Land Suitability and Economic Feasibility Analysis of Peanuts (*Arachis hypogaea*) in Jatinangor Subdistrict, West Java Province

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ABSTRACT

Jatinangor Subdistrict in West Java Province has potentiality to be grown by peanuts (Arachis hypogaea) due to the proper climate and the quite spacious availabity land. The farmers in this area are also used to grow this legume and the demand for this commodity increases by years. The objective of this study was to evaluate actual land suitability classes and economic feasibility of peanuts in Jatinangor Subdistrict. The methodology using survey method following by sampling and laboratory analyses to evaluate land suitability. The assessment used matching table considering the limiting factor for evaluating land suitability. The economic feasibility using R/C ratio (Revenue Cost Ratio). The results showed that the actual land suitability class for peanuts class S3 (Marginal Suitable) with the limiting factors of water availability, organic carbon content and slope. Non suitable also found with limiting factors of coarse material and slope. The R/C ratio for peanuts was 1.52, indicating that peanuts were feasible and profitable to cultivate in Jatinangor Subdistrict.

Keywords:Peanuts, coarse materials, organic carbon content, slope, water availability

1. INTRODUCTION

Jatinangor Subdistrict is located in Sumedang Regency, West Java Province, is an area with undulating to slightly hilly topography with the altitude between 681-900 meters above sea level. This area has a rainfall of around 1230 mm year^{-1} with rainy days each year of around 65 days. The temperature in Jatinangor ranges from 24-31^{o}C. The climatic conditions of this area meet the requirements for growing peanuts, as indicated by data on the productivity of this plant reaching 1.5 tons.ha^{-1}, higher than the national peanut productivity of 0.7-1.3 tons.ha^{-1} (Sumarno, 2015).

Peanuts are commodities with high economic value, that can be used for several purposes (Sumaryono 2022). The need for peanuts increased by years, inline with the increasing of population, the need for food diversification and community nutrition, and the increasing of food industry in Indonesia (Ulhair et al., 2018). The need for peanuts has not been met by domestic production, so imports of this commodity are still being carried out (Hama, 2018). In effort to decrease the import, enhance of peanut planting still needs to be developed, taking into account the ability, suitability and land availability.

Extensification of any commodities include peanut have to consider the land suitability (Harahap et al., 2019). Land suitability can be assessed for current conditions (actual land suitability) or after improvements have been made (potential land suitability). The results of the land suitability assessment can be used as the information about opportunities and constraints on land use and useful as a guide in optimal utilization of land resources (Ayorinde et al., 2015). Land evaluation analysis together with economic suitability evaluation need to be carried out as the guidelines in developing peanut cultivation in certain area (Widiatmaka et al., 2014). Therefore, it is necessary to conduct an evaluation of land suitability and economic

feasibility of peanut in agricultural land in Jatinangor Subdistrict to measure how the profit is obtained.

2. MATERIAL AND METHODS

This research used several materials for field work like maps and field equipments. There were also several laboratory instruments for soil analyses. Maps used were maps of Jatinangor Subdistrict like administrative map, soil, topography and rainfall. Field equipments used were Global Postioning System, Arc GIS 10.6., ring sampler, Munsell Soil Color Chart Book, clinometer, auger and some others. The laboratory instruments used were Atomic Absorption Spectroscopy, combustions, oven, pH meter, analytic scale, circulating water-supply system, and sieving. The summarize of the research step and flow chart can be seen in Figure 1.

