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ECONOMIC ANALYSIS OF POTATO SEED IN WEST JAVA, INDONESIA

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ABSTRACT
The purpose of this study was to study the supply of potato seed in West Java, Indonesia. The research respondent is farmers who use seed, with a sample of 377 farmers and a survey of all seed breeders totaling 43 farmers, using proportionate stratified random sampling. This research report is also complemented by a review analysis of potato seedling development in the last five years. There is considerable interest in the potential that can be developed, productive aged farmers, and adoption of new technologies. Factors exerting a strong influence include capital, technology, adequacy of seed, the proportion of certified seed, and farm credit. Factors identified as influencing the level of demand include the proportion of certified seed, seed prices, capital, and credit allocation for potato farming; at the level of supply factors that can exert influence are the availability of seed, the selling price of seed, and the capital of breeding farmers. Policy simulation on the use of certified seed potatoes shows that increase in the number of specific farm credits, the price of seed and fixed farm capital results in increased use of certified seed and reduced self-selection of seed.

Contribution/Originality: This study contributes to the existing literature by studing the supply of potato seed in West Java, Indonesia.

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1. INTRODUCTION
Potato (Solanum tuberosum) is among the commodities given the highest priority in vegetable development programs because it is a source of carbohydrates in supporting food diversification programs and non-oil export commodities, and as a raw material for processing industries. Although potatoes are not a staple food, consumer numbers tend to increase because the population of Indonesia is increasing, the community's standard of living increases, and numbers of foreign tourists living in Indonesia increase (Soelarso, 1997). This can be interpreted as a business opportunity for both domestic and export needs (Setiadi & Nurulhuda, 1994).

Efforts to increase production per unit of land area have traditionally been carried out in various ways, including plant row spacing. Pavek, Holden, and Spear (2018) reported in their research results that the maximum yields of potato crops do not necessarily produce maximum profits. That study aimed to identify the row width that produces the highest economic return from seven potato varieties over several years when grown in the Columbia Basin near Othello, Washington, USA. Specific objectives were to understand the effects of row width on potato tuber yield, quality, size, number of tubers per plant, and economic returns, and to demonstrate how inputs and land use

efficiencies can be improved by increasing production on a given area of land without increasing the use of fertilizers and seed-treatment pesticides. The results are illustrated in Figure 1.

