PRODUCTIVITY AND PRODUCTIVITY RISK OF POTATO FARMING IN BANJARNEGARA REGENCY

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ABSTRAK

Penelitian bertujuan untuk mengetahui produktivitas dan risiko produktivitas kentang varietas Granola dan Atlantic per musim tanam serta faktor-faktor apa yang mempengaruhi. Penelitian dilakukan di Wilayah Kabupaten Banjarnegara di tiga kecamatan yaitu Batur, Pejawaran dan Wanayasa. Dari jumlah *sampling frame* sebanyak 270 petani diperoleh sampel petani sebanyak 151 orang. Analisis yang digunakan dalam penelitian ini dengan uji beda rata-rata, uji beda varian dan uji beda nyata terkecil.

Hasil penelitian menunjukkan produktivitas kentang varietas Granola tidak berbeda dengan varietas Atlantic pada semua musim tanam. Faktor-faktor yang berpengaruh terhadap peningkatan produktivitas adalah jumlah tenaga kerja, benih, pupuk phonska, fungisida, dan insektisida. Tingkat serangan hama penyakit berpengaruh menurunkan produktivitas kentang. Risiko produktivitas kentang varietas Atlantic lebih besar dibanding varietas Granola. Faktor yang bersifat menurunkan risiko produktivitas (*risk reducing*) adalah jumlah pupuk organik, fungisida dan insektisida. Sedangkan tingkat kemiringan lahan bersifat meningkatkan risiko produktivitas (*risk inducing*).

Kata kunci : produktivitas, risiko produktivitas, usahatani kentang.

INTRODUCTION

Potato (*Solanum tuberosum*) is one of the horticulture products as alternative food after the rice and corn needed by people for foodstuff. There are some benefits of potatoes, i.e., (1) an alternative for food diversification with high value of nutrition; (2) a crop which give an income for the farmers; (3) a non-fuel commodity export; (4) raw materials for food industry and fast food (Foragri, 2009).

Every farm activity is posed with risks and uncertainties which farmers can hardly control. The climate problems like a long drought, uncertain climate, unpredicted pest disease attacks, and natural disaster are aspects of the risk and uncertainties (Soekartawi, 2002). Hardaker *et al.* (1997); Debertin (1986); Cassavant and Infanger (1984) argued that the risk is an imperfect knowledge in which the probability result is impossible to find out, and uncertainty occurs as the probability is not known well.

To quantify the risks, there are three kinds of perspectives on risks (Roumasset, 1979) that are: (1) risk as one of the measures on the probable results dispersion, for example as a variant; (2) risk as a probability which results in a certain decision; and (3) risk of how much an individual should pay to avoid the risk he or she does not prefer.

After 1980s, new varieties of potatoes had been introduced in Indonesia, such as Granola and Atlantic (Worldplant, 2010). Banjarnegara is center for the potatoes production of Granola and Atlantic variety. The Granola has been planting by farmers in this area since 1985, while the Atlantic was introduced in this area in 2006. There are three centers of potato production in this regent as in districts of Batur, Pejawaran, and Wanayasa (BPS Kabupaten Banjarnegara, 2009).

Research objectives are measuring the productivity potato of Granola and Atlantic varieties, determining productivity risk potato of Granola and Atlantic varieties and influencing factors to productivity dan productivity risk.

Hipothesis are (1) that the productivity of Atlantic variety is higher than that of Granola variety; (2) that the farm size, the number of labors, the number of organic fertilizer, the number of seeds, the number of phonska fertilizer, the number of fungicides, the number of insecticides, the seeds origin (certified), the farm patter (independence), and terracing technology (permanent) positively influences to the potato productivity. Meanwhile, the level of pest disease attack, the sloping level of the land, and the potato variety (Granola) has a negative effect to the productivity of potato; (3) that the productivity risks of the Atlantic variety are bigger than the Granola variety; (4) that the factors which influence negatively to the productivity risks are farm size, the number of labors, the number of organic fertilizer, the number of seeds, the number of phonska fertilizer, the number of fungicides, the number of insecticides, the potato variety (Granola), the seed origin (certified), the farm pattern (independence), and terracing technology (permanent). Meanwhile, the level of pest disease attack and the sloping level of the land have a positive effect to the productivity risk.