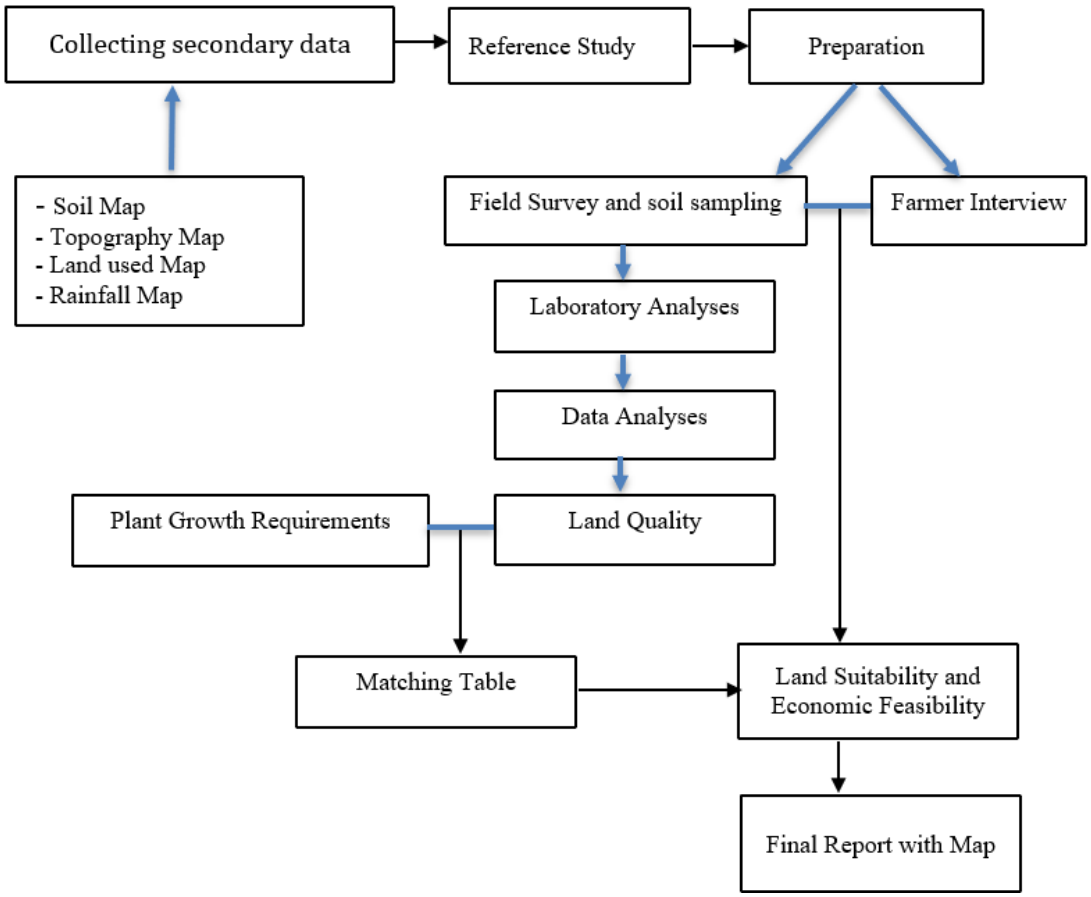

Figure 1 Research Step and Flow Chart

The method used was a descriptive method, with the emphasis of explorative and approaching to land mapping units, obtained from overlaying maps to have the similarity of several characteristics. Soil samples were taken in several spots in every land mapping unit, referred to Suganda et al (2026). The soils from several spot in the same land mapping unit were mixed compositely to homogenise for soil analysing in the laboratory. Disturbed soil samples were taken the depth of 30 cm for analysing pH, organic C, CEC, base saturation, and texture by referred to Van Reeuwijk (1982). Undisturbed soil samples were taken with ring samplers for bulk density and permeability analyses, referred to Klute and Dirksen (1986).

Land suitability classes were determining the inhibiting factors of several land caharacteristics. To have land suitability, the land characteristics were matched with plant

(peanut) growth requirements referred to Ritung (2014).

Economic feasibility needed data referred to (Soekartawi, 1984) to count whether the farming business is profitable or not by using a comparison between total revenue and total costs, known as the Revenue Cost Ratio (R/C). The value of R/C >1 is profitable, value of equal to 1 is break even and value of <1 1 is non profitable. Another consideration referred to Rossiter *et al.* (1997) in Ali (2016) devided into class 1 to 4 namely S1, S2, S3 and N. S1 is the most provitable, S2 is profitable, S3 is marginally profitable and N is unprofitable, that can be referred even thought it was not for peanut.

