herbicide amount 20.00 IDR per tree. Respondents of farmers are ejecting first seeding amount 60.00 IDR per tree and second seeding amount with basin amount 100.00 IDR per tree. Respondents of farmers are ejecting pest control cost 20.00 IDR per tree and final cut of end year amount 40.00 IDR per tree.

Amount of *Jatropha* seeds production in Rancah plantation are 5,156 kgs per year with *Jatropha* land area are 128,900 m^2 then its productivity are 0.04 kg / (m^2.year) or 40 gram/(m^2.year). *Jatropha* seeds that produced from farmers plantation bought by Mitra Sejahtera cooperation 700.00 IDR per kg.

1. Income and outcome components of *Jatropha* seeding and cultivation in plantation of Malingping South Garut, Cidaun Rancabuaya South Garut, Rancah Tambaksari Ciamis District as simulation base of financial feasibility activities of *Jatropha* seeding and cultivation.

Table of income and outcome components of *Jatropha* seeding and cultivation if will be implemented in work scale which bigger must be considering following aspects, that are:

a. Cost of cooperation management, that contained are:
    - Cost of cooperation salary,
    - Cost of subsidy.
b. Cost of operation, that contained are:
    - Office operation,
    - Field operation,
    - Others cost.
c. Cost of pre operation, that contained are:
    - Legal aspect affair / licensee and etc,
    - Field survey,
    - *Mapping area*,
    - Operation.
d. Cost of depreciation,
e. Lent interest.

As description for completing financial analysis of work feasibility of *Jatropha* seeding and cultivation are presented description of cooperation official respondents.

1. *Jatropha* Cooperation official respondents Mitra Sejahtera who are 4 men and 2 women whose 52 to 62 years old.
2. Officially status of respondents are chairman, vice chairman, secretary, treasurer and staff of *Jatropha* cooperation Mitra Sejahtera who becoming state official is 1 respondent and 5 respondents non state official.
3. All of respondents domicile in Mekarsari Village, Tambaksari sub District, Ciamis District with main salary 500,000.00 IDR per month and subsidy 200,000.00 IDR per month.
4. Address of *Jatropha* cooperation Mitra Sejahtera is in Mekarsari Village, Kencana Street Number 18 with amount of cooperation management 4 personels and cooperation members are 50 personels who contained 25 men, 21 women and 4 boys.

CONCLUSION AND RECOMMENDATION

Conclusion

1. Bandung District is having locations where feasible to be cultivated *Jatropha* around 122,950.00 ha area or 41.94 % from regional area of Bandung District from result of spatial analysis using Geographic Information System computer based.
2. Social and economic condition of farmers communities in locations of *Jatropha* plants seeding and cultivation are lower and poor. Activities of *Jatopha* seeding and cultivation if supported by government and private sector can be giving positive impact to social and economic condition of communities and giving multiplier effect to regional development and its around.
3. Income and outcome components of *Jatropha* seeding and cultivation activities which accepted from field not enough giving information for financial feasibility study in bigger work scale and profitable.

Recommendation

1. Regional Government of Bandung District has to continue study in locations where feasible to be cultivated *Jatropha* seriously and carefully so that potency of vegetables energy sources which developed in Bandung District can be got as one of strategy for development in the future that facing energy crisis and uncertainty.
2. National program in vegetables energy sources supply is very accurate to be implemented quickly in the field also from governmental fund, private fund, communities participation so that structural poverty in rural can be solved and given problems settlements.
3. Next research about financial feasibility study of *Jatropha* seeding and cultivation must be done so that can be known accurate work scale linked with income and outcome components and can become reference by stakeholders in *Jatropha* seeding and cultivation.

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