THE 10TH INTERNATIONAL CONFERENCE ON BIOSCIENCE AND BIOTECHNOLOGY
RESEARCH, EDUCATIONAL SYSTEM AND MANAGEMENT OF BIOSCIENCE AND BIOTECHNOLOGY TOWARD THE INDUSTRIAL

Denpasar, 01 September 2019

Dear Mr. I Ketut Sumantra
Agrotechnology Department, Faculty of Agriculture, Universitas Mahasaraswati Denpasar

On behalf of the Scientific and Organizing Committee, we are pleased to invite you to participate in the 10th Conference on Bioscience and Biotechnology (10th ICBB), which will be held at Postgraduate Building 3th floor, Campus Universitas Udayana, Denpasar, Indonesia from 23rd to 24th September 2019.

We are pleased to inform you that the following paper has been accepted for **Oral Presenter Presentation** at this conference and will be added to the final program upon your completion of the formal registration process

Title : "Factors Affecting The Production and Fruit Quality Of Salak Gulapasir in The New Development Area in Bali"

As reminder for all author, the deadline of full paper submission is 24 September 2019.

Information on the conference, template for full paper and poster can be found at https://icbb.unud.ac.id. This website will be updated on a regular basis but we would be delighted to supply any additional information you may require.

We look forward to welcoming you in Bali, Indonesia.

Sincerely yours,

Dr. I Made Sukewijaya, S.P., M.Sc
Chairman of 10th ICBB, 2019

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SCIENCE

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Factors Affecting the Weight and Quality of *Salak Gulapasir* Planted in Origin and New Development Areas

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Abstract. The success of Karangasem regency to develop *Salak Gulapasir* plants has made other regions interested in cultivating this commodity. Currently *Salak Gulapasir* has been planted in other areas in Bali such as in Tembuku-Bangli Regency, Payangan-Gianyar Regecy, Petang-Badung Regency and Pupuan-Tabanan Regency. The problem faced in its development is the lower fruit quality. This study aims to identify and analyze soil factors, climate and crop management which were thought to cause differences in fruit production and quality of *Salak Gulapasir* plants which were firstly planted in the area of Sibetan, and in the new development areas in Bali. The study used survey methods covering several activities including secondary data collection, field observations, sample observations, interviews with farmers. Data were analyzed by factor regression (Principal Component Analysis). The results showed that *Salak* Gulapasir from Sibetan-Karangasem had higher fruit weight and quality (flesh thickness, higher in TSS and total acid ratio. Planting area and soil locations significantly affected fruit weight and fruit quality. *Salak Gulapasir* plants from Sibetan-Karangasem produced better weight and quality than if planted in Pupuan-Tabanan area, which was an area of *salak* development. Soil components that affected fruit weight were: N, P, CEC, soil texture, C-organic, and soil acidty.

Keywords: salak, environment, new area.

Introduction

The problem faced by farmers in developing *Salak Gulapasir* outside Karangasem is that the selling price for the same unit is cheaper because fruit traders and consumers consider the quality of fruit to be lower. As a result of the unbalanced assessment of *Salak Gulapasir* originating from outside Sibetan-Karangasem, it is feared that it will affect the income and production continuity.

The yield and quality of *Salak* is low in new development areas in Bali, especially in Tabanan Regency, it is not yet known whether due to the influence of climate factors, soil factors, plants or cultivation techniques. Soil, climate, and management factors together will form a new agroecosystem, the response to *Salak* Gulapasir plants will be different from the agroecosystem from Sibetan-Karangasem. Handling the low quality of *salak* is by conducting a study of several factors such as soil, climate, plants and crop management and adjusting the farming patterns cultivated with local climate patterns according to the ecological requirements needed through manipulation of plants and the environment. These adjustments must be based on the identification, understanding or proper interpretation of land and climate in each agroecosystem and location. Sorting out areas with climatic conditions that are suitable for *salak* commodities for certain areas requires a more comprehensive identification and interpretation of soil, climate, plants and cultivation techniques, so that known factors causing yields and fruit quality are low and implemented as a basis for improving fruit yield and quality.