3. RESULT AND DISCUSSIONS

3.1 Information of Research Location

Jatinangor Subdistrict is located in Sumedang Regency, West Java Province, consisting of 12 villages, namely Cipacing, Sayang, Mekargalih, Cinta Mulya, Cisempur, Jatimukti, Jatiroke, Hegarmanah, Cikeruh, Cibeusi, Cileles, and Cilayung. This district has an area of 2620 ha consisting of 371 ha of rice fields, 1168 ha of settlements, 755 ha of gardens, and 326 ha of others. The research location is at an altitude ranged of 326-845 m above sea level (asl).

The administrative map of research location is divided into 11 Land Mapping Unit (LMU) according to the overlying maps of soil, topography, land used and rainfall (Figure 2). Farmers in this area have been cultivating peanuts for generations. Although management is still done simply, such as tilling the land with a hoe, not a tractor. However, farmers have bought seeds at seed stores and given fertilizer according to the recommended dosage.

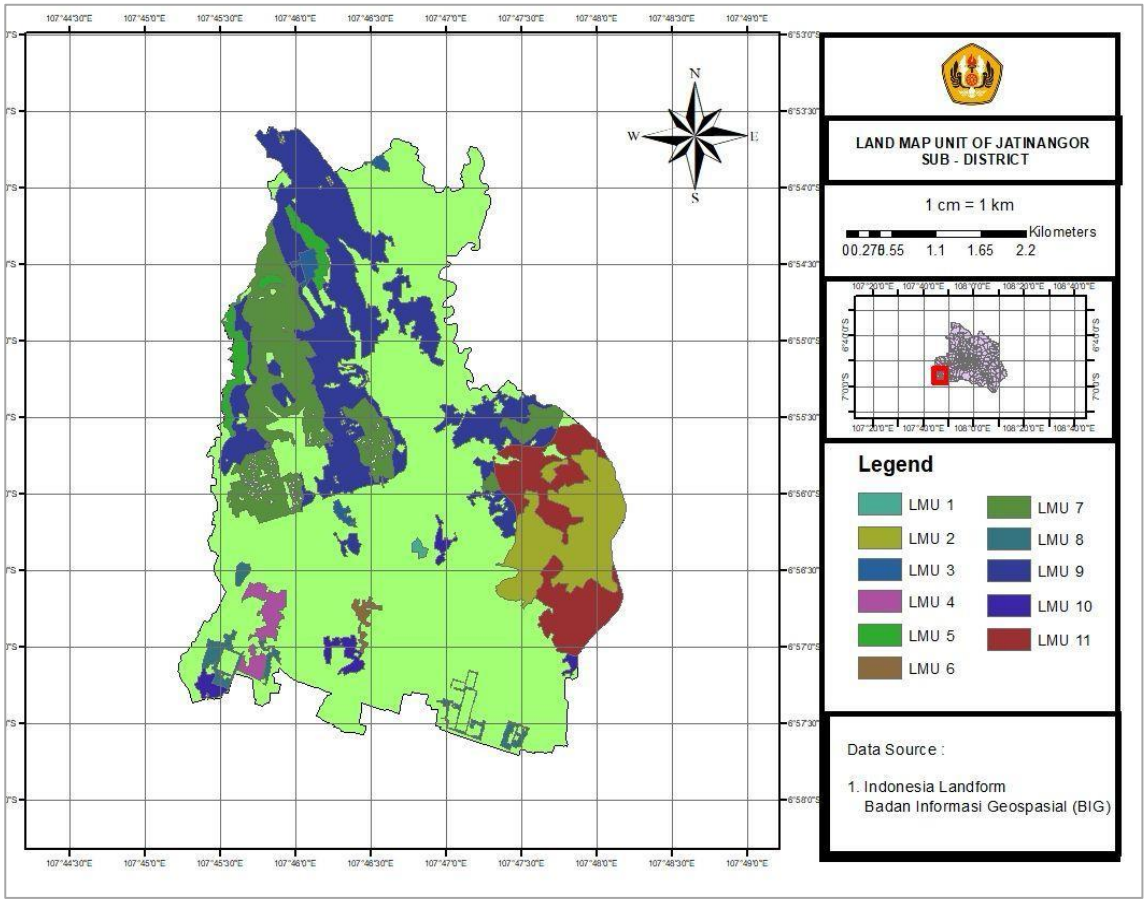

Figure 2 Land Mapping Unit of Jatinangor Subdistrict

3.2 Land Suitability Analysis

Land suitability analysis was done by matched the table of land characteristics with table of plant (peanut) growth requirements referred to Ritung (2011), namely matching table analysis. Table 1 informed the land characteristics for peanut growth requirements. Table 2 served the land characteristics in every land mapping unit (LMU), LMU 1 till LMU 11, which had been matched with peanut growth requirements, resulted in actual land suitability.

Table 1 Land characteristics for peanut growth requirements

Land Characteristics	Land Suitability Classes			
	S1	S2	S3	N
Temperature (tc) Average Temperatur (°C) Humidity	12-24 42-75	24-27 10-12 36-42 42-75	27-30 8-10 30-36 > 70	>30 <8 < 30
Water availability (wa) Rainfall (mm)	350-600	600-1.000 300-350	>1.000 230-500	<230
Rooting Condition (rc) Texture Coarse material (%) Soil Depth	fine, medium fine <15 >75	Medium 15-35 50-75	Medium coarse 35-55 20-50	Coarse >55 <20