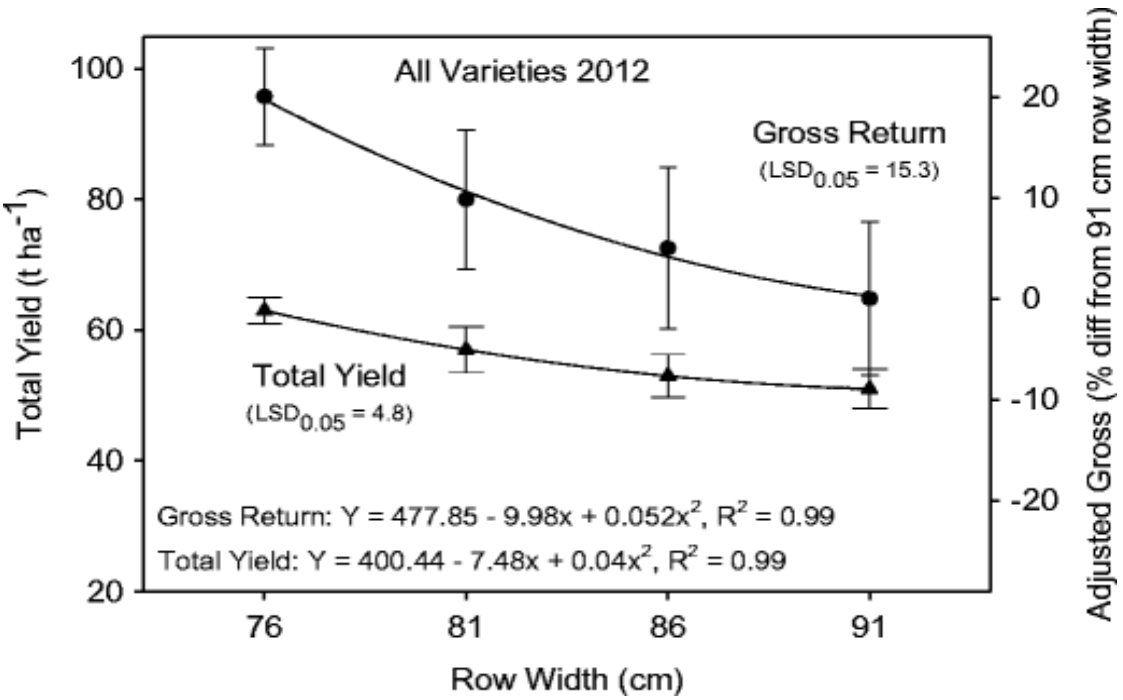

Figure-1. Total yields and economic benefits of potato row spacing (Pavek et al., 2018).

The effect of row width {76, 81, 86, 91 cm (30, 32, 34, 36 in)} averaged across four varieties (Alturas, Ranger Russet, Russet Burbank, and Umatilla Russet) was assessed during 2012 on total yield and adjusted gross return. Circles and triangles represent average gross returns and total yield values, respectively, for each row width treatment. P <0.05 for correlation coefficients. Error bars placed on each mean represent standard error. LSD 0.05 values are shown in parentheses. In-row spacing was 25.4 cm. Frasetya, Harisman, Sudrajat, and Subandi (2019) experimented with rice plants and found that planting space width will impact rice productivity because it affects the plant's sunlight capture and nutrients and water. uptake

Subandi and Firmansyah (2018) found that field cultivation may depend on environmental, meteorological, or seasonal conditions and requires a considerable workforce to obtain a good yield and optimal profit. UNECE (The United Nations Economic Commission for Europe) (2015) stated that to harvest a plentiful and healthy yield of seed potatoes for international trading, producers have to plant seed potatoes of the highest quality. The standard sets common terminology and minimum requirements for certifying high-quality seed potatoes for international trade. It covers varietal identity and purity; genealogy and traceability; diseases and pests affecting commercial quality or yield; external tuber quality and physiology; sizing and labeling; and restriction of chemical pesticide use. To minimize chemical usage, even in the protection of plants from pests and diseases, the biological means of crop protection is of importance; as stated by Subandi and Setiati (2017) biological pest control will avoid environmental contamination by chemical pesticides, will be more efficient and sustainable, and is not harmful ecologically.

Another technique used is in regard to fertilization and traditional methods, shown to be possible as reported by Ali and Barbara (2018). The technique of foliar fertilization (Basfoliar Extra 36, per 400 dm of water on 1 hectare) had a significant effect on the commercial yield of both total and seed potato tubers.

To date, the supply of potato seed is largely dependent on both imported and local seeds, even though the productivity of potato plants is still likely to be increased (Bachrein, Bram, Ana, Djoko, & Sukmaya, 1997).

Irrigation and regulation of growth media are other ways in which potato seed production can be increased, as reported by Wawan, Sumadi, and Hamdani (2018). Certain interactions between the composition of growing media and watering intervals can influence the percentage of tuberization established by stolon and tuber weight per plant. Irrigation is not usually employed in potato cultivation, but water and land conservation measures should be incorporated for sustainable yield and to avoid degradation. Subandi, Abdel Wahab, and Taufikurrahman (2019) found there are no conservation measures of uneducated or better said irresponsible people or bad governments or false administration made the cultivated land neglected and at last degraded.

To ensure the success of potato cultivation at the farm level, seed production is very important. Margaret, Maliro, Demo, and Njoloma (2012) show that the production of potato seeds under conventional systems has not been effective in avoiding or reducing pathogen build-up and has consequently led to reduction in the quality of potato seed and low crop yields.

Potato seed is propagated from vegetative structures called "seed potatoes" rather than true seeds harvested from floral structures. True potato seeds are tiny, rare, difficult to mature, and are used as breeding material to develop new varieties. Potato crops can be established using certified seed potatoes purchased locally from nurseries, home improvement centers, catalogs, or at home (Peffley, 2018). Potato is a tuberous crop, with different ways of

breeding utilized to improve production. Subandi, Eri, and Arie (2018) discuss improving the production (fruiting) of dragon fruit by manual crossing.

