

Factors Influencing a Potato Farmer's Choice of Seed Supplier: Empirical Evidence from The Philippines¹.

Executive Summary

As a production input, the demand for seed potatoes is derived from the demand for fresh and processed potatoes. However, in the absence of a formal seed certification system, a Filipino potato farmer's decision to purchase seed tubers will evoke considerable risk. When a farmer perceives that the decision to purchase is important and where the consequences of making a poor decision are likely to have an adverse long-term impact on the operation of the farm, farmers may attempt to reduce the risk of purchasing by splitting orders between several alternative suppliers, to purchase from well known reputable suppliers, or to purchase from those suppliers with whom they have dealt in the past. Empirical evidence collected from comprehensive personal interviews with potato farmers in The Philippines suggests that the seed supplier's reputation is the most important factor influencing a potato farmer's choice of seed supplier. The seed supplier's reputation is a measure not only of the seed supplier's credibility (customer base and financial strength), but also a measure of the extent to which the seed supplier is able to satisfy the farmer's demand for seed which is competitively priced and of the desired physiological age. Because of the long-term impact seed quality has, not only on the current crop, but on the productivity of any future crops derived from that seed, seed quality is evaluated by two variables including freedom from pests and diseases and seed size. Since these two factors were considered important by all potato farmers, in choosing between alternative seed suppliers, the seed supplier's offer quality, the level of technical support and the extent to which the seed supplier facilitated communication between the parties, became the key determinants. Cluster analysis revealed three quite distinct clusters of farmers, differing in the extent to which they favored different components of the seed supplier's offer, the area of potatoes cultivated, the number of crops for which they retained the seed and the level of education the farmer had attained. Contrary to expectations, the more educated farmers were more demanding of advice and technical support. Since this group of farmers were considered more likely to appreciate superior quality seed and be prepared to pay for it, they were considered the most likely target market for imported seed.

Key words: seed, potatoes, supplier selection criteria, The Philippines.

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Abstract

Empirical evidence collected from comprehensive personal interviews with potato farmers in The Philippines reveals five factors that best explain a farmer's choice of seed supplier. Seed quality and the seed supplier's reputation are the two most important factors. Given the high cost of seed and the impact seed quality has not only on the current crop but any future potato crops derived from that seed, such is not unexpected. Results suggest that by providing technical support, enhancing offer quality and facilitating regular communication, it is possible for a proximal seed supplier to differentiate their product offer from alternative suppliers. Fortuitously, such investments are most appreciated by the larger potato farmers.

Introduction

Potato production in The Philippines is increasing. Population growth and urbanization has expanded the market for food crops and rising per capita incomes have stimulated the demand for more exotic foods to diversify diets (Horton 1987). As a production input, the demand for seed potatoes is derived from the demand for fresh and processed potatoes (Vrolijk 1994). However, unlike most other food crops, the potato is propagated vegetatively, for potatoes are highly heterozygous and varietal purity cannot be maintained from botanical seed.

Because potatoes are vegetatively propagated, with each successive crop, the productivity of the seed generally decreases, due to the accumulation of disease. Generally, those plants which become infected produce infected tubers which, when re-planted, provide infected plants and a potential source of infection for other plants (Beukema and van der Zaag 1990). Consequently, no aspect of growing potatoes is more important than the selection of the best possible planting material, for the yields obtained from different stocks of the same variety under the same conditions of culture, depends more upon the quality of the planting material than on any other single factor (Balaoing and Lazo 1967). Seed tuber quality not only directly influences the crop, but it may also have an impact on the productivity of any future crops derived from that seed or grown in the same soil (Beukema and van der Zaag 1990). At planting time, the seed should be sufficiently mature that emergence will take place quickly; the seed should be free of pests and diseases that could spread during the growing season and destroy the crop or contaminate soils that have otherwise been free from infestation; and, to encourage a more uniform crop, the seed should not contain a mix of varieties and seed size should not vary greatly (van der Zaag 1987; van der Zaag 1990, Rasco 1994).