The climate element affects almost all aspects of agricultural activities both in the long term, short term and daily. The needs for precise climate information is increasingly being felt strategically in supporting agricultural programs. Handling of low *salak* quality is by conducting a study of several factors such as plants, soil and climate, as well as adjusting the farming patterns cultivated with local climate patterns. These adjustments must be based on the identification, understanding or proper interpretation of land and climate in each agroecosystem and location. Thus in sorting out areas with climatic conditions that are suitable for *salak* commodities for certain areas, it is necessary to identify and interpret the soil and climate more comprehensively, so that the causes of low fruit quality can be identified.

The quantity and quality of *salak* is greatly influenced by environmental factors, especially water content and soil nutrients (Ashari, 2006a; Lestari et al., 2011; Lestari and Ebert, 2002), soil pH (Sumantra et al., 2012), height of the place above sea level (Sumantra et al. 2014), crop management (Sukewijaya et al., 2009).

Another problem faced by *salak* farmers in Tabanan area in increasing fruit yield and quality is still doing traditional cultivation actions using a very simple method. Fertilization has not been carried out intensively, nor has the provision of water relied solely on rainfall (Ashari, 2002; Sukewijaya et al., 2009). As a result of the cultivation of *salak* plants, the weight of the *salak* harvest varies slightly each season. The purpose of this research is to identify and analyze soil, climate and crop management factors that are thought to cause differences in yield and quality of *Salak* Gulapasir.

Method

The study was conducted in two districts, namely Karangasem Regency and Tabanan Regency. In Karangasem Regency the research locations were selected purposively namely: Duda Timur Village, Dukuh, Telaga, Karanganyar, Kutabali, Kecing, Kresek, Jungutan. In Tabanan Regency, the areas studied included: Duren Taluh Village, Kebon Jero, Anggesari, Munduk Temu, Pajahan, Batungsel and Saribuana,

The tools used include: GPS map 60 CSX, light meter, thermo hygrometer, soil moisture tester, drill, scope, hoe, rope, meter, scale, oven and laboratory equipment for soil analysis and fruit quality.

The materials used were *Salak Gulapasir* plants with a uniform growth rate, had been fruiting and had an average age of 8 years. Plant materials were taken from two locations, namely in the center of *salak* development in the Selat and Bebandem districts, Karangasem Regency and the Districts of West Slemadeg and Pupuan, Tabanan Regency, with an altitude of 450-780 m above sea level.

Research using survey methods included several activities including secondary data collection, field observations, sample observations, interviews with farmers, soil and plant organ sampling, and laboratory analysis. The survey was conducted at each location at the height of the *salak* agroecosystem, which was 450-780 m above sea level. The location and height of the habitat is determined by purpsive sampling. Observations were carried out at 12 locations, in each district and each location observed 16 plants.

A survey of *Salak Gulapasir* cultivation techniques that had been and was being carried out by farmers in the area of origin and the area of development had only been selected by 24 farmers. The criteria for respondent farmers were that they were willing to be respondents, were able to read and write, having *Salak Gulapasir* plants that had been fruitful and a minimum area of ownership of 500 m^2. The number of observation locations as well as sub-sample plants so that in each location amounted to 12 samples. Selected *salak* plants were maintained in accordance with the way of maintenance carried out by farmers with the intention to match the actual conditions in the field. In this study no specific treatment was given to plants. Research emphasized on exploration to recognize differences in fruit quality and the factors that influence it.

Based on the *salak* plant location that had been determined, then the observation and sampling of plants and soil in each sub zone was carried out. Field observations included observations of plants and soil

1. Observation of plants included: fruit weight $grain^{-1}$ and fruit weight kg^{-1}, edible parts, thick fruit flesh, sugar content (TPT), acid content, sugar-acid ratio.

2. Soil observation with three stages, namely: (1) soil sampling, through soil surveys, (2) soil sample analysis, and (3) interpretation of soil sample analysis results. Soil sampling was done using a drill, at a depth of 0-40 cm. The number of soil samples taken from 12 samples at each location. Soil samples taken analyzed in the laboratory were the percentage of sand, dust and clay using the pipette method, soil pH with a pH meter, organic matter with the Black and Walky method, salinity with a coductometer, CEC with the NH_4OAc method, and total macro N nutrient content in the Kyedall method, P_2O_5 with Bray I method and K_2O with Bray I method.