To address various problems and existing conditions, it was necessary to conduct a study to obtain answers and solutions to the above problems. This study examines the economics of potato seed at the level of breeder farmers, seed institutions, and farmers using potato seeds, and it was expected that this research would identify the factors that influence the demand and supply of potato seed so that eventually it is expected that a demand model and the availability of potato seed in West Java can be established.

Table 1 shows that West Java Province is the leading producer of potatoes in Indonesia. The topography, climate, and soil conditions are conducive for potato growth and development in this province. Many regions or districts are suitable for potato culture, including Lembang, Pangalengan, Cipanas, and Garut.

Table-1. Potato production (tons) by province (2015–2019).

No.	Province	Year					Growth (2019 vs 2018, %)
		2015	2016	2017	2018	2019	
1.	Aceh	70,047	63,022	47,960	14,842	26,529	78.74
2.	Sumatera Utara/North Sumatra	106,452	91,400	98,893	108,016	118,778	9.96
3.	Sumatera Barat/West Sumatra	60,064	50,583	40,398	40,209	50,730	26.17
4.	Jambi	113,051	91,081	82,252	89,308	111,812	25.20
5.	Sumatera Selatan/South Sumatra	381	675	324	1,029	672	−34.67
6.	Bengkulu	14,956	7,341	6,226	6,640	4,093	−38.36
7.	Lampung	464	362	336	608	297	−51.18
8.	Jawa Barat/West Java	259,228	288,368	277,187	265,536	245,418	−7.58
9.	Jawa Tengah/Central Java	278,552	272,978	269,476	290,665	294,015	1.16
10.	Jawa Timur/East Java	212,173	227,996	241,180	312,966	320,209	2.31
11.	Bali	1,953	672	424	136	208	53.39
12.	Nusa Tenggara Barat/West Nusa Tenggara	3,412	7,734	1,804	1,528	1,503	−1.60
13.	Nusa Tenggara Timur/East Nusa Tenggara	193	697	827	697	530	−23.99
14.	Sulawesi Tengah/Central Sulawesi	972	568	1,943	1,450	1,294	−10.73
15.	Sulawesi Selatan/South Sulawesi	29,522	48,895	31,831	54,016	50,629	−6.27
16.	Sulawesi Barat/West Sulawesi	25	137	30	331	289	−12.69
17.	Maluku	7	33	1	1	1	66.67
18.	Papua Barat/West Papua	13,075	599	33	114	18	−84.21
19.	Papua	7	42	41	27	71	159.12
Indonesia (total)		1,219,270	1,213,038	1,164,738	1,284,760	1,314,657	2.33

Notes: Table includes the 20 highest-yielding provinces out of the 34 provinces of Indonesia.
Source: Indonesian Centre Institute for Statistics (2019).

Certain predictable factors influence the demand and supply of seeds, including the fulfillment of potato seed requirements being dependent on imported seeds at prices five to six times that of home-grown potatoes, or on supplies from certified seed breeders at prices three times that of home-grown potatoes. Most still self-select seeds by setting aside a portion of production to be made into seed without the proper seed certification procedure, so the results are less than satisfactory.

Because the purpose of this study was to analyze markets related to meeting certified potato seed requirements, we utilized a model of policy simulation that describes the demand and supply of potato seed in West Java: identifying the factors that influence the level of demand for farmers' seed, certified seed supply levels (G4) and the level of demand for imported seeds, forming a model of demand and supply for certified potato seed, then simulating an intervention policy for the procurement of certified potato seed.

The purpose of the research was to identify the market characteristics of certified potato seed, in an effort to understand the demand and supply of this seed so that intervention can be carried out to help farmers, breeders, and

officials at the Potato Seed Institution in meeting the requirement for quality potato seed, and as input for producers' decision making in regard to developing policies to improve the seed agribusiness.

The assessment of the economics of certified potato seed that was carried out generally examined problems relating to productivity, efficiency, cost, application of production factors, seed quality, and the distribution system so that research explaining the economic aspects of supply and demand for seed might be able to answer questions on the economics of certified potato seed. This case study of the economic aspect of certified potato seed production, conducted in Pangalengan District, Bandung Regency, West Java, is also expected to contribute theoretically to the economic development of certified potato seed and new insights helping decision makers improve production.