Throughout the majority of the developed world, potato farmers purchase seed tubers from recognized seed growers or seed merchants. In most instances, the seed has been produced under a certified seed program where seed tubers are guaranteed to be of the desired variety and, within established tolerance

limits, to be substantially free of pests and diseases (Crissman 1990). In North America, over 85% of the ware potato crops are grown from certified seed. In Europe, this figure approaches 70%, but in Asia, less than 5% of the potatoes cultivated are grown from certified seed (van der Zaag 1991). Despite many previous attempts to introduce and implement formal seed certification systems in Asia, for a number of agro-ecological and technical reasons, the majority of national potato programs have failed to significantly improve either the quality or the quantity of seed tubers available to farmers (Schmiediche 1995). Consequently, the farmer must either produce his own seed or purchase seed from other farmers, the ware market, seed merchants or seed importers.

In the absence of a formal seed certification system, unless the farmer has made the effort to visit the seed producer and to inspect the crop before harvest, seed quality can only be evaluated by its external features. Unfortunately, a disease infected tuber is often indistinguishable from a healthy tuber. Furthermore, there is no guarantee that the seed will be of the desired physiological age and that it will emerge quickly and uniformly (Crissman and Hibon 1996). Consequently, in The Philippines, a farmer's decision to purchase seed tubers will evoke considerable risk for the majority of small potato farmers.

Supplier selection criteria.

Where there is no difficulty in accurately specifying the exact nature of the input and there are several reliable suppliers in the market, then a buyer can choose that supplier who offers the lowest price among all those who fulfill the functional requirements (Hakansson, Johanson and Wootz 1977). However, when the decision to purchase is important and evokes considerable risk, buyers may, amongst other strategies, attempt to reduce the risk of purchasing by either splitting orders between several alternative suppliers or to purchase from well known suppliers with whom they have dealt in the past (Cunningham and White 1973, Shapiro and Bonoma 1984). Cardozo and Cagley (1971) and Puto, Patton and King (1985) demonstrate that organizational buyers are strongly attracted to well known or existing suppliers, for current suppliers are perceived as being less risky.

In the farm input market, farmers often attempt to simplify the purchasing task and to reduce perceived risk by purchasing inputs successively from the same supplier(s) (Kool 1994). Such a purchasing strategy may be pursued for a number of reasons including; (i) limited time in which to make the decision to purchase; (ii) inadequate time to critically judge and to evaluate technological developments and improvements, because, over time, farmers may come to rely upon input suppliers for expertise and advice; and, (iii) the convenience of not having to make a choice on every occasion that the farmer makes a decision to purchase.

Where the transaction occurs frequently and there is little perceived risk, farmers are unlikely to evaluate alternative suppliers every time they purchase (Kool 1994). Such goods are generally purchased by ordering the desired amount of product from the preferred supplier. Conversely, for more infrequently purchased goods, there is often some degree of information search and evaluation of the alternatives, especially where the product is perceived to be important.

Product importance is the perceived significance of the purchasing decision in terms of the size of the purchase and/or the potential impact of the purchase on farm operations. Product importance refers to the perceived consequences of making the wrong decision (McQuiston 1989). Conceptually, product importance is comprised of three aspects including financial importance, relevance to the end product and relevance to the continuation of the production process on the farm (Kool, Meulenberg and de Broens 1997). Not unexpectedly, product importance will determine the amount of time a farmer allocates to the purchasing decision; the more important the decision, the greater the amount of time invested and the greater the number of people consulted in making the decision to purchase (Moriarty and Spekman 1984; McQuiston 1989).

Furthermore, the less experience the farmer has in making the decision to purchase an input, the more unfamiliar the purchasing task will be (Kool 1994). Purchase complexity is the perceived lack of information relevant to the decision to purchase a particular product or input (McQuiston 1989, Bunn 1993). Increased purchase complexity leads to greater uncertainty which, in turn, leads to higher levels of perceived risk. Farmers may reduce risk by either embarking upon a more extensive search for information (McQuiston 1989), or to purchase from well known, preferred suppliers (Anderson, Chu and Weitz 1987).