Data were analyzed using a t test at the 5% level. Factor analysis (Principal Component Analysis) was carried out with the aim to explain the structure of the relationship between many variables in the form of factors or formed variables, in addition to reducing the number of origin variables which were numerous in number to a number of new variables. The results of the formed variables or factors were used as input in factor regression analysis.

Finding and Discussion

T test results on the *Salak Gulapasir* cultivation activity scores between farmers in Tabanan and Karangasem were not significantly different. Of the seven cultivation activities evaluated covering the stem setting, shade setting, fertilizing, watering, controlling pests, diseases and harvesting showed that *salak* farmers from Karangasem scored higher than the activities carried out by farmers in Tabanan (Table 1).

By using score 1 for not doing activities and score 5 for intensive activities in each sub-cultivation activity, the intensity of *salak* cultivation in Karangasem was quite intensive with a mean score of 3.67, while in Tabanan it was less intensive with a value of 2.58.

Table 1. Average score of *Salak Gulapasir* cultivation in Tabanan and Karangasem (N = 24)

Cultivation Activities	Tabanan (score)	Karangasem (score)
Stems and shoot settings	3.22	4.33
Shade settings	3.67	5.00
Fertilization	2.27	3.52
Weeding	3.67	5.00
Watering	1.00	1.67
HPT Controling	1.00	2.00
Harvest	3.25	4.17
Average score	2.58	3.67
t hit. = 1.601 tn ; P value : 0.135255		

Remark: ** = P > 0.01; * = P > 0.05; tn = P <0.05.

Soil Character and Climate of Research Location

The results of the analysis of N, P, CEC, KB, pH and soil texture levels showed differences between the soils in the *Salak* Gulapasir plantations in the Karangasem area and the soil in the Tabanan area, whereas the levels of C-organic and K available were not significantly different. (Table 2).

Tabel 2. Average C-organic content, N.P, K, CEC, and KB of soil on *Salak Gulapasir* land in Karangasem and Tabanan (N = 24)

Variabel	C-organik (%)	N-Total (%)	P availabe (ppm)	K available (ppm)	CEC (me/100 g)
Karangasem	3.57±1.20	0.25±0.04	50.08±3.53	21.66±4.42	23.25±2.65
Tabanan	4.11±1.71	0.18±0.02	10.34±3.90	19.05±7.89	33.27±4.88
t hit.	-0..9 tn	5.44**	4.33**	0.99 tn	-6.25**
P value	0.38	0.000	0.001	0.332	0.000

Remark: ** = P > 0.01; * = P > 0.05; tn = P <0.05.

Salak Gulapasir planting areas in Karangasem and Tabanan areas had different characteristics of rainfall and humidity, but on average the temperature was not different. The mean annual rainfall in the Karangasem area is higher and the average humidity was lower (Table 3).

Tabel 3. Sand, dust, clay and soil pH content in *Salak Gulapasir* in Karangasem and Tabanan (N = 24)

Variabel	**Sand (%)**	**Dust (%)**	**clay (%)**	**pH**	**KB (%)**
Karangasem	50.17±10.48	36.33±5.34	14.33±5.34	6.01±0.25	90.27±21.5
Tabanan	29.86±10.71	47.85±7.82	22.28±7.82	5.71±0.18	66.77±20.0
t hit.	4.53**	-3.71**	-2.91**	2.18*	3.76**
P value	0.0002	0.001	0.009	0.041	0.001

Remark : ** = P > 0.01; * = P > 0.05; tn = P <0.05.

Light interception under the canopy of *salak* plants observed at 12.00 showed different values (Table 4). The *salak* planting area in Karangasem showed the value of interception of light was higher than in the Tabanan area. The difference in the value of interception was due to the higher density of the large unity plant so that the light that fell on the ground was lower.

Tabel 4. Average rainfall, temperature, humidity and light interception of *Salak Gulapasir* plantations in Karangasem and Tabanan (N = 24).