Peat Depth (cm) Maturity	<60 Sapric+	60-140 Sapric, hemic+	140-200 Hemic,fibric+	>200 Fibric
Nutrient Retention (nr) CEC (cmol kg^{-1}) Base saturatiion (%) pH H_2O Organic Carbon (%)	 >16 >50 5,6 – 7,6 >1,2	 ≤ 16 35 – 50 5,4 – 5,6 7,6 – 8,0 0,8 – 1,2	 <35 < 5,4 > 8,0 < 0,8	
Toxicity (xc) Salinity (dS/m)	< 1	1 – 1,5	1,5 – 2	> 2
Sodicity (xn) Alkalinity/ESP (%)	< 5	5-8	8 - 12	> 12
Sulfidic hazard (xs) Sulfidic Depth (cm)	> 100	75 - 100	40 - 75	< 40
Erosion hazard (eh) Slope (%) Erosion haxard	< 8 Very low	8 – 16 Low-medium	16 – 30 Heavy	> 30 Very heavy
Flooding hazard (fh) Puddle	F0	-	F1	> F1
Land preparation (lp) Surface rock (%) Outcrop rock (%)	< 5 < 5	5 – 15 5 - 15	15 – 40 15 - 25	> 40 > 25

Source: Ritung (2011)

Table 2 informed that the land characteristics of the study area had the same value of average temperature (23.8 °C) and relative humidity (81%). This condition was

possible due to the coverage area spread out in the same close region. Other characteristics were also similar, like there was no peat since it was soil mineral. There were also no toxicity (the salinity was less than 1 dS/m), no sodicity (the alkalinity less was than 5%), and no sulfidic hazard till depth of 100 cm. There were no flooding, and no obstacle of land preparation: no surface rock (less than 5%) and no rock outcrop (less than 5%)

The land suitability classes ranged in S3 (marginally suitable) to N (non suitable). Marginally suitable or S3 in all LMU (except LMU 2, 5 and 9) were due to water availability from rainfall was only 234.12 mm year^{-1}, much less than the range of plant needed (350-600 mm year^{-1}). Another limiting factor was the slope which was in ranged of 16-30% (LMU 1, 4, 10 and 11). LMU 2 had limiting factor of nutrient retention (organic carbon content) that less than 0.8%. There were three LMU classified as non-suitable (LMU 2, 5 and 9) due to the slope were more than 30%. The complete land suitability analyses can be seen in Table 2.

