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# Optimization of Farming Production Factors of Alabio Yam and the Opportunity for Reserve Strengthening of Farmers Household in Non-tidal Swampland (Case in the North Hulu Sungai Regency, South Kalimantan Province)

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***Abstract:***
*Food security at village level and household is a necessary and sufficient requirements to ensure the needs of the household individual consumption. Therefore, the issue of food reserves at village level and household is an important issue and became one of the pillars of food security. This article aims to analyze the use of production factors in order to optimize and also to determine the opportunity of Alabio yam production, to be able to be used as the one of carbohydrate source, which is able to substitute the rice. For this purpose, the production function model with stochastic frontier Cobb-Douglas type is used. There are 80 Alabio yam farmers who used as respondents. The results show that the most of the variables in the model as expected, which is positive, except the pesticides which have a negative sign. Farmers in the swampland have a good technique efficiency by an average of 85.20%. The management of production factors usage between farmers who use the large area and narrow area is not different. Alabio yam is able to be food reserves of framers household because able to store until 6 months and can be consumption substitute for rice if processed properly.*
***Key Word****: swampland, Alabio yam, technical efficiency and food reserves.*

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## I. Introduction

Hunger and malnutrition cases are some indicators of food security and it occurs in producing countries (Hanani, 2012; Rachmat, 2010; Rosyadi and Purnomo, 2012). These empirical evidence shows that there has been a failure in development strategy of food security which macro oriented but less attention to the micro consideration, that is household including surrounding environment namely village (Didiet and Purnomo, 2012). National food security is necessary but not sufficient condition to ensure the fulfillment of consumer needs across the province and regency. Food security at village and household levels is necessary and sufficient requirements to ensure the consumption needs of all household individual. Therefore, the issue of food reserves at the village level and household is an important issue and became one of the pillars of food security. Moreover, the sub-optimal land such as non-tidal swampland; number of food insecure population is also caused by poverty itself; natural disasters and or affected as the result of climate change. But on the other hand; non-tidal swamplands have the potential for yam plant in addition to the rice crop.

One of the commodities that can be developed in swampland as food base other than rice is yams plant. Kinds of local yams are widely cultivated and has been handed down in non-tidal swampland, South Kalimantan, one of which is a type of Alabio yam (*Dioscoreaalata* L). When linked with the concept of food security as decanted in Law No. 18 of 2012 on food, in fact every farming including Alabio yam farming is not enough to simply increase production without any incentive economically in the form to increase the income of farmers. Alabio yam farming in swampland is an important part of efforts to achieve the production target to be able to be used as carbohydrate source than rice, and also to increase the income of farmers. According to economic principles, to get the maximum profit aspect, the farming must be optimized. For that to know whether the use of production factors have been allocated in an efficient dosing quantity and satisfy the principle of profit maximization.

This article aims to analyze the use of production factors in order to optimize and also to determine the opportunity of Alabio yam production to be able to be used as one of carbohydrate sources that is able to substitute the rice.

## II. Material And Methods

**Data and SamplingTechniques**

This research conducted at agro-ecosystem non-tidal swampland in North Hulu SungaiRegency. The regency were purposively selected on the basis that the North Hulu SungaiRegency is the only regency in South Kalimantan which became centers of Alabio yamplant. In addition, the farmers are human resources in agriculture that has been handeddownmanaging thericefarmingin swampland.

Primarydataiscollectedthroughastructuredinterviewguidedquestionnairebyfarmers who manage Alabio yam farming and direct observation in the field. The maincriteria farmers selected as respondents are farmers who have experienced farming ofAlabioyamplantsatleasttwogrowingseasons.Samplingtechniqueiscarriedoutinstages(multi-stage sampling). The first stage selected the district purposively; namely SungaiTabukanDistrict.