THEORETICAL FRAMEWORK

1. Production and Risks

Doll and Orazem (1984) stated that production function reflects a combination of production factors employed to create the corresponding product. The function of production can be formulated mathematically as follows:

$Y = f(X_1, X_2, X_3, \ldots\ldots X_n \mid X_k)$ .... (1)

In which: Y is production, X_1 - X_n is production variables, and X_k is a constant factor of production.

A production function often used in an analysis is a Cobb Douglas production function (Yotopoulus and Nugent, 1976; Nicholson, 1998). In a mathematic formulation, the Cobb Douglas production function can be stated like below:

$Y = AX_1^{b1} X_2^{b2} .....X_i^{bi} e^n$ .... (2)

To ease the estimation, the Cobb Douglas production function should be modified into a natural algorithm as follows:

$ln\ Y = ln\ A + {}_{b1}lnX_1 + {}_{b2}lnX_2 ..... + {}_{bi}lnX_i$ ... (3)

To find out the parameter value or regression coefficient, it is done an ordinary least square (OLS) method (Gujarati, 1997).

To calculate the number of production risks in the farm of potatoes of Granola and Atlantic varieties a formula proposed by Moscardi and de Janvry (1977); Anderson and Griffiths (1982); Olarinde *et. al.* (2007) can be applied as:

θ *Or* $V(Y) = \delta_Y / \mu_Y$ .... (4)

In which: θ or $V(Y)$ = variant coefficient of production, δ_Y = standard deviation of production and μ_Y = an average production.

2. Function of Risked-Production

Stocastic production function which considering the risk is still limited. Just and Pope (Roumasset, 1976) explains that theoretically and empirically, the function of stocastic production is formulated into three stands, those are:

$q = F_1 (X) = f (x)e^{\varepsilon} \quad E (\varepsilon) = 0$ ..... (5)

$q = F_2 (X) = f (x)\varepsilon \quad E (\varepsilon) = 1$ ..... (6)

$q = F_3 (X) = f (x) + \varepsilon \quad E (\varepsilon) = 0$ ..... (7)

These three equations have not considered the risk variable sufficiently. The equation (7) is the best production function for a modification to suffice the risk criterion. Furthermore, Just and Pope (Roumasset, 1976) modify the distracting variable (ε) to be a risk function $h(X)_{\varepsilon.}$ Then, they add the function to the production function used to estimate. Through a modified function, it can be found out a relation between the input and its expected output, and the relation of the input and production risk as well. The modified equation is:

$q = F_3 (X) = f(x) + h(X)\varepsilon$ .... (8)

An estimation of production risk function $h(X)_{\varepsilon}$ can be taken by regressing σ^2_i to the X variable. Since σ^2_i is unknown, Just and Pope (Roumasset, 1976) suggests using a residual (μ_i) as an approach. The analysis procedure, then, is as follows: first estimate the production function, using a method of *non linier square* (NLS) then a value of μ_i will be found out, where $\mu_i = h(X_i)\varepsilon$, then regress μ^2 to $h^2(X)\sigma$ or ln μ^2 terhadap ½ $lnh^2 (X)\sigma$, next estimate function of production risk using an approach of minimizing the sum of square .

To find out the factors influencing production risks, an estimation model used, according to Anderson and Griffiths (1982), is as follows:

$$V(Y) = \beta_0 \prod_{i=1}^{k} Xi^{\beta i} \text{ .... (9)}$$

Where $V(Y)$ is production risks, Xi is the influencing factors, β_0 is a constant and β_i am a regression coefficient.

RESEARCH METHOD

The basic method applied in this research is a descriptive analysis method. The location of the research was purposively chosen in the region of Banjarnegara regency, since the regency is one of the production centers of potatoes of Granola and Atlantic varieties in Central Java. Then three districts were selected purposively, i.e. Batur, Pejawaran and Wanayasa as the production center of the potatoes.