The evaluation of actual land suitability and the coverage area of every land mapping unit is presented in Table 3. The compilation of the coverage area of every actual land suitability is presented in Table 4.

Table 2 Land Suitability Analysis of Peanut in Jatinagor District

Land Characteristics	LMU 1	LMU 2	LMU 3	LMU 4	LMU 5	LMU 6	LMU 7	LMU 8	LMU 9	LMU 10	LMU 11
Temperature(tc) - average (°C) -average humidity (%)	23,8 S1 81 S2	23,8 S1 81 S2	23,8 S1 81 S2	23,8 S1 81 S2	23,8 S1 81 S2	23,8 S1 81 S2	23,8 S1 81 S2	23,8 S1 81 S2	23,8 S1 81 S2	23,8 S1 81 S2	23,8 S1 81 S2
Water availability (wa) - rainfall (mm)	234.12 S3	234,12 S3	234,12 S3	234,12 S3	234,12 S3	234,12 S3	234,12 S3	234,12 S3	234,12 S3	234,12 S3	234,12 S3
Rooting Condition (rc) - drainage - texture - peat:	Good S1 Loam S1 No Peat	Good S1 Loam S1 No Peat	Good S1 Sandy clay loam No Peat	Good S1 Loam S1 No Peat	Good S1 Loam S1 No Peat	Good S1 Loam S1 No Peat	Good S1 Loam S1 No Peat	Good S1 Loam S1 No Peat	Good S1 Coarse S3 No Peat	Good S1 Loam S1 No Peat	Good S1 Loam S1 No Peat
Nutrient retention(nr) - CEC (cmol kg^{-1}) - Base saturation (%) - pH H$_2$O - Organic C (%)	19,77 S1 76,72 S1 6,04 S1 3,15 S1	20,35 Si 85,26 S1 6,51 S1 0,12 S3	17,96 S1 81,93 S1 5,86 S1 1,81 S1	23,16 S1 84,1 S1 6,79 S1 3,14 S1	23,16 S1 84,09 S1 7,24 S1 3,15 S1	19,33 S1 61,96 S1 5,55 S1 3,26 S1	19,57 S1 78,90 S1 5,74 S1 2,91 S1	22,54 S1 91,83 S1 6,23 S1 1,81 S1	19,92 S1 89,97 S1 6,15 S1 3,4 S1	23,12 S1 69,57 S1 6,5 S1 1,45 S1	17,54 S1 81,28 S1 6,67 S1 2,90 S1
Toxicity (xc) - Salinity (dS/m)	0,07 S1	0,04 S1	0,04 S1	0,03 S1	0,04 S1	0,04 S1	0,04 S1	0,04 S1	0,03 S1	0,05 S1	0,03 S1
Sodicity (xn) - Alkalinity ESP (5)	3.7 S1	2.9 S1	2.8 S1	3.6 S1	4.7 S1	3.7 S1	3.7 S1	3.7 S1	2.7 S1	3.9 S1	4.1 S1
Sulfidic hazard (xs) -Sulfidic depth	No S1	No S1	No S1	No S1	No S1	No S1	No S1	No S1	No S1	No S1	No S1
Erosion Hazard (eh) - Slope (%)	17 S3	16 S3	55 N	30 S3	35 N	6 S1	6 S1	1 S1	49 N	25 S3	23 S3
Flooding hazar - Puddle	No S1	No S1	No S1	No S1	No S1	No S1	No S1	No S1	No S1	No S1	No S1
Land preparation (lp) -Surface rock (%) -Outcrop Rock	< 5% S1 < 5% S1	< 5% S1 < 5% S1	< 5% S1 < 5% S1	< 5% S1 < 5% S1	< 5% S1 < 5% S1	< 5% S1 < 5% S1	< 5% S1 < 5% S1	< 5% S1 < 5% S1	< 5% S1 < 5% S1	< 5% S1 < 5% S1	< 5% S1 < 5% S1
Actual Land Suitability	S3wa,eh	S3wa,nr	Neh	S3wa,eh	Neh	S3wa	S3wa	S3wa	Nrc,eh	S3wa,eh	S3wa,eh