Each district selected again each of the two villages namely Gelagah Village and TelukCati Village. From each of these villages will be determined proportionate random sampling.Overall number of sample farmers as the primary data source planned is 80 respondents.Farmers who belong to the category of farmers with small areas are farmers who organizethe land < 0.5 *borong* **(1 *borong* = 1/6 hectares)**; whereas farmers who belong to thecategoryoffarmerswith largeareasareorganizeland>0.5*borong*.

**Data Analysis**

Dataanalysisusingastochasticfrontierproductionfunctionanalysis.Stochasticfrontiermodel is an extension of the deterministic original models to measure the stochastic effectswithinthefrontierproduction.Inthisstudy,theproductionfunctionusedisthestochasticfrontierproductionfunction oftheCobb-Douglas(CD).Intheproductionfunction,factorsthatdirectly affect the quantity of products produced are production factors that dominant used in thebusiness. These estimated factors are land, seeds, urea fertilizer, pesticides and labor. Byenteringtheindependentvariablesintothefrontierequationthentheestimatorequationmodeloffrontierproductionfunct ionofAlabioyamfarminginswamplandcanbewrittenasfollows:

$$LnY=\beta_0+\beta_1 lnX_1+\beta_2 lnX_2+\beta_3 lnX_3+\beta_4 lnX_4+\beta_5 lnX_5+\beta_6 lnX_6+\beta_7 lnX_7+D+e$$

where:

Y : Production of Alabio yam in swampland (kg)
$X_1$ :land area(hectares)
$X_2$ : seeds (cuttings)$X_3$ :ureafertilizer(kg)
$X_4$ : SP 36 fertilizer (kg)
$X_5$ : KCL fertilizer (kg)
$X_6$ : pesticides (litters)
$X_7$ :Labor(manday)
$X_8$ :Dummy(D)
$\beta_0$ :intercept
$\beta_j$ : coefficientof estimators'parameter wherei=1,2,3,....
$v_i$–$u_i$:errorterm($u_i$)technicalinefficiencyeffectsinthemodel.
$D_i$ is a dummy variable that can considered as an indicator of value 0 and 1 for eachlandareasizegrouping(D),where$D_1$=0fornarrowareas(<5*borong*);and$D_1$=1forlargeareas(> 0.5*borong*). isregressionparameters;and*u* isanerrorterm.

ThehypothesisthatusedisproductionfactorallocatedfarmersinAlabioyamfarminginnon-tidalswampland,NorthHuluSungaiRegencyhasnottechnicallyefficient.Hypothesistestingisperformedbasedonthees timatedproductionfunctionwithpartialtest.Totestthe hypothesismadeasfollows:

H0 : ki=1
Hi : ki≠1

Hypothesistestingisdonebyttest

AnalysistodeterminetheopportunitiesofAlabioyamforFoodReservesisdonedescriptively.

## III. Result

**EstimationParametersofOLSandFrontierProductionFunctions**

Parameter estimation of Cobb-Douglas production function with method of OrdinaryLeastSquare(OLS)methodgivesanoverviewoftheaverageperformancefromfarmers'production process at existing technology level. Table 1 presented estimation parameters oftheaverage productionfunction and itssignificance value.

**Tableno 1** :TheEstimationResultsofCobb-DouglasProductionFunctionwithUsingOLSMethod

**Coefficient[s]**

| Model | UnstandardizedCoefficients | | StandardizedCoefficients | t | Sig. | CollinearityStatistics | |
|---|---|---|---|---|---|---|---|
| | B | Std.Error | Beta | | | Tolerance | VIF |
| (Constant) | 3,496 | ,319 | | 10,945 | ,000 | | |
| Landarea($X_1$) | ,215 | ,072 | ,204 | 2,971 | ,004 | ,234 | 4,270 |
| Seed($X_2$) | ,336 | ,055 | ,368 | 6,059 | ,000 | ,301 | 3,327 |
| UreaFertilizer($X_3$) | ,175 | ,085 | ,178 | 2,045 | ,045 | ,146 | 6,850 |
| SP-36Fertilizer($X_4$) | ,097 | ,108 | ,086 | ,903 | ,370 | ,121 | 8,236 |
| KCl Fertilizer($X_5$) | ,054 | ,024 | ,103 | 2,315 | ,024 | ,563 | 1,777 |
| Pesticide($X_6$) | ,003 | ,055 | ,002 | ,050 | ,960 | ,739 | 1,353 |
| Labor ($X_7$) | ,037 | ,027 | ,063 | 1,355 | ,180 | ,506 | 1,975 |
| Dummy(X-8) | ,125 | ,065 | ,104 | 1,904 | ,061 | ,370 | 2,705 |