Irrespective, a farmer's purchasing behavior is assumed to be purposively directed towards the achievement of rational economic goals, where the emphasis of the farmer's buying behavior is towards finding least cost solutions which best satisfy functional criteria (Kool 1994). Quality, price and the ability to deliver are regarded as the most important criteria by which most organizational buyers evaluate potential suppliers (Cunningham and White 1973; Lehmann and O'Shaughnessy 1974; Dempsey 1978). However, a farmer's decision to buy seed may also be expressed in rational economic terms such as value-for-money (Kool, Meulenberg and de Broens 1997) or value-in-use (Hutt and Speh 1995). Seed which is substantially free of pathogens will cost more to produce and therefore it will cost more to purchase (Monares 1981). However, improved seed is generally more productive.

Horton (1987) suggests that because of the potential variation between different seed sizes, varieties, the physiological age of the seed and the health of the seed tubers, seed sales are highly dependent on customized marketing programs. Furthermore, because of the nature of the relationship often established between seed potato suppliers and farmers (Crissman 1989), processing companies and input suppliers (Higginbottom 1996), relationships between potato farmers and market intermediaries may influence an individual farmer's decision to purchase seed. In this respect, the farmer's decision to purchase seed may be influenced by the long standing relationships that have been established between buyers and sellers.

Gronroos (1995) defines relationship marketing as the means of establishing, maintaining and enhancing relationships with customers and other partners, at a profit, so that the objectives of both parties involved in the relationship are met. A firm must not only attract customers, but it must also build relationships with the customer. Through making capital investments, providing technical advice,

improving supply logistics and a host of other elements, the relationship becomes both more attractive and more profitable. Christopher, Payne and Ballantyne (1991) view relationship marketing a primarily a concept which adds customer service and quality to the traditional marketing mix. However, the meaning of the term service varies with the nature of the product and the requirements of the buying organization (Hutt and Speh 1995). Service may include such variables as reliable delivery, technical assistance, innovations and adaptations, credit arrangements, support for special needs and advance notice of impending price changes or shortages in supply.

Leenders and Fearon (1993) suggest that a preferred supplier should provide the quality specified, deliver on time, at an acceptable price and react to unforeseen needs. Preferred suppliers take the initiative of suggesting better ways to service customers and attempt to find new ways of developing products and services which will allow customers to perform their operations more economically.

However, in oligopolistic markets, the final determinants in supplier selection may be made from those moderately important variables which become more significant in situations where alternative suppliers offer standardised marketing mixes (Dempsey 1978). Supplier attributes such as reputation, financial position, communication and attitude toward the buyer may become decisive criteria when suppliers have equalled one another in quality, delivery, price and service capabilities. Lehmann and O'Shaughnessy (1974) indicate that when the purchase decision necessitates a large capital outlay, the supplier's reputation may become an important decision variable. The supplier's reputation may be used to distinguish between those suppliers with whom the buyer will interact and those who will no longer be considered. Jackson (1985) suggests that buyers feel more at risk when they purchase from less well known suppliers.

Most buyers prefer to purchase from local sources (Hakansson and Wootz 1975). Local suppliers are generally less expensive and offer more dependable service than those located at a distance. Delivery may be more prompt because the distance is shorter and there is less likelihood of transport delays (Leenders and Fearon 1993). Balaoing and Lazo (1967), report that the high cost of imported seed tubers, their untimely arrival, availability for only part of the year, inappropriate varieties and the inappropriate physiological age of the seed on arrival have presented problems for Filipino potato farmers in the past.

Based on the extent literature, this paper seeks to identify how influential some 35 supplier performance attributes were in a potato farmer's choice of seed supplier and to identify any underlying correlations between these attributes which might help explain the farmer's decision to purchase.

Methodology.

During January to July, 1999, 235 potato farmers in the highland mid-elevation areas of Benguet and Mountain Province in Northern Luzon (The Philippines) were asked to respond to a comprehensive survey instrument which sought to obtain information on the potato production system, the factors influencing the demand for seed, the factors influencing the farmer's choice of seed supplier and the

nature of the farmer's long-term relationship with their most preferred seed supplier. This paper discusses the farmer's responses to 35 item measures which sought to determine the importance of the various attributes potato farmer's most valued from seed suppliers.