Table 3. The evaluation of actual land suitability and the coverage area of every LMU

LMU	Actual Land Suitabiliiy	Coverage area (ha)
1	S3wa,eh	2.8
2	S3wa,nr	166.7
3	Neh	15.3
4	S3wa,eh	27.4
5	Neh	41.7
6	S3wa	7.5
7	S3wa	255.5
8	S3wa	32.5
9	Nrc,eh	416.3
10	S3wa,eh	28.5
11	S3wa,eh	155.7

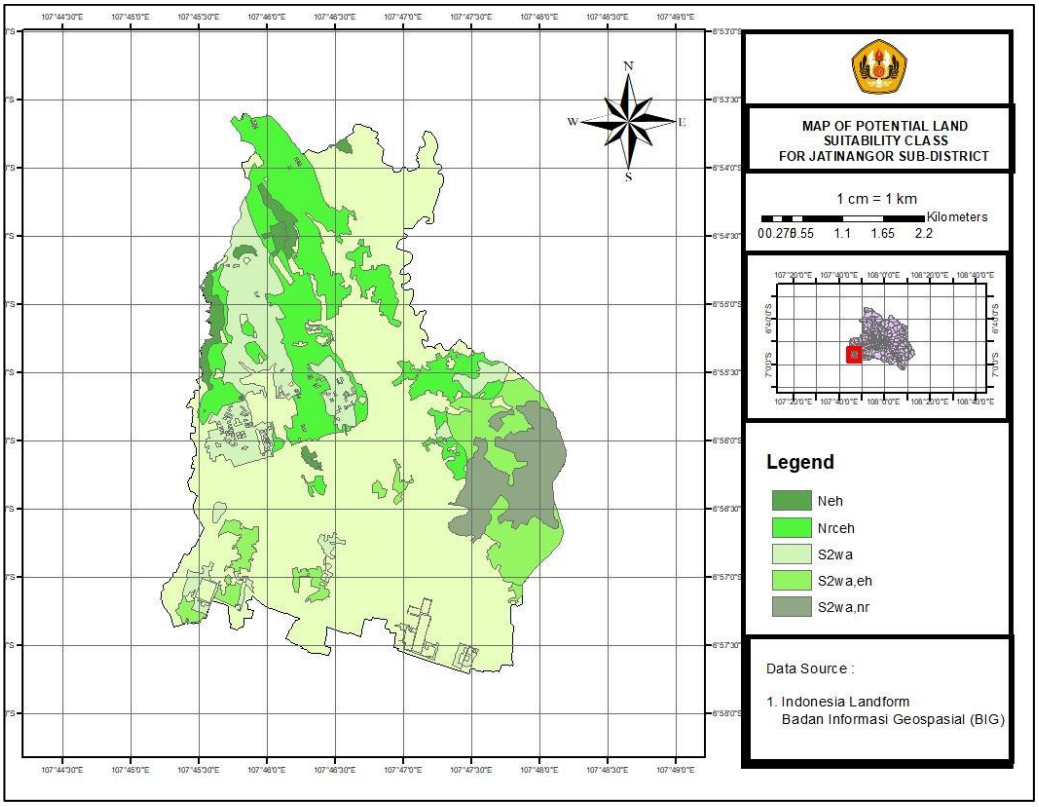

Figure 3 The Distribution of Actual Land Suitability of Peanut in Jatinangor Subdistrict

Table 4 The coverage area of each actual land suitability

No	Actual Land Suitability	LMU	Area (ha)	Total Area (%)
1.	S3wa,eh	1, 4, 10, 11	214.4	18.64
2.	S3wa,nr	2	166.7	14.49
3.	S3wa	6, 7, 8	295.5	25.69
	Total area Marginally suitable	1, 2, 4, 6, 7, 8, 10, 11	676.6	58.83
4.	Neh	3, 5	57	4.95
5.	Nrc, eh	9	416.3	36.2
	Total area of Non Suitable	3, 5, 9	473.3	41.16