a.DependentVariable:Produksi_Y

Estimation results show that, average production function that best fit formed describesthebehavioroffarmersintheproductionprocessofyamAlabio.Thedeterminationcoefficient of the average production function ($R^2$ adj) obtained 0.92 with F value of 103.93which is greater than F table at α = 1%. Inputs used in the average production functionmodelcanexplain 92%fromAlabioyamvariationintheresearcharea.

Productionfactorsoflandarea,seed,KCLfertilizeranddummyvariablesfoundsignificant influenced towards the Alabio yam production in the research area, with positivesign as expected, and estimation parameters or production elasticity of 0.215; 0.336; 0.054and 0.125 respectively. Another factors are urea, SP 36 fertilizer as the TSP source andpesticidesfoundnotsignificant.

These figures indicate that the addition of land area, seed, KCL fertilizer and laborrespectively by 10% with the other inputs fixed and conducted not simultaneously, it is stillcan increase the Alabio yam production in the research area, even with relatively smalladditionalproduction is2.15%;3.36%;and0.56%.

By using a description of the production curve, then the position of the use of thesethree factors are in the area of production II (the rational area) use of production inputs.Farmers still rational, if willing to add the extensive use of land, seed, and KCL fertilizer toobtainhigher production,althoughadditionalproductionwillbeobtainednot great.

Production factors of urea and TSP (SP 36) found not significant influenced to theAlabio yam production in the research area with a positive sign as expected. Not affectedfrom urea fertilizer factor production is thought to be caused by a rich source of N in theswampland.

Table 2 displays the estimation results of stochastic frontier production function whichuses seven production factors. Estimation results illustrate the best practice from the farmerrespondentsintheexistinglevelof technology.TheestimationisdonewithMLEmodels.

**Tableno 2** :EstimationParametersofStochasticFrontierProductionFunctionofEstimationResultwith MLE Method

| **Variables** | **Parameters** | **Estimation Value** | **Standard Deviation** | **t-ratio** |
|---|---|---|---|---|
| (Constant) | $\beta_0$ | 3,721 | 0,9711 | **3,832** |
| Landarea($X_1$) | $\beta_1$ | 0,462 | 0,2120 | **2,179** |
| Seed($X_2$) | $\beta_2$ | 0,706 | 0,2748 | **2,569** |
| UreaFertilizer($X_3$) | $B_3$ | 0,092 | 0,0581 | **1,583** |
| SP-36Fertilizer($X_4$) | $B_4$ | 0,169 | 0,5299 | **0,319** |
| KCl Fertilizer($X_5$) | $B_5$ | 0,085 | 0,0429 | **1,981** |
| Pesticide($X_6$) | $B_6$ | -0,507 | 0,7919 | **0,640** |
| Labor ($X_7$) | $B_7$ | 0,023 | 0,1235 | **0,186** |
| Dummy(X-8) | **$B_8$** | **0,042** | **0,5284** | **0,079** |