Currently, some 76% of the potatoes harvested in The Philippines are cultivated in either Benguet or Mountain Province, where it is believed that some 5,680 hectares are devoted to intensive potato production (Gayao and Sim undated). Potato production generally occurs within a permanent upland vegetable cultivation system at elevations between 1,200-2,600 metres above sea level. Most farms are small, averaging only 1.3 hectares, and are often comprised of several small parcels of land, often at different elevations (Crissman 1989). Almost all cultivation activities are done manually as the mountainous terrain limits mechanization. Family labour plus hired labour is utilized to assist in land preparation, planting, hilling-up, harvesting and hauling the ware potato crop to the roadside where it is available for the traders to collect (Gayao and Sim undated). Because the majority of fields are accessible only by foot and because of the need to carry-in the various production inputs including seed and fertilizer (chicken manure) and to carry-out the ware potato crop, the vast majority of potato production is found within close proximity to the one and only road that provides access to and from the region. Along this road, the Halsema Highway, farmers were selected from one of five municipalities in proportion to the area of the potato crop planted in the municipality (Gayao et al 1997).

However, in order to approach farmers, it was first necessary to seek permission from the head man in the village. The head man also provided contact names and addresses of suitable respondents. In the absence of any reliable mail or telecommunications system, farmer's were approached individually, either in their homes or in the farmer's field, in order to find a suitable time to conduct the interview. During these initial discussions, contact names and addresses for other potential respondents were also sought. In the absence of any reliable list of respondents, such methods of data collection are necessary in the developing countries (Della Vedova and Brieva 1995).

The interviews were conducted in the farmer's homes by a skilled technician employed by the Highland Agriculture and Resources Research and Development Consortium, Benguet State University. Given that the majority of potato farmers in the study area speak English, the survey instrument was written in English and the interviews were conducted in English, although farmers often responded in their native dialect. In order to test for comprehension, a convenience sample of 32 potato farmers were drawn from the immediate vicinity of the University campus in La Trinidad. No difficulties in comprehension were identified.

Farmers were asked to respond to each of the 35 item measures on a scale of 1 (not at all important) to 7 (very important). Scales were developed from previous research reported by Campbell (1985), Cunningham and White (1973), Lehmann and O'Shaughnessy (1974), Hakansson and Wootz (1975), Dempsey (1978) and McQuiston (1989).

The data was encoded and analyzed using SPSS for Windows (Version 9.0). Scheffe's Test was performed to identify any significant difference in the importance of the 35 item measures and factor

analysis undertaken to identify any significant correlations between individual measures. Varimax rotation, with Kaiser normalization, was performed to more clearly indicate which items belonged to which construct and further clarification of the items contributing to each construct was achieved by applying the reliability coefficient (Cronbach's alpha).

From the literature, a number of segmentation variables were identified which could potentially influence the potato farmer's choice of seed supplier. Such included; the size of the farm, the area cultivated in potatoes, the proportion of the ware potato crop retained for seed, the number of years for which seed was retained, the capacity to store seed tubers on-farm, the proportion of farm income derived from potatoes, the number of years the farmer had been growing potatoes (Della Vedova and Brieva 1995) and the level of formal education the farmer had attained and the number of family members working on the farm (Bos 1998). In the first instance, the segmentation variables were cross-tabulated with each of the resultant factors to identify those which were significant.

Although there is some debate about the use of factor scores in cluster analysis (Hair, Anderson and Tatham 1995), each of the resultant factors were entered into hierarchical cluster analysis to isolate any potential market segments. The average linkage cluster algorithm was employed, because, according to Punj and Stewart (1983), the average linkage cluster algorithm will outperform Ward's minimum variance method in the presence of outliers.

After ascertaining the number of clusters, nonhierarchical cluster analysis (k means) was performed to profile each of the resultant clusters, after which further validation and profiling was accomplished by the addition of the significant demographic segmentation variables.

Results and Discussion.