	Total Areea		1149.9	100

Table 4 informed that Jatinangor Subdistrict in general classified as S3 (marginally suitable, 58.83%) and N (non suitable, 41.16%). The area that marginally suitable is greater than the area that non suitable. Limiting factor in S3 suitability were the water availability (wa) of the rainfall that less than 3500 mm per year, erosion hazard (eh) due to the slope in the ranged of 16-30% and nutrient retention of organic carbon content that less of 0.8%. Meanwhile the limiting factor of non suitable were the erosion hazard of slope that higher than 30%, and the rooting condition of texture that very coarse. These limiting factors of water availability of low rainfall can be solved by adding water from spring or other water source. The slope can be reduced by terrace and the organic carbon content can be increased by adding the organic matter (Sembiring et al, 2014)

3.4 Economic Feasibility Evaluation

Economic feasiblity evaluation was conducted from field interviews with farmers in every LMU. The number of samples taken in each LMU was carried out using the judgment sampling method (proportional sampling), based on the subjectivity of the researcher (Etikan et al., 2016). In each LMU 2 farmers were used as sample points. The data of farmers had the age range of 27-76 years with diverse educational backgrounds from elementary school, junior high school, and high school.

The cultivation methods of farmers in the area are almost the same, starting from land management by hoeing, fertilizing plants 1-3 times each season, and using chemical and organic fertilizer for peanut growth. For 1 ha, the farmer needed 50 kg seeds, 300 kg Urea, 100 kg Phonska, 150 kg manure, 2 L pesticide and 10 workers in 8 working days. Other supporting facilities are agricultural tools used in maintaining peanut plants until harvest. The component of output and variable cost of peanut's economic feasibility is presented in Table 5.

The average peanut production produced is 3.3 tons (3,300 kg) with an average selling price of Rp. 6,572,-/kg. The revenue (R) obtained by calculating the average production multiplied by the selling price is Rp. 21,687,600,-. The total cost is Rp. 14,233,980. The income obtained (the difference between revenue and total cost) is Rp. 7,453,620,-

Table 5 Component of output and variable cost (in ha) of peanut's economic feasibility

No	Component	Unit	Price (Rp)	Value Unit x Price
1	Revenue of the production			
	Peanut yield/ha (kg)	3,300	6,572	21,687,60
2	Cost of Peanut Production			
	Peanut seed (Kg)	50	50,000	2,500,000
	Fertilizer - Urea (kg) - Phonska (kg) - Manure (kg)	 300 100 150	 3,945 18,020 2,400	 1,183,500 1,802,00 360,000
3	Pesticide (L)	20	126.700	2,534,000
4	Payment of man-days (month)	4	1,463,620	5,854,480
5	Total Cost			14,233,980
6	Gross Margin (Revenue-Cost)			7.453.620
7	Ratio R/C			1.52

The R/C ratio used to see the profits obtained in peanut farming for each value issued. The R/C ratio obtained from the divided of income and total costs. The R/C ratio was of 1.52. It indicated that the peanut farming carried out by farmers was declared profitable and feasible to be cultivated. The R/C value was 1.52, means that for every Rp. 1 cost, the farmer gets an income of Rp. 1.52-.

4. CONCLUSSION

The actual land suitability class for peanut plants in Jatinangor Subdistrict is S3 (marginally suitable) with the limiting factors of water availability (less than 3500 mm year^{-1}), erosion hazard due to slope (ranged in16-30%), and nutrient retention of organic carbon content (less than 0,8%). The area with S3 covered of 676.6 ha, or 58.83% of the total area. These limiting factors of water availability of low rainfall can be solved by adding water from spring or other water source. The slope can be reduced by terrace and the organic carbon content can be increased by adding the organic matter. The rest was N (non suitable) with limiting factors of slope, water availability, organic c and texture.

The economic feasibility analysis for peanut in Jatinangor District was feasible Net R/C ratio of 1.52 and a Gross Margin of Rp. 7,453,620.in every ha.

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