Among the farmers in the districts, the sampling frame is used to screen the relevant samples, by selecting the farmers who cultivate the two varieties of potatoes in the recent year (three cropping seasons). This gave 110 farmers (Batur), 68 (Pejawaran) and 92 farmers (Wanayasa). Among the 270 farmers selected based on the sampling frame, they were then refined using the Slovin formula in Consuelo (1993). It resulted in 151 farmers. Each district was sampled proportionally, by taking 60% of the whole population.

The data types collected in the study are primary and secondary data. The data were collected through observation, and interview using questionnaire.

1.Analysis of Productivity and Productivity Risks

a. It is assumed that the productivity of potatoes of Atlantic variety is higher than the Granola variety

To test the hypothesis, t test is used:

$$t_{hitung} = \frac{\mu_{YA} - \mu_{YG}}{\sqrt{(S_A^2/n_A + S_G^2/n_G)}} \text{.......(10)}$$

The hypothesis formula is:

$Ho : \mu_{YA} \leq \mu_{YG}$ It means the productivity of Atlantic variety is lower or same as that of Granola variety.

$Ha : \mu_{YA} > \mu_{YG}$ It means the productivity of Atlantic variety is higher than that of Granola variety.

b. To find out the factors influencing the potatoes productivity, the Cobb Douglas production function is used, and the estimation model:

$$Y = \beta_0\, L\_TANAM^{\beta 1}\, TK^{\beta 2}\, P\_ORG^{\beta 3}\, BENIH^{\beta 4}\, P\_PHONS^{\beta 5}\, FUNGI^{\beta 6}\, INSEK^{\beta 7}\, SRNG\_HPT^{\beta 8}\, KMR\_LHN^{\beta 9}\, D\_VAR^{\delta 1}$$

$D\_ASBNH^{\delta 2}\ D\_POLUT^{\delta 3}\ D\_TTERAS^{\delta 4}$ ....(11)

In ln, it can be formulated as follows:

$$\ln Y = \ln \beta_0 + \beta_1 \ln L\_TANAM + \beta_2 \ln TK + \beta_3 \ln P\_ORG + \beta_4 \ln BENIH + \beta_5 \ln P\_PHONS + \beta_6 \ln FUNGI + \beta_7 \ln INSEK + \beta_8 \ln SRNG\_HPT + \beta_9 KMR\_LHN + \delta_1 D\_VAR + \delta_2 D\_ASBNH + \delta_3 D\_POLUT + \delta_4 D\_TTERAS + \varepsilon_1 \text{ .... (12)}$$

The hypothesis of the model is:

$H_0 : \beta_i = 0$ It means that there is no effect of i[tch] independent variable to the dependent variable (potato productivity).

$H_a : \beta_i \neq 0$ It means that there is an effect of i[tch] independent variable to the dependent variable (potato productivity).

c. To calculate the productivity risks, according to Moscardi and de Janvry (1977); Olarinde *et al.* (2007), it is used the following formula:

$$\theta \text{ atau } V(Y) = \delta_Y / \mu_Y \text{ .... (13)}$$

To examine the hypothesis saying that the productivity risks of Atlantic variety are more than that of Granola variety, it is used a difference analysis of two variances using *F-test* method (Sumodiningrat, 1996); (Snedecor and Cochran, 1973):

$$F_{hitung} = \sigma^2_{YA} / \sigma^2_{YG} \text{ .... (14)}$$

$$\sigma^2 = \Sigma y^2/n. \text{ ....(15)}$$

$$y = Y - \bar{Y} \text{ .... (16)}$$

The hypothesis formula is:

$Ho : \sigma^2_{YA} \leq \sigma^2_{YG}$ It means that productivity risk of Atlantic variety is less than or same as the productivity risks of Granola variety.