The seed economy is part of agricultural economics, which can be defined either as a science that studies and analyzes agriculture economically or as economics applied to agriculture (Agricultural Service Office of West Java, 2003). The term "seed" covers all forms of plant material from generative and vegetative processes, including cuttings, grafts, tubers, and others (Sjamsoe'oed, 1997).

Seed certification is the process of awarding plant seed certificates after the stages of inspection, testing, and supervision have been performed, and where the results meet all the requirements for distribution/marketing for farming (Hendarto, 1996). On the other hand, the certifying body, in this case, UPTD BPSBTPH (2002) (Technical Implementing Unit of the Office of Food Crops and Horticulture Seed Supervision and Certification), must have benchmarks and standard monitoring methods for each type of plant seed.

In addition, several factors that are predicted to affect the level of demand for certified potato seed must be examined, in addition to other factors thought to influence the supply of seed. Further study is needed of imported potato seed and its relationship to planting area, seed import regulations, and the ratio of imported potato prices to those of home-grown potatoes.

2. RESEARCH METHODS

This research is a descriptive verification and review analysis. Descriptive research was conducted to obtain an overview of breeders' socioeconomic situation, farmers and users of potato seed and seed production institutions in Pangalengan, Bandung Regency, West Java. Simultaneously, verification was aimed at determining the interdependent relationship between variables thought to affect the demand and supply levels of certified potato seed in Pangalengan. The survey data were collected between 1995 and 2004 and included the latest developments in potato seed production as of 2019. Through a hypothesis test formulated using statistical calculations, a review of the analysis was conducted on the development of potato seed in this region over the preceding five years.

Analyses were done using Microsoft Office XP Excel 2003 software. Percentage analysis was conducted to determine the number of farmers included and the level of capital derived from both agricultural and nonagricultural income. This analysis was also used to classify the quality and quantity of potato seed used by farmers. In processing and identifying data, factor analysis and regression analysis were both used. Factor analysis determines new variables – factors less than the number of original variables. In contrast, regression analysis consists of two kinds of test: (1) the F-test statistic, to collectively test independent variables, and (2) the t-test statistic, to test individual variables. The model can be formulated using linear regression with the following equation:

$$Y = \beta_0 + \beta_1 Xd_1 + \beta_2 Xd_2 + \cdots + \beta_7 Xd_7 + \epsilon$$

where, Y = D = demand (seed) per hectare.
Xd1 = proportion of certified seeds; Xd2 = seed price (Rp.); Xd3 = credit allocation (millions).
Xd4 = farmers' capital; Xd5 = seed technology; Xd6 = adequacy of seed.
Xd7 = farm interests and prospects; ϵ = disturbance error.

3. RESULTS AND DISCUSSION

3.1. Capital Availability and Purchasing Power of Potato Seed Farmers

The results of analysis of all aspects and characteristics of potato farming and seed potato cultivation and usage in West Java are as follows, categorized into three major factors. Factor 1: components include six variables: agricultural income relative to capital, user farmer technology, potato farming experience, interest in cultivation, and prospects for potato sales, farmer education level. Factor 2 contains four variables: off-farm income relative to capital, seed quality, seed adequacy, and level of land availability. Factor 3 comprises two variables: seed source variable and ease of obtaining seed.

Factor 1, with a contribution of 40.275%, is the factor of farm capital.

Factor 2, with a contribution of 16.568%, is a factor in farming technology.

Factor 3, with a contribution of 10.963%, is the seed adequacy factor.

A breakdown of the allocation of income from agricultural and nonagricultural activity in regard to seed capital for potato seed farmers is presented in Table 2. Based on the respondents interviewed in this study, most were classified under moderate (39.8%) followed by very high (38.2%). For medium- and high-cost capital categories (30–59%) of 55.7%, it is expected that a sufficiently large allocation of capital from both agricultural and nonagricultural income could further increase these potato seeds. This was not supported by the allocation of adequate credit assistance for farmers. From interviews it was found that >97% of farmers received low to very low credit assistance, so better support for these potato farmers is needed.

Table-2. Allocation of income from agricultural and nonagricultural activity regarding seed capital.