Notes :*significantatα=5%

Thefactorsthatsignificantlyinfluencedtowardsthefrontierproductionoffarmerrespondents found that production factors of land, seed and KCL fertilizer are equal to theaverageproductionfunctionthatobtained.Thisillustratesthattheaverageproductionfunctionoffarmerrespondentsh adapproachedthelimitsoftheproductionfunction.Productionfactorsofureafertilizer,SP-36fertilizerandpesticidesontheaverageproduction function found not effected on the production farmer respondents, apparently inthe stochastic frontier production function of these factors are also still not affect to thefrontier production of Alabio yam plant farmers. The estimation parameters on the Cobb-Douglas average production function indicates the elasticity value of average productionfromtheinputsused.Thesamethingappliesinthestochasticfrontierproductionfunctionofthe Cobb-Douglas.TheestimationparametersinthestochasticfrontierCobb-Douglasproductionfunctionindicatestheelasticityvaluesof frontier productionfrom inputsused.

Estimation results in Table 2 indicate that the elasticity of frontier production fromfactors production of land area is 0,462. This number is found significantly different fromzero at α = 5%. This number is found greater than the production elasticity of land area attheaverageproductionfunction,whichis0.215.Thissuggeststhattheuseoflandareamore elastic on stochastic frontier production function compared to the average productionfunction.Theadditionoflandareaby10%willincreasethefrontierproductionofAlabioyamfarmersslightlyl argerthantheincreaseofitsaverageproduction,wheretheadditionof land area of 10% will increase the additional frontier production of respondent farmers of2.15%atthecondition oftheotherinputsarefixed.

Elasticity of frontier production of seedlings obtained 0.706 and significantly different atsignificancelevelα=5%.Thisnumberisfoundtobegreaterthantheproductionelasticityof seed on the average production function, which is 0.336 and significantly different fromzero at α = 5%. This suggests that the use of seeds is more elastic in the stochastic frontierproduction function compared to the average production function. Increasing the number ofseeds by 10% will increase the frontier production of Alabio yam farmers greater than theincreaseofitsaverageproduction,whichincreasethenumberofseedsby10%willincrease the additional frontier production of respondent farmers of 3.36% with the otherinputs arefixed.

Frontier production elasticity of KCL fertilizer obtained values of 0.085 and significantlydifferentat 5%significance level.This suggests that the use ofKCL fertilizers is moreelastic on stochastic frontier production function compared to the average production. Theaddition amount of 10% KCL fertilizer will increase the production of Alabio yam farmersgreater than the increase of its average production, where the addition of 10% KCL fertilizerwill only increase the additional of frontier production of respondent farmers of 0.54%, at thecondition of the other inputs are fixed. According to researches, KCL fertilizer is moreresponsiveabsorbedbyAlabio yam,becauseitfunctionstoenlargethetuber.

Productionfactorsofland,seedandKCLfertilizerfoundsignificantlyinfluencedtowards the frontier production of respondents farmers, whereas production factors of ureafertilizer, SP-36 fertilizer and pesticide found not significantly affect. This illustrates that interms of land area, seed, and KCL fertilizer that used, farmers still have opportunity to get ahigherfrontierproductionwiththe wayofaddingthese threefactors.

Based on frontier production function coefficients can be determined the level of totalproductivity / technical efficiency (TER) were measured by comparing the actual productionachieved farmers with potential production that can be achieved, namely the productionestimation of the frontier production function. These TER values as proxy managementfactoronAlabioyamfarminginswampland.ThehighertheTERvaluecanbeaccomplished by farmer, the better management that conducted by these farmer on theirfarming in combining the production factors. The maximum TER value that can be achievedby a farmer is one, which is the production achieved equal to maximum production potentialthatestimatedwithfrontierproductionfunctions.

Thecalculationresultsofthetechnicalefficiencylevelofeachsamplingfarmer;apparently the average TER values achieved at 0.8520 with the highest TER value of0.9797, and the lowest of 0.6615 indicates that most farmers relatively can achieve the two-thirds of TER maximum value. The efficiency number of 85.20 % gives the meaning that theaveragefarmercanachieveatleast85.20%ofproductionfromthepotentialproductionthat acquired from production inputs combination that used. This means also that there arestill opportunities of 14.80 percent to increase Alabio yam production in the research area.Although not many comparative researches, the level of technical efficiency achieved byfarmers' nowadays in swampland, North Hulu Sungai Regency was relatively high. For landscale described by dummy variable, there is no significant difference. This means that thetechnical efficiency level of farmers who organize both large scale and small scale are notdifferentthe levelsofefficiency.