$Ha : \sigma^2_{YA} > \sigma^2_{YG}$ It means that productivity risk of Atlantic variety is more than that of Granola variety

d. To find out the factors influencing the risk productivity, the estimation for function of productivity risk is as follows:

$$V(Y) \text{ or } u\varepsilon_1^2 = \beta_0\ L\_TANAM^{\beta 1}\ TK^{\beta 2}\ P\_ORG^{\beta 3}\ BENIH^{\beta 4}\ P\_PHONS^{\beta 5}\ FUNGI^{\beta 6}\ INSEK^{\beta 7}\ SRNG\_HPT^{\beta 8}\ KMR\_LHN^{\beta 9}\ D\_VAR^{\delta 1}\ D\_ASBNH^{\delta 2}\ D\_POLUT^{\delta 3}\ D\_TTERAS^{\delta 4} \text{ .... (17)}$$

In ln, the formula can be stated as follows:

$$\varepsilon_1^2 = \ln \beta_0 + \beta_1 \ln L\_TANAM + \beta_2 \ln TK + \beta_3 \ln P\_ORG + \beta_4 \ln BENIH + \beta_5 \ln P\_PHONS + \beta_6 \ln FUNGI + \beta_7 \ln INSEK + \beta_8 \ln SRNG\_HPT + \beta_9 KMR\_LHN + \delta_1 D\_VAR + \delta_2 D\_ASBNH +$$

$\delta_3 D\_POLUT + \delta_4 D\_TTERAS + \varepsilon_2$ ....(18)

The hypothesis of the model above is:

$H_0 : \beta_i = 0$ It means that there is no effect of i[tch] independent variable to the dependent variable (productivity risk).

$H_a : \beta_i \neq 0$ It means that there is an effect of i[tch] independent variable to the dependent variable (productivity risk).

FINDINGS AND DISCUSSION

1. The Productivity and the Influencing Factors.

The productivity of potatoes between the varieties of Atlantic and Granola is not different in all cropping season, i.e. in a range of 14.284,65-15.497,12 kgs / hectare. The total productivity of the varieties in the second cropping season (dry season) tends to be higher than other seasons, third season (dry-rainy season), and first cropping season (rainy season).

Table 1. Mean Difference t test Potato of Productivity Average Granola and Atlantic Varieties

Potato Class	Productivity Average (kg/ha)		t test
	Granola (N=96)	Atlantic (N=55)	
Season I (Rainy Season)			
- ABC Class	12.379,85	12.929,29	-1,690**
- Seed Class	1.431,74	1.254,92	$1,219^{ns}$
- Rindil Class	473,06	421,60	$0,695^{ns}$
- Total	14.284,65	14.605,81	$-0,826^{ns}$
Season II (Dry Season)			
- ABC Class	13.058,32	13.460,30	$-1,071^{ns}$
- Seed Class	1.674,39	1.361,19	2,220**
- Rindil Class	760,49	675,63	$0,757^{ns}$
- Total	15.493,20	15.497,12	$-0,009^{ns}$
Season III (Dry-Rainy Season)			
- ABC Class	12.397,67	12.761,28	$-0,818^{ns}$
- Seed Class	1.670,52	1.518,00	$1,085^{ns}$
- Rindil Class	733,46	716,47	$0,182^{ns}$
- Total	14.801,65	14.995,75	$-0,366^{ns}$
Third Season (One Year)			
- ABC Class	12.611,95	13.050,29	$-1,193^{ns}$
- Seed Class	1.592,22	1.378,04	1,508*
- Rindil Class	655,67	604,57	$0,545^{ns}$
- Total	14.859,83	15.032,89	$-0,403^{ns}$

Source: Analysis of Primary Data, 2012

The factors influencing the increase of potato productivity are number of labor, number of seeds, number of phonska fertilizer, that of fungicides, and of insecticides. Meanwhile the level of pest disease attack decreases the productivity. The certified seed has a higher productivity, compared to the uncertified, local variant. It means the certified seed influences to increase the technical efficience.