Confirming the earlier work of both Crissman (1989) and Gayao et al (1997), the majority of potato farmers in Benguet and Mountain Province are relatively small farmers. Farm sizes ranged from a minimum of 0.05 hectares to a maximum of 8.0 hectares, with a mean farm size of 0.62 hectares. More than 52% of the potato farmers interviewed cultivated between 0.25 hectares and 0.60 hectares of land, however, fewer than 10% of farmers cropped more than 1 hectare of land.

The area of the farm cropped in potatoes ranged from a minimum of 0.05 hectares to a maximum of 5.0 hectares, with the mean cropping area in potatoes approaching 0.34 hectares. Over 88% of the farmers interviewed cultivated between 0.1 and 0.25 hectares of potatoes, with only 7% of farmers cultivating more than 1 hectare of potatoes.

In general, farmers retained between 10-30% of the crop for seed, with most farmers (59%) retaining 20% of the ware crop for seed. Generally, farmers retained the small to medium sized tubers for seed, selling the large and extra large tubers to rural traders. However, the proportion of the crop that was retained for seed was highly dependent on the prevailing prices in the ware potato market, for as prices in the ware potato market increased, the proportion of the crop retained for seed decreased. The farmer's decision as to how much of the crop to retain for seed was also influenced by the number of potato crops

the farmer chose to grow each year, the farmer's financial position, the seed storage capacity on-farm and the anticipated losses during storage. Storage capacity ranged in size from less than 500 kg (20%) to more than 3 tonnes (1.0%), however, the majority of farmers (53%) had the capacity to store less than 1 ton.

Most potato farmers (98%) used all, or a proportion of the seed they retained from their ware potato crop, to plant one or more subsequent crops, with the majority of potato farmers (76%) retaining their own seed for up to four subsequent crops. While over 94% of potato farmers indicated that they would like to renew a proportion of their potato seed every year, in reality, only 68% were able to do so. Such would suggest that seed was either unavailable or that farmers were either unwilling or unable to purchase a greater quantity of seed. Most farmers (62%) purchased less than 500 kg of seed per year. On average, farmers paid between 13-15 pesos per kg for seed.

In purchasing seed tubers, the majority of farmers (85%) purchased seed from well known seed suppliers. Only one farmer regularly purchased certified seed, with a further 12% of farmers purchasing certified seed sometimes. Such would suggest that the informal seed system in the highlands satisfies no less than 87% of the demand for seed.

The majority of farmers (70%) derived all of their household income from the cultivation of arable crops. For most farm households, half (50%) of the on-farm income was derived from the cultivation of potatoes.

The majority of farmers (95%) were married and living in households with more than two occupants. While over 72% of farm households had more than four occupants, in most cases (71%), only one member of the household worked full-time on the farm.

The majority of farmers interviewed (58%) had been growing potatoes for more than 10 years. However, most farmers (92%) had no formal post-secondary education.

The two most important attributes influencing a potato farmer's choice of seed supplier were the seed supplier's reputation and the seed supplier's ability to provide tubers that were not contaminated with a mix of more than one variety (Table 1).

Table 1. Variables Influencing the Farmer's Choice of Seed Supplier

	Mean	SD
Supplier has a good reputation	6.97 ^a	0.18
Supplier provides pure (not mixed) seed	6.97 ^a	0.34
Supplier is financially strong	6.96 ^a	0.22
Supplier provides seed of desired physiological age	6.96 ^a	0.27
Supplier provides seed from a recognized seed area	6.95 ^a	0.27
Supplier has a strong customer base	6.95 ^a	0.32
Seed supplied improves yield	6.95 ^a	0.22
Supplier offers favorable terms of repayment	6.94 ^a	0.35
Supplier offers competitive pricing	6.91 ^a	0.36