Variables	**Rainfall (mm)**	**Temperature (ºC)**	**Humidity (%)**	**Light interception (%)**
Karangasem	3195.16 ±171.71	22.42 ± 0.61	85.01 ± 1.13	84.48 ± 3.25
Tabanan	2630.75 ±175.36	22.46 ± 0.66	86.49 ± 0.92	79.14 ± 2.21
t hit.	7.96**	-0.18tn	-3.49**	4.70**
P value	0.000	0.859	0.002	0.0001

Remark : ** = P > 0.01; * = P > 0.05; tn = P <0.05

Results and Results Components

The results of the t test analysis showed differences in the results and components of *Salak Gulapasir* cultivated in the Karangasem area and in Tabanan. Table 4 shows the *Salak Gulapasir* cultivated in Karangasem produced a higher number of fruit bunches of plant-1, the number of fruit harvested bunches-1, and a higher number of fruit harvested plants-1. The results of the correlation analysis showed the number of fruit harvesting tree-1 was positively correlated with the number of fruit bunches of harvest-1 (r = 0.996 **). It meant that the more fruit bunches-1 will cause the number of fruit trees-1 more and more.

Table 5. Average number of fruit bunches, fruit weight, edible fruit weight and fruit harvest weight of *Salak Gulapasir* in Karangasem and Tabanan areas (N = 24)

Location	Ni=umber of fruit bunches-1 (item)	**Fruit weight (g)**	**Edible fruit weight (g)**	**Fruit harvest weight (kg plants $^{-1}$)**
Karangasem	21.53± 1.62	48.13 ± 4.01	34.47 ± 4.82	1.37 ± 0.25
Tabanan	19.85± 1.82	41.86 ± 3.48	29.11 ± 4.47	1.13 ± 0.21
t hit.	2.36 tn	4.09**	2.82*	2.56*
P value	0.027	0.0004	0.010	0.017

Remark: ** = P > 0.01; * = P > 0.05; tn = P <0.05

Quality of *Salak Gulapasir*

The results of the analysis showed that the physical quality of *Salak Gulapasir* fruit including the thickness of the fruit flesh, total dissolved solids, total acid and TPT / total acid showed a difference except for the fruit length/diameter ratio. *Salak* cultivated in Karangasem produced better quality (Table 6)

Tabel 6. Average of physical quality of *Salak Gulapasir* in Karangasem and Tabanan (N=24)

Location	**Fruit flesh thickness (cm)**	**Ratio of P/D fruit**	**Total dissolved solids (^{O}Brix)**	**Total acid (%)**	**Ratio of TPT dan total acid**
Karangasem	0.58 ± 0.09	0.77 ±0.10	15.64 ± 0.59	0.37± 0.17	48.71± 18.06
Tabanan	0.49 ± 0.08	0.71 ±0.09	16.71 ± 0.33	0,56± 0.16	32.51± 11.39
t hit.	2.48 *	-1.515 tn	-5.41**	-2.75*	2.63*
P value	0.0208	0.1440	0.000	0.0003	0.0017

Remark: ** = P > 0.01; * = P > 0.05; tn = P <0.05

Result of Factor Analysis

Factor analysis was carried out with the aim to explain the structure of the relationship between many variables in the form of factors or variable formations, in addition to reducing the number of origin variables which were numerous in number to a number of new variables. The results of the formed variables or factors were used as input in factor regression analysis. The following was an analysis of soil factors, climatic factors in the experimental sites and factor analysis of cultivation techniques applied by *salak* farmers in two locations.

Analysis of Soil factor

The analysis showed that of the ten soil variables four factors were formed together (Table 7). A shared factor of one with a percentage of variance = 40.345. Two, three, and four joint factors with 19.403, 13.084 and 10.779 variance percentages respectively, and cumulative percentage of variance formed from the four shared factors = 83.613% and the remaining 16.387% consisted of six shared factors (Table 7). The number of shared factors representing ten soil sub-variables was determined by the total initial eigenvalue value ≥ 1, which were four factors.