Classification	%	Agricultural income		Nonagricultural income	
		Number of farmers	%	Number of farmers	%
Very low	<14	–	–	1	0.3
Low	15–29	60	15.9	163	43.2
Medium	30–44	150	39.8	49	13.
High	45–59	23	6.1	161	42.7
Very high	>60	144	38.2	3	0.8
Total	–	377	100	377	100

Notes: Percentages represent total respondents.

3.2. Quantity and Quality of Potato Seed Produced by Farmers

Experienced farmers generally manage their farms more efficiently, including the allocation of inputs in seed sources and capture technology. Farmers in this group tend to predict the possibility of attack by plant pest organisms associated with the season, cropping system, and the use of production facilities, varieties, and other inputs.

Based on the respondents interviewed in this study, most (98.2%) were classified as either medium or high. Only a small proportion of farmers had very high or low capture technology. From the research, it was found that most farmers (42.2%) used self-selected seed followed by those using imported seed (23.3%), those using seed obtained from traders, and lastly seed breeders (2.9%), according to the Seed Research Institution. From this research, it can be seen that the use of certified potato seed is not widespread. On the other hand, farmers still considered both the quantity and quality of potato seed and classified it as medium (82%) for quantity and 50.4% for quality, while 49.3% of respondents considered the quality of the seed used to be high (see Table 3).

Table-3. Quantity and quality of potato seed.

Classification	Quantity		Quality	
	Number	%	Number	%
Very low	–	–	–	–
Low	1	0.3	1	0.3
Medium	309	82.0	190	50.4
High	67	17.8	186	49.3
Very high	–	-	–	–
Total	377	100	377	100

Based on the respondents interviewed in this study, most farmers thought that the ease of obtaining seed was either medium or high (53.1%), and only 19.9% stated that it was easy to obtain certified seed while 27.1% stated that it was difficult.

Thus, the demand factors for potato seed at the user level are determined by farming capital, farming technology, and seed sufficiency. Based on these factors, a potato seed demand model was formulated using linear regression.

Based on the output analysis, a factor equation model was formed according to significant F-values (6296.719) and R2 (0.992), which means that 99.2% of changes in demand for certified potato seed are caused by changes in demand variables while other factors cause the remainder, and DW (1.851) does not occur auto correlation, this determines the demand for potato seed by the user farmer.

For the area of product development considered over the period 1993–2004, the production level of potato plants in West Java Province was shown to fluctuate.

The highest potato crop production in West Java Province was achieved in 2017 (288,368 tons), but in 2019 this had decreased to 245,418 tons. The dynamics of potato crop production in West Java Province are shown in Table 1.

3.3. Potato Seed Supply

The initial assumption is that there are as many as 14 variables (components) affecting the supply of seed potato for breeder farmers: the availability of seeds (Xs1), a guarantee of current factors of production (Xs2), a guarantee of factors of production (Xs3), capital allocation for procurement of Saprotan (Xs4)), capital allocation for product facility construction (Xs5), capital or credit assistance (Xs6), capital allocation for selling production (Xs7), self-owned capital (Xs8), technological capability for preharvest management (Xs9), technological capability for postharvest management (Xs10), training frequency (Xs11), training effectiveness (Xs12), frequency of counseling (Xs13), and the effectiveness of counseling (Xs14).

The supply of potato seed begins from the first producer – that is, breeders in the field of research at the Research Centre for Horticultural Crops, where potato seed is produced. Breeder seed level means that the seed is further produced for distribution to farmers Table 4.

Table-4. Results of variable test and the 14 components in the supply of potato seed at breeder level.

Component	Initial Eigenvalue			Extraction sums of squared loadings			Rotation sums of squared loadings		
	Total	% of variance	Cumulative (%)	Total	% of variance	Cumulative (%)	Total	% of variance	Cumulative (%)
1	3.611	25.793	25.793	3.611	25.793	25.793	2.906	20.760	20.760
2	2.511	17.936	43.729	2.511	17.936	43.729	2.613	18.662	39.422
3	2.012	14.374	58.103	2.012	14.374	58.103	2.467	17.624	57.046
4	1.185	8.465	66.568	1.185	8.465	66.568	1.333	9.522	66.568
5	1.074	7.674	74.242						
6	0.763	5.452	79.694						
7	0.656	4.686	84.380						
8	0.582	4.155	88.535						
9	0.495	3.534	92.069						
10	0.339	2.422	94.491						
11	0.293	2.095	96.586						
12	0.223	1.596	98.183						
13	0.176	1.255	99.437						
14	0.079	0.563	100,000						

Extraction method: Principal component analysis.
Source: Compiled from survey data, 2004.