Table 2. Factors Influencing Potato Productivity

Variable	Expected sign	Unstandardized Coefficients		Standardized Coefficients	t	Sig
		B	Std. Error	Beta		
Season I (Rainy Season)						
Constant	+/-	5,654***	0,767		7,372	0,000
TK	+	0,223***	0,053	0,305	4,195	0,000
P_ORG	+	-4,61E-03ns	0,023	-0,013	-0,199	0,843
BENIH	+	0,303***	0,086	0,235	3,519	0,001
P_PHONS	+	6,389E-02*	0,035	0,127	1,840	0,068
FUNGI	+	9,000E-02**	0,044	0,154	2,052	0,042
INSEK	+	-2,18E-02ns	0,025	-0,062	-0,878	0,381
SRNG_HPT	-	-0,222**	0,087	-0,171	-2,541	0,012
KMR_LHN	-	-4,83E-04ns	0,021	-0,001	-0,023	0,981
D_VAR	-	-3,42E-03ns	0,028	-0,010	-0,122	0,903
D_ASBNH	+	0,103***	0,023	0,270	4,395	0,000
D_POLUT	+	-9,70E-03ns	0,033	-0,026	-0,297	0,767
D_TTERAS	+	3,795-03ns	0,026	0,009	0,146	0,884
R^2		0,598				
F-statistic		15,704***				0,000
Season II (Dry Season)						
Constant	+/-	7,397***	0,736		10,049	0,000
TK	+	0,220***	0,050	0,375	4,387	0,000
P_ORG	+	-7,37E-03ns	0,029	-0,018	-0,252	0,802
BENIH	+	9,796E-02ns	0,090	0,077	1,094	0,276
P_PHONS	+	4,71E-02ns	0,040	0,086	1,169	0,244
FUNGI	+	-3,89E-03ns	0,039	-0,008	-0,099	0,921
INSEK	+	6,243E-02*	0,035	0,138	1,798	0,074
SRNG_HPT	-	-0,168***	0,063	-0,194	-2,691	0,008
KMR_LHN	-	-2,65E-03ns	0,021	-0,008	-0,124	0,901
D_VAR	-	7,012E-04ns	0,029	0,002	0,024	0,981
D_ASBNH	+	6,337E-02**	0,025	0,172	2,555	0,012
D_POLUT	+	-1,84E-02ns	0,033	-0,050	-0,553	0,581
D_TTERAS	+	-3,48E-02ns	0,027	-0,081	-1,267	0,207
R^2		0,540				
F-statistic		12,354***				0,000
Season III (Dry-Rainy Season)						
Constant	+/-	3,322***	0,964		3,447	0,001
TK	+	0,418***	0,090	0,230	4,652	0,001
P_ORG	+	2,627E-02ns	0,039	0,048	0,678	0,499
BENIH	+	0,381***	0,108	0,393	3,511	0,000
P_PHONS	+	6,864E-02ns	0,046	0,128	1,495	0,137
FUNGI	+	-2,62E-02ns	0,051	-0,046	-0,518	0,605
INSEK	+	8,335E-02**	0,033	0,204	2,552	0,012

SRNG_HPT	-	-0,103^{ns}	0,087	-0,086	-1,176	0,241
KMR_LHN	-	2,833E-02^{ns}	0,025	0,068	1,114	0,267
D_VAR	-	3,373E-03^{ns}	0,035	0,009	0,097	0,923
D_ASBNH	+	5,490E-02*	0,031	0,106	1,743	0,083
D_POLUT	+	-3,73E-02^{ns}	0,039	-0,085	-0,947	0,345
D_TTERAS	+	-2,63E-02^{ns}	0,027	-0,051	-0,830	0,408
R^2		0,561				
F-statistic		13,789***				0,000
Third Season (One Year)						
Constant	+/-	5,690^{ns}	0,470		12,118	0,000
TK	+	0,253***	0,035	0,333	7,295	0,000
P_ORG	+	-5,16E-03^{ns}	0,017	-0,012	-0,308	0,758
BENIH	+	0,250***	0,055	0,177	4,545	0,000
P_PHONS	+	7,21E-02***	0,023	0,134	3,142	0,002
FUNGI	+	4,023E-02^{ns}	0,025	0,073	1,636	0,103
INSEK	+	4,142E-02**	0,017	0,102	2,428	0,016
SRNG_HPT	-	-0,150***	0,045	-0,211	-3,377	0,001
KMR_LHN	-	3,976E-03^{ns}	0,013	0,011	0,301	0,764
D_VAR	-	1,539E-02^{ns}	0,018	0,040	0,810	0,418
D_ASBNH	+	6,59E-02***	0,015	0,162	4,494	0,000
D_POLUT	+	-1,72E-02^{ns}	0,021	-0,042	-0,835	0,404
D_TTERAS	+	-2,09E-02^{ns}	0,017	-0,044	-1,252	0,212
D_MT1	+/-	-6,04E-02***	0,014	-0,164	-4,336	0,000
D_MT2	+/-	5,39E-02**	0,022	0,147	2,402	0,017
R^2		0,542				
F-statistic		34,513***				0,000