Table 7. Contribution of soil factor components (*Total Variance Explained)*

Soil Components	Eigenvalues (Initial Eigenvalues)		
	Total	**% Variation**	**Cumulative %**
1	4.035	40.346	40.346
2	1.940	19.403	59.750
3	1.308	13.084	72.834
4	1.078	10.779	83.613
5	0.500	5.003	88.617
6	0.463	4.625	93.242
7	0.379	3.790	97.032
8	0.202	2.023	99.055
9	0.086	0.857	99.912
10	0.009	0.088	100.000

The results of the analysis on the matrix component and scores component obtained four soil components: soil-1, soil-2, soil-3 and soil-4. Based on the value of the component factors of each variable which was> 0.5: soil-1 consisted of N levels, P levels, CEC, KB, Sand, dust. The soil-2 component consisted of C-organic and clay percentage. Soil-3 component: pH and soil component-4 K content (Table 8).

Table 8. Matrix components and score components of soil

Variables	Matrix components				Score components			
	Soil-1	**Soil-2**	**Soil-3**	**Soil-4**	**Soil-1**	**Soil-2**	**Soil-3**	**Soil-4**
C-organik	-0.059	0.909	0.099	-0.017	-0.015	0.469	0.075	-0.015
N Level	0.828	-0.101	0.125	-0.071	0.205	-0.052	0.095	-0.066
P-available	0.729	-0.242	-0.284	0.272	0.181	-0.125	-0.217	0.252
K-available	0.111	-0.032	-0.658	0.680	0.027	-0.016	-0.503	0.631
KTK	-0.818	0.425	-0.034	0.232	-0.203	0.219	-0.026	0.215
KB	0.589	-0.444	0.395	0.215	0.146	-0.229	0.302	0.199
pH	0.418	0.149	0.675	0.380	0.104	0.077	0.516	0.353
Sand	0.837	0.456	-0.166	-0.164	0.207	0.235	-0.127	-0.153

Dust	-0.754	-0.142	0.351	0.439	-0.187	-0.073	0.268	0.407
Clay	-0.584	-0.644	-0.075	-0.268	-0.145	-0.332	-0.057	-0.249

Analysis of climate factors

The results of the analysis showed, two factors were formed together from the four climate variables, namely a single factor with a percentage of variance = 44.913 and two factors together with a percentage of variance = 41.644 and cumulative percentage of variance formed from the two shared factors = 86.557% and the remaining 13.443% consists of two common factors (Table 9). The number of shared factors representing the four climate sub-variables was determined by the total initial eigenvalue value ≥ 1, which were two factors.

Table 9. Contribution of climate factor components (Total Variance Explained)

Components	**Eigenvalues (Initial Eigenvalues)**		
	Total	**% Variation**	**Cumulative %**
1	1.797	44.913	44.913
2	1.666	41.644	86.557
3	.474	11.846	98.404
4	.064	1.596	100.000

The results of the analysis on the matrix component and scores component obtained two climate components: climate-1 and climate-2. Based on the factor component value of each variable that was> 0.5, the climate component-1: rainfall and light interception, climate component-2: temperature and humidity (Table 10).

Table 10. Matrix components and score components of Climate

Climate variables	**Matrix components**		**Score components**	
	1	**2**	**1**	**2**
Rainfall	0.925	0.042	0.515	0.025
Temperature	-0.489	0.849	-0.272	0.509
Humidity	-0.197	-0.943	-0.110	-0.566
Light Interception	0.814	0.235	0.453	0.141

The results of the analysis showed, of the seven variables of cultivation formed two common factors, namely the joint factor one with the percentage of variance = 36.891 and the two shared factors with the percentage of variance = 25.195 and the cumulative percentage of variance formed from the two shared factors = 62.086% and the remaining 37.914% consistsed of five common factors (Table 11). The number of shared factors that represent the seven aspects of cultivation with a total initial eigenvalue value ≥ 1 was as many as two factors.

Table 11. Contribution of cultivation technique components (Total Variance Explained)

Components	Eigevalue (Initial Eigenvalues)		
	Total	**% Variation**	**Cumulatif %**
1	2.582	36.891	36.891
2	1.764	25.195	62.086
3	0.913	13.041	75.127
4	0712	10.172	85.299
5	0.531	7.588	92.887
6	0.317	4.522	97.409
7	0.181	2.591	100.000

The results of the analysis on the matrix components and score component obtained two components of cultivation activity: cultivation-1 and cultivation-2. Based on the value of the factor component of each variable that was > 0.5, the cultivation component-1 consisted of the stem / shoot setting, shade setting, fertilization, weeding, while the culture component-2 consisted of watering and controlling pests and diseases (Table 12).