**The Opportunity of AlabioYamfor Food Reserves**

Alabio yam is a potential source of carbohydrates that can be used as an alternativefood to reduce the rice consumption which continues to increase. In addition as a staplefood, Alabio yam is also potentially be used as a home industry (small) material to largeindustries.

**Table no 3**:comparison of components (%) between WhiteAlabioYam and RedAlabioYam

| Components(%) | WhiteAlabioYam | RedAlabioYam |
|---|---|---|
| **Water** | 77.55 | 83.16 |
| **Starch** | 11.30 | 11.07 |
| **Protein** | 2.71 | 1.57 |
| **Fiber** | 1.36 | 1.44 |
| **Total Sugar** | 2.80 | 4.48 |

OneofthealternativestotheAlabioyamdailyconsumptionisprocessintoshreddedyam. Shredded yam in a semi-finished product, dried flake with approximately 10%moisture content, so it can be retained. The utilization is easy, watered enough with hotwater, stir, and then steamed about 15 minutes until soft. Shredded can be consumedwith vegetables and side dish, or mixed with sugar solution. Shredded yam can also bemixedwithegg,flour,andsugarthenfriedorsteamedbackaccordingtothetaste.Alabioyam flour also can be used as well as other flour, which is a basic ingredient for cake /breadandnoodles.Toimprovethenutritionalvaluecanbemixedwithwheatflourorthenuts flour according to the type of cake that will be created or taste. Flour is made bygrindingthedriedmaterialthensieved.Flourmoisturecontentofabout10%andcanberetained for six months in plastic packaging. As the material industry, Alabio yam havepotentialasrawmaterialstarchindustry,alcoholanddrugsmaterials,suchasthetypeofredAlabioyamcanbeus edforthemanufactureoficecream.

Usually, the people in the North Hulu Sungai Regency as a local wisdom, consume theAlabio yam by steaming / boiling, and frying. There is also process into a kind of food-stylepizza, called the "*lempeng*". Tubers that have round-shaped and branched, it has red /purple or white colors. As material, the composition of Alabio yam is sufficient. Aside frombeing a source of carbohydrates, also contains starch, protein, and, even sugar. In order tohave more added value, it is time to process Alabio yam into various processed productswhich more varied, interest appearance and according to the taste of community and alsoable to become household food reserves, because it can be stored for 6 months as long aslocatedin adryplace.

## IV. Conclusion

a. The calculation results of the technical efficiency level of each sampling farmer, apparently the average TER values achieved at 0.8520 with the highest TER value of 0.9797 and the lowest of 0.6615, which can indicate the majority of farmers is relative able to achieve two-thirds of TER maximum value. Efficiency number of 85.20 % gives the meaning that the average farmer can achieve at least 85.20 % of the production potential acquired from the combination of inputs production that used. It also means, there are still opportunities of 14.80 % to increase the Alabio yam production in the research area.

b. All the variable of production factors are positive except pesticides production factors. Variable of production factor of land and seeds have the highest elasticity value. This means that the production factors of these two has the greatest influence on the production of Alabio yam.

c. There is no differences in terms of management of the production factors use between Alabio yam farmers who organize the large areas and small areas.

d. As food material, the composition of Alabio yam is sufficient. Aside from being a source of carbohydrates, it also contains starch, protein, and, even sugar. In order to have more added value, it is time to process Alabio yam into various processed products which more varied, interest appearance and according to the taste of the community and able to become household food reserves, because it can be stored for 6 months as long as the products are located in a dry place.

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