Factor 1 comprises five variables: agricultural means of production capital allocation, capital allocation of production facilities, self-owned capital allocation, capability of preharvest technology, and effectiveness of training. Factor 2 comprises three variables: guarantee of production factors (to date), frequency of counseling, and effectiveness of counseling. Factor 3 comprises four variables: capital allocation from profit, postharvest technology, training frequency, and capital/credit allocation. Factor 4 comprises two variables: seed availability and production factors (current).

Based on determinant variables, the four factors are described thus:

Factor 1, with a contribution of 25.793%, is a factor of farm capital.

Factor 2, with a contribution of 17.936%, is a factor of production.

Factor 3, with a contribution of 14.375%, is a training–counseling factor.

Factor 4, with a contribution of 8.465%, is the availability of seed.

Thus, the supply of seed potatoes at the breeder level is determined by capital, production, training–counseling, and seed availability. Based on the analysis of these factors, a potato seed supply model was formulated using linear regression with the following results: the dynamics of the development of potato seed productivity in West Java Province in the period 1995–2004 shows that productivity of potato seed cultivated by breeders and seed halls fluctuates. The highest productivity was achieved by G2 seeds in 2001 (>20 tons/ha), while G3 potato seeds reached 18 tons/ha.

From the regression analysis of potato seed supply to the breeder, farmers were allocated factors determining the estimated supply level of certified seed to breeder farmers; then, a factor equation model was formed by significant values of F (82,850) and R2 (0.943).

3.4. Potato Seed Imports

Results are based on the model set out in the research methodology; three factors are expected to affect the supply of imported potato seed: the ratio of imported seed prices to that of home-grown, the area of potato plants farmed in the country, and the import policies that apply. Based on these factors, the potato supply seed supply model was formulated using linear regression.

The final results of multiple regression analysis of imported potato seed supply models were used to predict the magnitude of the response for imported potato seed supply resulting from changes in crop area, import prices, and regulatory restrictions on imported potato seed. An equation model was created from the data given above following significant F-value (6,739) and R2 value (0.771).

3.5. Simulation Model of Supply And Demand for Certified Potato Seed

Elasticity was estimated to create a new equation by transforming the equation from the cross-section into a time series equation, then linearizing it with the time series variable. To determine the elasticity level of the demand and supply functions of certified potato seed, a regression analysis of the demand and supply functions was made by changing the quantitative data occurring in the form of logarithms; the resulting elasticity values are presented as logarithmic functions in Table 5 and Table 6.

Table-5. Logarithmic functions of requests for certified potato seed.

Variable	F	t	Description
Log Xd1	0.032	3.340	Proportion of certified seed
Log Xd2	−0.035	−2.125	Seed price
Log Xd3	0.193	17.727	Loan allocation
Log Xd4	0.850	61.122	Farmer capital

Notes: F = 3,520.243; R2 = 0.980; n = 293; Sig F = 0.000.

Table-6. Logarithmic functions of certified potato seed offered.

Variable	F	t	Price
Log Xs3	0.801	16.072	Selling
Log Xs4	0.296	1.091	Farmer capital
Notes: F =147	n = 43	R2 = 0.880	Sig F = 0.000

To determine the level of demand and supply of certified potato seed – for example, through analyses such as those simulated using Microsoft Office XP Excel 2003 software – it can be calculated through the estimation of time series data in the form of seed proportion, seed price, credit allocation, farmer capital, farming capital breeders, planting area, import prices and import regulations; an equation model can then be created to analyze the simulation of demand and supply of certified potato seed by entering the determining variables.