Table 12. Matrix components and score components of cultivation

Cultivation Variables	Matrix components		Score components	
	1	**2**	**1**	**2**
Stem and shoot setting	0.679	-0.378	0.263	-0.215
Shade setting	0.802	-0.043	0.311	-0.024
Fertilization	0.755	-0.294	0.293	-0.166
Weeding	0.507	0.044	0.197	0.025
Watering	0.394	0.843	0.153	0.478
Controlling pests and diseases	0.510	0.766	0.197	0.435
Harvest	0.649	-0.211	0.187	-0.273

Factors Affecting the Weight of *Salak* Fruit

The results of the analysis of the main components of soil, climate and cultivation techniques, there were nine factors that formed the basis of consideration as independent variables (X) in the factor regression analysis to determine the factors that affected the weight of fruit tree-1 (Y). The nine new formation factors consisted of ten soil variables formed four common factors (soil-1, soil-2, soil-3 and soil-4), four climate variables formed two common factors (climate-1 and climate-2), seven cultivation variables formed two common factors (cultivation-1 and cultivation-2) and dumi factors (location of Tabanan and Karangasem).

The results of the factor regression analysis of variance using the SPSS 20.0 application package showed, simultaneously the nine independent variables (X) significantly affected the weight of the *salak* plants^{-1} (R2 = 78.9%).

Based on the partial regression analysis (Table 13), of the nine independent variables (X) that significantly affected the weight of *salak* plants^{-1} (Y) was the planting location (dumi), soil-1, soil-2, soil-3. While the independent variables climate-1, climate-2, land-4, cultivation-1 and cultivation-2 did not have any significant effect. Based on the results of the analysis it could be made clear that the factors that influenced the weight of the fruit of the plans-1 were: soil component-1 consisting of levels of N, levels of P, CEC, KB, Sand, dust. The soil component 2 consisted of C-organic and the percentage of clay and soil component 3 consisted of pH.

Table 13. Results of partial regression analysis of fruit weight plant-1

Model	**Unstandardized Coefficients**		**Standardized Coefficients**	**t hit.**	**Sig.**
	B	**Std. Error**	**Beta**		
(Constant)	892.023	134.086		6.653 **	0.000
Dumi (location)	689.073	260.068	1.292	**2.650 ** **	0.019
Climate-1	89.371	104.872	0.328	0.852 tn	0.408
Climate-2	70.487	71.163	0.259	0.990 tn	0.339
Soil-1	-325.649	90.458	-1.196	**-3.600 ** **	0.003
Soil-2	-114.801	45.748	-0.422	**-2.509 * **	0.025
Soil-3	-180.657	66.476	-0.663	**-2.718 * **	0.017
Soil-4	20.771	47.874	0.076	0.434 tn	0.671
Cultivation-1	-12.951	63.479	-0.048	-0.204 tn	0.841
Cultivation-2	-32.119	51.566	-0.118	-0.623 tn	0.543

Remark: ** = highly significantly affected ($p<0.01$); * = significantly affected ($p<0.05$); tn = ($p>0.05$).

Discussion

The yields and quality of *Salak Gulapasir* cultivated in Karangasem and in Tabanan were different. The fruit weight of *salak*-1 from Karangasem was 21.24% higher than originating from Tabanan. The difference in fruit weight of the plant-1 was caused by differences in the number of fruits and the weight of fruit-1 (Table 4)

The weight of fruit plant^{-1} (fruit yield) and higher yield components were caused by environmental factors, especially soil conditions more suitable to support plant growth and development. This was indicated by the results of the factor regression test that the location of the place to grow and soil conditions significantly influenced the weight of the fruit plant^{-1}. Soil conditions that affected the weight of the fruit plant-1 were levels of N, P levels, KB, texture, C-organic and soil pH. Whereas climatic conditions which included rainfall, temperature, humidity and interception of light did not significantly affect the weight of fruit plant^{-1}. Likewise with cultivation techniques which included stem, shade setting, fertilization, watering, pest control and harvesting activities.