Source: Analysis of Primary Data, 2012

Note:

L_TANAM	=	farm size (ha)
TK	=	labors (HKO/ha)
P_ORG	=	organic fetilizer (kg/ha)
BENIH	=	seeds (kg/ha)
P_PHONS	=	phonska feritilizer (kg/ha)
FUNGI	=	fungicides (kg/ha)
INSEK	=	insecticides (lt/ha)
SRNG_HPT	=	pest disease attact (percen)
KMR_LHN	=	the sloping level of the land (derajat)
D_VAR	=	dummy of the potato variety, D= 1 Granola D=0 Atlantic
D_ASBNH	=	dummy of the seed origin, D=1 certified D=0 uncertified
D_POLUT	=	dummy of the farm pattern D=1 independence D=0 dependence
D_TTERAS	=	dummy of the terracing technology D=1 permanent D=0 not permanent
D_MT1	=	dummy of season 1, D=1 MT I (rainy season) D=0 others
D_MT2	=	dummy of season 2, D=1 MT II (dry season) D=0 others

In general, the number of labor, of seeds, and of phonska fertilizer applied in the field have not been efficient. It needs more to apply. However, the use of fungicide and insecticide is not efficient, so it needs to reduce.

2. The Productivity Risk and the Influencing Factors

Productivity risk of Atlantic variety is higher than that Granola variety in all cropping season. The result of difference test of the variance in all cropping season indicates that the productivity of Atlantic variety is higher than Granola variety, meaning that the Atlantic has more productivity risk than the Granola. The productivity risk of potatoes in the third season (dry-rainy season) for the varieties is higher than the first (rainy) and second (dry season).

Table 3. Difference Varian Test (Risk) Potato Productivity Risk Granola and Atlantic Varieties.

Season	Varian of Productivity		Ftest	Ftable 1%
	Granola (N=96)	Atlantic (N=55)		
Season I (Rainy Season)	4.339.373	6.924.915	1,59***	1,48
Season II (Dry Season)	4.781.126	8.853.720	1,85***	
Season III (Dry-Rainy Season)	6.251.642	12.413.083	1,98***	
Third Season (One Year)	5.124.047	9.397.239	1,81***	

Source: Analysis of Primary Data, 2012

The factors reducing productivity risk (*risk reducing*) are the number of organic fertilizer, the number of fungicide and of insecticide. Meanwhile, the sloping level of the land increases the productivity risk (*risk inducing*).

Table 4. Factors Influencing Potato Productivity Risk.

Variable	Expected Sign	Coefficient	Std. Error	t-Statistic	Prob.
Season I (Rainy Season)					
C	+/-	-5,404224^{ns}	16,67735	-0,324046	0,7464
TK	-	1,642431^{ns}	1,091609	1,504596	0,1347
P_ORG	-	-1,364656***	0,497904	-2,740804	0,0069
BENIH	-	-0,529726^{ns}	1,864208	-0,284156	0,7767
P_PHONS	-	0,050968^{ns}	0,717406	0,071045	0,9435
FUNGI	-	-1,455783**	0,608033	-2,394252	0,0180
INSEK	-	0,145116^{ns}	0,537189	0,270140	0,7875
SRNG_HPT	+	0,587977^{ns}	1,904173	0,308783	0,7580
KMR_LHN	+	0,758344*	0,450686	1,682644	0,0947
D_VAR	-	-0,841953*	0,436417	-1,929239	0,0702
D_ASBNH	-	-0,008628^{ns}	0,497074	-0,017357	0,9862
D_POLUT	-	-0,315157^{ns}	0,710256	-0,443724	0,6579
D_TTERAS	-	-0,767065^{ns}	0,565091	-1,357419	0,1769
R^2		0,266348			
F-statistic		2,202863**			0,017521
Season II (Dry Season)					
C	+/-	3,319807^{ns}	15,88915	0,208936	0,8348
TK	-	1,159269^{ns}	0,981321	1,181334	0,2395
P_ORG	-	-1,151220*	0,641774	-1,793809	0,0750
BENIH	-	-1,185226^{ns}	1,927036	-0,615051	0,5395
P_PHONS	-	0,003767^{ns}	0,860813	0,004376	0,9965
FUNGI	-	-0,039991^{ns}	0,855244	-0,046759	0,9628