High-quality seed is sought by farmers; Grace, Edriss, Maonga, and Dzanja (2018) stated, "The main results showed that the quantity harvested was positive and significantly affected farmers choosing improved varieties." Kyomugisha, Christopher, and Johnny (2018) stated that the added value applied to potatoes at the farm yielded higher economic benefits to farmers. Added value would earn a farmer 25% more than when no added value was applied. Seed quality is affected by the presence of or absence from pest disorders. Thomas-Sharma et al. (2016) mentioned that seed potato degeneration, the reduction in yield or quality caused by an accumulation of pathogens and pests in planting material due to successive cycles of vegetative propagation, is a long-standing production challenge for potato growers around the world.

3.6. Potato Seed Demand Prospects

Based on the respondents interviewed, most thought that the prospects of selling potato seed were either good (60.2%) or moderate (39%), while those who considered the prospects low comprised only 0.8%. This shows that the sale of potato seed appears to have good prospects.

Farmers adopt certified seed technology if they believe the differences in yield and income are indeed high, and any new technique must provide optimism in regard to achieving significant additional yield/increase in yield or a marked reduction in costs before it will be accepted by most farmers (Mosher, 1986). A report from the Agricultural Service Office of West Java (2003) stated that the average national productivity of potatoes is 15 tons/ha while the average productivity of research is 35 tons/ha. This report reveals a wide productivity gap, 20 tons/ha (57.1%).

From a comparative analysis of potato farming using several seed sources, it can be seen that if farmers who choose their potato seed with a productivity of 15 tons/ha obtain a net income of Rp. 7.95 million/ha and B/C ratio of 0.36, farmers using imported potato seed with relatively higher seed prices providing productivity of 30 tons/ha would have a net income of Rp. 24.8 million/ha and B/C ratio of 0.49, while farmers choosing certified potato seed at a cost greater than that of imported seed but providing the same productivity of 30 tons/ha would obtain a net income and a B/C ratio of Rp. 43 million/ha and 1.34, respectively.

In regard to West Java specifically, if farmers choose their seed, potatoes would net an annual income of Rp. 612.52 billion while farmers who choose imported seed would get Rp. 1.3 trillion more per year. In contrast, if all farmers used certified seed, domestic seed production would generate an extra Rp. 1.5 trillion in annual revenue. Supposing all farmers using their selected seed got the lowest returns and used imported seed, they would get lower yields from using certified seed because the cost of importing seed becomes greater than that incurred for domestic seed certification.

This improved allocation of seed-specific credit will facilitate potato farmers in regard to accessing seed sources, technology, markets, agricultural means of production, and other production facilities. Provision of this specific credit must be made in the form of binding credit that can be used only to purchase certified potato seed because, if the loan is given in the form of money, that would be used for external purchase of certified seed, showing that the main factor constraining farmers in procuring certified potato seed is limited funds, even though they already know that using certified seed will increase production.

4. CONCLUSIONS AND RECOMMENDATIONS

4.1. Conclusions

Factors that have proven influence on the level of demand for certified potato seed include the proportion of certified seed, seed prices, capital owned by farmers, and credit allocation for potato farming. At the level of supply of certified potato seed, influencing factors include its availability, selling price, and the capital level in breeder farming. Policy simulation on the use of certified potato seed shows that increasing the level of specific farm credit will result in an increase in the use of certified locally produced seed and, at the same time, reduction in the use of self-selected and imported seed.

4.2. Recommendations

Suggestions that can be offered from the results of this study are: (1) the government must adopt a policy to increase the allocation of financing through capital assistance for farmers and facilitate their access to capital sources in the form of specific credit for certified potato seed. (2) Enhancement of the efficiency of potato farming could be achieved through provision of specific credit for certified potato seed so that farmers can be more efficient in using Saprotan and production facilities, resulting in enhanced production and income. (3) Through the provision of specific credit for certified potato seed, farmers will further optimize the utilization of widely available natural resources so that these efforts can increase land productivity without damaging the ecological balance. (4) To increase the use of certified potato seed, the government (through various related agencies) must undertake thorough planning by providing seed sources, improving seed technology, managing potato planting quotas, and assisting in the development of horticultural commodities prepared in a participatory manner involving farmer users, breeders, seed institutions, and seed traders. (5) Although the contribution of the results of this study to the development of agricultural social economics has given new insights into the provision of specific credit for certified potato seed, it still requires improvement and so it is advisable to conduct further research with more in-depth scrutiny in regard to both data collection and a statistical model approach.

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