Salak Gulapasir from Karangasem showed the average fruit weight, thick fruit flesh, TPT / total acid ratio was higher than from Tabanan (Tables 4 and 5). Fruit taste depended on the complex interactions of sugar, organic acids, phenols, tannins and volatile substances (Ghosh and Palit, 2003). The content of sugar and acid affected the level of sweetness, the higher the ratio of sour sugar, the sweeter the fruit taste (Wijana, 1990). Sugar and organic acid levels came from the results of photosynthesis which were accumulated in the stages of fruit development and maturation (Ghosh and Palit, 2003). Acid levels decreased and sugar levels increased in line with the process of fruit ripening (Ulrich, 1970).

In line with this study, the TPT / total acid ratio was higher in *Salak Gulapasir* fruit from Karangasem, presumably caused by the results of photosynthesis accumulated in the fruit. This was indicated by the weight of the fruit grain-1, the portion of fruit that could be eaten and thick fruit flesh was higher (Tables 4 and 5).

Soil was a component of natural resources which covered all solid parts above the earth's surface, which were formed from parent material that was influenced by climate performance, living bodies and local reliefs within a certain time (Hardjowigeno, 1993). Although *salak* plants could grow in all types of soil (Djaenudin et al., 2000), but in this study *salak* plants with Karangasem sandy clay give higher yields and fruit quality was better than *salak* from Tabanan which had dusty clay texture. This could be caused by the roots of *salak* plants were very shallow, so that in soil with sandy clay texture the roots would easily grow and develop to absorb water and nutrients (Anarsis 1999; Tjahjadi, 1989).

Total N levels, P-available, and K-available components in *Salak Gulapasir* land in Karangasem area were higher than *Salak Gulapasir* land in Tabanan (Table 2). *Salak Gulapasir* land in Karangasem with total N levels in moderate conditions (0.25%), P levels available were very high (50.08 ppm) and K is very low (21.66 ppm). Whereas *salak* land in Tabanan has a total N and P content which were low respectively 0.18%, 10.34 ppm K levels were very low (19.05 ppm). Higher NPK nutrient levels in Gulapasir *salak* land in Karangasem were supported by higher soil pH and KB values (Table 2). The higher value of soil chemical variables was inseparable from the cultivation activities carried out by farmers in Karangasem. This was shown from the average of seven cultivation activities with a moderately intensive score of 3.67 and on the fertilization sub-activity with a score of 3.52, while the cultivation activities carried out by farmers in Tabanan were less intensive with a score of 2.58 and on fertilizing activities with a score of 2.27 (Table 1). Marschner (1995) states the concentration of nutrients in the soil is an important factor for plant growth. Availability depends on several factors including soil moisture, pH, CEC and the amount of organic matter and nutrients supplied to the soil.

In line with the results of this study several researchers stated that environmental factors affecting fruit yield and quality can originate from soil fertility (Kusumainderawati et al., 1992; Soleh et al., 1993), soil pH (Soleh et al., 1996), soil water and nutrient content (Ashari, 2006a; Lestari and Ebert, 2002). If some conditions for plant growth were not fulfilled either pH, soil structure, soil fertility conditions, crop management could interfere with vegetative growth, flowering and fruit quality was not optimal (Soleh et al., 1996; Purnomo and Sudaryono, 1994 and Tjahyadi, 1998).

Therefore, in the context of developing *Salak Gulapasir* in new areas in Bali, especially in Tabanan Regency, it was necessary to carry out more intensive land and crop management through improved cultivation such as the provision of organic and inorganic fertilizers and liming.

Conclusions and suggestions

Salak Gulapasir from Karangasem had higher fruit weight and quality (flesh thickness, TPT / total acid ratio). Planting location and soil significantly affected fruit weight plant^{-1} and fruit quality. Soil components that affected fruit weight were: levels of N, P, CEC, KB, soil texture, C-organic content, and soil pH.

Salak Gulapasir development in new areas in Bali, especially in Tabanan Regency, needed to improve the physical and chemical properties of soil in *salak* cultivation techniques by providing fertilizer, liming and irrigation.

REFERENCES