Supplier provides seed of the desired size	6.91 ^a	0.31
Supplier provides seed of desired variety	6.90 ^a	0.31
Supplier provides seed that is free from pests and disease	6.89 ^a	0.36
Farmer has good prior experience with supplier	6.85 ^a	0.39
Supplier can provide desired quantity of seed	6.74 ^a	0.47
Supplier can offer credit	6.73 ^a	0.67
Supplier can deliver seed at planting time	6.70 ^a	0.54
Supplier introduces new varieties	6.55 ^a	0.71
Supplier offers continuous product support	6.47 ^b	0.71
Supplier is technically capable	6.21 ^c	0.74
Supplier provides technical information	6.21 ^c	0.67
Supplier offers other farm inputs	6.12 ^c	0.72
Supplier is technically competent	6.07 ^d	0.55
Supplier can meet immediate needs	6.00 ^c	0.55
Supplier provides training programs	5.79 ^e	0.65
Supplier can deliver to my farm	5.66 ^f	0.70
Have a long-standing relationship with the supplier	5.64 ^f	0.64
Supplier is close to my farm	5.54 ^g	0.76
Supplier can provide certified seed	5.33 ^h	0.63
Supplier shares the risk of potato growing	5.29 ^h	1.48
Supplier is willing to provide market information	5.23 ⁱ	1.41
Supplier provides imported seed	5.11 ⁱ	0.66
Supplier lets me visit their farm	4.94 ^j	1.30
Supplier is in frequent communication with me	4.51 ^k	0.98
Supplier visits my farm	4.23 ^l	0.89
Supplier buys my ware potatoes	4.20 ^l	0.93

where 1.0 is least important and 7.0 is most important
those values with the same superscript are not significantly different at $p = 0.05$

However, there was no significant difference between the first 17 attributes at $p = 0.05$. Not unexpectedly, this group of attributes contained most of those the literature suggested as being important; quantity, quality, price, reliability of delivery and reputation. So as to provide an alternative method of ascertaining the relative importance of each variable and to identify any significant correlations which might exist between the variables, principal component analysis was undertaken. Factor analysis revealed five factors that accounted for almost 68% of the total variation in farmer's responses (Table 2).

Table 2. Factors Influencing the Farmers Choice of Seed Supplier.

	1	2	3	4	5
Strong customer base	0.87				
Financially strong	0.82				
Good reputation	0.82				
Offers favorable terms of repayment	0.80				
Provides seed of desired physiological age	0.75				
Competitive pricing	0.70				
Can deliver to farm		0.76			
Provide quantity of seed required		0.70			

Close to the farm		0.68			
Meet immediate needs		0.66			
Provide desired variety		0.63			
Supply other farm inputs		0.58			
Offer credit		0.52			
Visits my farm			0.85		
Lets me visit their farm			0.82		
Frequent communication			0.81		
Provides market information			0.81		
Technically capable				0.83	
Offers continuous product support				0.82	
Provides technical information				0.59	
Technically competent				0.62	
Seed is free from pests and diseases					0.84
Seed is of the desired size					0.75
Eigenvalue	6.47	3.77	2.59	1.45	1.27
Cronbach's alpha	0.88	0.83	0.84	0.83	0.72
% variation	28.1	16.4	11.3	6.3	5.5
Cumulative %	28.1	44.5	55.8	62.1	67.6

Factor 1 suggests that farmer's will seek to procure seed from those seed suppliers who have a good reputation. In purchasing seed potatoes, reputation is a very complex construct; not only is it a measure of the seed supplier's credibility (customer base and financial strength), but it is also a measure of the extent to which the seed supplier is able to satisfy the farmer's demand for seed which is competitively priced and of the desired physiological age.

Given that seed is the most significant cost of potato production in the Philippines (Crissman 1989; Aromin et al 1993; Callueng et al 1993; Sana et al 1993; Rasco and Aromin 1994; Rasco 1994), not unexpectedly, potato farmers will seek to secure the lowest price from alternative seed suppliers. However, in order to grow potatoes, most farmers must borrow to finance the crop, including the cost of purchasing seed. Since most small farmers are unable to secure a loan from the financial institutions, the major source of finance is the seed supplier (Tagarino et al 1998). In most cases, the seed supplier will extend credit on the basis that they also market the potato crop, deducting the cost of the seed, interest charges and returning the balance to the farmer. However, in the tropics, market prices fluctuate widely and yields are highly unpredictable. In Northern Luzon, typhoons are a frequent occurrence thus making potato production very risky. In this regard, choosing a seed supplier who is financially strong will limit the farmer's exposure to financial ruin, for, in the event of crop failure, a financially strong seed supplier will be able to allow the farmer to repay the loan over many years.