INSEK	-	0,551415^{ns}	0,760197	0,725359	0,4695
SRNG_HPT	+	0,809464^{ns}	1,370309	0,590716	0,5557
KMR_LHN	+	-0,120660^{ns}	0,450777	-0,267670	0,7894
D_VAR	-	-0,743671*	0,492963	-1,508574	0,0784
D_ASBNH	-	-0,080624^{ns}	0,518978	-0,155352	0,8768
D_POLUT	-	0,574733^{ns}	0,727413	0,790106	0,4308
D_TTERAS	-	-0,382980^{ns}	0,601064	-0,637171	0,5251
R^2		0,185570			
F-statistic		1,076138*			0,084863
Season III (Dry-Rainy Season)					
C	+/-	9,401216^{ns}	17,00469	0,552860	0,5812
TK	-	-0,240937^{ns}	1,415268	-0,170241	0,8651
P_ORG	-	-1,628856**	0,704556	-2,311891	0,0222
BENIH	-	-0,468494^{ns}	1,961430	-0,238853	0,8116
P_PHONS	-	0,517520^{ns}	0,828307	0,624792	0,5331
FUNGI	-	-0,987609^{ns}	0,882932	-1,118557	0,2652
INSEK	-	-1,206496**	0,594072	-2,030894	0,0441
SRNG_HPT	+	1,888041^{ns}	1,593617	1,184752	0,2381
KMR_LHN	+	-0,216684^{ns}	0,433655	-0,499668	0,6181
D_VAR	-	-0,717259*	0,508136	-1,411549	0,0870
D_ASBNH	-	0,141788^{ns}	0,494863	0,286520	0,7749
D_POLUT	-	-0,660734^{ns}	0,716968	-0,921567	0,3583
D_TTERAS	-	-0,491773^{ns}	0,573128	-0,858050	0,3923
R^2		0,240088			
F-statistic		1,754407*			0,056267
Third Season (One Year)					
C	+/-	0,125869^{ns}	0,092839	1,355776	0,1759
TK	-	0,020478^{ns}	0,069280	0,295585	0,4983
P_ORG	-	-0,009632***	0,003338	-2,885292	0,0041
BENIH	-	-0,022884^{ns}	0,109008	-0,209942	0,6432
P_PHONS	-	-0,004631^{ns}	0,004535	-1,021106	0,3078
FUNGI	-	-0,007991^{ns}	0,005018	-1,592541	0,1120
INSEK	-	-0,018396***	0,003436	-5,354402	0,0000
SRNG_HPT	+	0,008200^{ns}	0,008883	0,923128	0,3565
KMR_LHN	+	-0,001107^{ns}	0,002623	-0,422024	0,6732
D_VAR	-	-0,007060*	0,003596	-1,963542	0,0502
D_ASBNH	-	0,005429^{ns}	0,029280	0,185383	0,6644
D_POLUT	-	0,001639^{ns}	0,004096	0,400079	0,6893
D_TTERAS	-	-0,003737^{ns}	0,003316	-1,127105	0,2603
D_MT1	+/-	-0,038033***	0,002780	-13,67953	0,0000
D_MT2	+/-	-0,057650***	0,004490	-12,81974	0,0000
R^2		0,260125			
F-statistic		5,554353***			0,0000

Source: Analysis of Primary Data, 2012

Note:

L_TANAM	=	farm size (ha)
TK	=	labors (HKO/ha)
P_ORG	=	organic fetilizer (kg/ha)
BENIH	=	seeds (kg/ha)
P_PHONS	=	phonska feritilizer (kg/ha)
FUNGI	=	fungicides (kg/ha)
INSEK	=	insecticides (lt/ha)
SRNG_HPT	=	pest disease attact (percen)
KMR_LHN	=	the sloping level of the land (derajat)

D_VAR	=	dummy of the potato variety, D= 1 Granola D=0 Atlantic
D_ASBNH	=	dummy of the seed origin, D=1 certified D=0 uncertified
D_POLUT	=	dummy of the farm pattern D=1 independence D=0 dependence
D_TTERAS	=	dummy of the terracing technology D=1 permanent D=0 not permanent
D_MT1	=	dummy of season 1, D=1 MT I (rainy season) D=0 others
D_MT2	=	dummy of season 2, D=1 MT II (dry season) D=0 others

CONCLUSION AND ITS POLICY IMPLICATION

1. Conclusion

1. The productivity of potatoes of Granola variety is not different from that of Atlantic variety in all cropping season. The productivity of both varieties is highest at the second cropping season II (dry season).
2. The factors influencing the increase of productivity are number of labor, seeds, phonska fertilizer, fungicides, and insecticides. The level of pest disease attack reduces the potato productivity. The certified seed has higher productivity than the uncertified seed (local). The use of labor, the seeds and the phonska fertilizer has not been efficient so that it needs to be added. Meanwhile, the number of fungicides and insecticides applied is not efficient, meaning it needs to be reduced. The certified seed influences to increase the technical efficience.
3. The productivity risk of Atlantic variety potato is higher than that of Granola variety. The productivity risk of both varieties is highest the third cropping session (dry-rainy).
4. The factor reducing the productivity risks (risk reducing) are the number of organic fertilizer, of fungicide and of insecticide. Meanwhile the sloping degree induces the productivity risk (risk inducing).

2. Policy Implication

The finding shows that the certified seed give productivity than the uncertified seed (local). The farmers there rely on the production of certified seed of Potato Seed Center (Balai Benih Kentang) Kledung-Temanggung. The data of the center shows that their production only covers 50-60 percents of the potato farmers's need in the (Banjarnegara and Wonosobo). The limited number of certified seed has induced a higher cost, especially in the beginning of cropping season. The cost is more for the Atlantic variety. Many farmers then turn to the local variant which is the result of breeding made by the breeding farmer group in Grogol village, Pejawaran district and another in Sumberejo village of Batur district. Therefore, it needs to increase the production capacity of the certified seed in the center of Kledung-Temanggung. This will satify the demand of certified seed in a lower cost and the farmer will minimize to plant the local variant.

The application of fungicide and insecticide induces the potato productivity, but their overuse in a high frequency is not efficient and inflicts a health effect among the farmers and can danger the environment. Thus, the farmers need a professional explanation from the pest disease control officer (PPHP, Petugas Pengamat Hama Penyakit), the field supervisor for farmers (PPLP, Petugas Penyuluh Lapangan Pertanian) and the supervisor of agricultural labor (PPLTHL, Petugas Penyuluh Lapangan Tenaga Harian Lepas). Then, farmers are expected to control the pest disease by considering the economic limit to decrease the frequency and the dosage of the fungicide and insecticide applied. This will decrease the cost, and avoid the bad health effect to farmers and to the environment. It also needs to suggest the use of organic fungicide and insecticide by showing an authentic model to prove that the organic pesticide is saver for human and more friendly to the environment.

In the third cropping season (dry-rainy) of August/September-December/January, it shows higher productivity risk, compared to the first season (rainy) of December/January-March/April and the second cropping season (dry) of April/May-July/August. To reduce the risk, the farmers need a special insurance of agriculture, cultivate the seed with high quality in higher quantity as the back up for the died plants, do a regular watering and pest contol. This needs to be considered since at the beginning of cropping season, they have a dry season, but as the plants grow, it changes into a rainy season, bringing a highly potential pest attack.

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