Factor 2 captures the seed suppliers offer quality in terms of the quantity of seed required, the desired variety, the availability of complementary farm inputs, credit and the geographic proximity of the seed supplier. Potato production in The Philippines is concentrated in the highland mid elevation areas of Benguet and Mountain Province (86%)(Crissman 1989). Here the land is very steep, with the majority of the potato crop cultivated on terraces. Access is often difficult and the communication and

transportation infrastructure poorly developed. Not unexpectedly, farmer's will prefer to deal with those seed suppliers who are geographically closer. Although seed is the most significant cost of production (36%), agricultural chemicals and fertilizers amount to 23% and 17% of production costs respectively (HARRDEC 1996). Cash constrained farmers must not only borrow the capital to purchase seed, but also to purchase other production inputs. Consequently, farmers will prefer to purchase seed from those suppliers who not only provide complementary farm inputs, but are also more able to respond to the farmers immediate needs, particularly in providing fungicides for the control of late blight.

In the absence of a successful certified seed potato production system in The Philippines, it is very difficult for those farmers who wish to purchase seed to accurately assess seed quality. It is not possible to judge seed quality by examining its external appearance, for a disease infected tuber is often indistinguishable from a healthy tuber. Furthermore, there is no guarantee that the seed will be of the desired variety or physiological age. Since the majority of seed is harvested from the ware crop, in order to reduce purchase uncertainty, a farmer may visit a potential seed supplier during the growing season and perhaps again at harvest to achieve a better indication of seed quality (Crissman 1989). Factor 3 (reassurance) captures the importance of information exchange and communication between both parties. In the absence of any telecommunications infrastructure, face-to-face communication and regular visits to each others farms will be the manner in which most information is exchanged and any problems relating to the purchase of the seed can be amicably resolved. Furthermore, where the seed supplier has financed the crop, most potato farmers are dependent on their seed supplier for market information

Feder, Just and Zilberman (1985) indicate that limited access to information is one of the major constraints to the rapid adoption of new technologies in the developing world. Given that the majority of farms in The Philippines are smaller than 1.3 hectares (Crissman 1989), farmer's will actively search for better technologies to increase productivity per unit area. As technology is constantly changing and as the farmer becomes more proficient with the technology utilized, the potential for further gains in productivity arise. However, whether or not the farmer is able to take advantage of the opportunity is dependent on the availability of technical information. Factor 4 (technical support) captures the farmer's preference to purchase from those seed suppliers who provide continuous product support, technical information and who are perceived to be technically capable and technically competent.

Factor 5 (seed quality) captures two of the variables which define seed quality (seed size and seed sanitation). Small tubers are preferred by most farmers, for if larger tubers are used, a greater weight of seed per unit area must be planted (Beukema and van der Zaag 1990).

Having identified the various factors influencing the farmer's choice of seed supplier, the data was further analyzed to identify which factor(s) were most influential (Table 3).

Table 3. Importance of the Factors in the Farmers Choice of Seed Supplier.

Factor	N	Minimum	Maximum	Mean	SD
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Factor 1	235	5	7	6.95	0.23
Factor 5	235	5	7	6.90	0.30
Factor 2	235	5	7	6.24	0.43
Factor 4	235	3	7	6.24	0.55
Factor 3	235	3	7	4.70	0.97

where 1.0 is least important and 7.0 is most important.

Factor 1 (reputation) was the most important factor influencing a potato farmer's choice of seed supplier. Factor 5 (seed quality) was the second most important factor. The small standard deviation(s) would suggest that Factors 1 and 5 were pre-requisite factors; these were attributes that farmer's expected from all seed suppliers. If such is true, then in choosing between alternative seed suppliers, Factors 2 (offer quality), 3 (reassurance) and 4 (technical support) may become the key determinants, depending upon the farmer's individual needs for technical support, value-added service and communication.

Comparing the five factors with the nine demographic segmentation variables (the size of the farm, the area cultivated in potatoes, the proportion of the ware potato crop retained for seed, the number of years for which seed was retained, the capacity to store seed tubers on-farm, the proportion of farm income derived from potatoes, the number of years the farmer had been growing potatoes, the level of formal education the farmer had attained and the number of family members working on the farm), no statistical difference was obtained for Factor 5, indicating that seed quality was the most important factor for all farmers.

While there was no significant difference between Factor 1 and farm size, for farmers cultivating less than 1,000 square metres of potatoes (16%), the seed supplier's reputation was much less important. Factor 1 was important to all potato farmers except a very small proportion (1%) who derived less than 25% of their household income from the cultivation of potatoes. Factor 1 was also found to be significantly less important for those 8% of farmers who had attended or completed post-secondary education.

The farmer's level of education was also found to impact significantly upon Factor 3, where reassurance was much more important to those farmers who had attended or completed post-secondary education. Factor 3 was most valued by those farmers whose properties were generally larger than 2,500 square metres and by those farmers cultivating more than 1,000 square metres of potatoes. Conversely, Factor 3 was much less important for those farmers who either did not intend to retain a proportion of the crop as seed, or where the farmer stored less than 500 kg of seed on the farm.

Factor 4 (technical support) was found to be significantly less important for those small farmers whose property was generally less than 2,500 square metres and similarly, for those farmer's cultivating less than 1,000 square metres of potatoes. Conversely, Factor 2 (offer quality), was more appreciated by those farmers with properties generally larger than 2,500 square metres and by those farmers cultivating more than 1,000 square metres of potatoes.

The four variables which were found to have the greatest potential to differentiate between farmers were the size of the farm, the area of the farm planted in potatoes, the number of crops for which the farmer retained seed and the level of education the farmer had attained. Since it was expected that there would be a high degree of correlation between farm size and the area of the farm planted in potatoes, the decision was made to drop one of the variables. Since the area of the farm cropped in potatoes was anticipated to provide a better and more accurate measure of the farmer's demand for seed, this variable was chosen to more accurately profile the resultant clusters.

Hierarchical cluster analysis quite clearly indicated that a three cluster solution was the most appropriate, for the clustering (agglomeration) coefficient indicated only a small difference in going from one cluster to two (0.915) and from three clusters to four (1.078). However, a considerable difference was observed in going from two clusters to three (5.114).

Non-hierarchical cluster analysis not only confirmed that a three cluster solution was the most appropriate, but revealed similar results to those observed from the cross-tabulations (Table 4).

Table 4. Final cluster centers

	Cluster 1	Cluster 2	Cluster 3	F	Sign
Factor 1	6.98	6.97	6.99	0.507	0.603
Factor 2	6.44	6.10	6.19	11.01	0.000
Factor 3	5.58	3.78	4.38	89.28	0.000
Factor 4	6.55	6.01	6.08	21.93	0.000
Factor 5	6.90	6.88	6.90	0.097	0.907
Education	1.82	1.47	1.50	7.09	0.001
Area of potatoes	2.74	2.38	1.78	32.55	0.000
No. of crops seed retained	3.03	3.04	1.56	107.33	0.000
Cluster size	62	45	78		

The farmer members (62) of Cluster One (conscientious buyers) were described as the medium to large potato farmers. Although they were the best educated (most to secondary level), they actively pursued those seed suppliers who offered extensive technical support (Factor 4). They were the most demanding buyers in terms of offer quality (Factor 2) and the level of reassurance (Factor 3) they sought from seed suppliers. Since most farmers intended to retain seed for four or more subsequent crops, it was no surprise that such farmers endeavored to purchase the best quality seed and wherever possible, to seek every assurance from the seed supplier that they could deliver the quality of seed desired.

The farmer members (45) of Cluster Two (complacent buyers) were the medium sized potato farmers. However, in contrast to the farmers in Cluster One, they were much less educated, with most farmers having only undertaken primary schooling. While these farmers were very conscious of the product offer quality, they sought few assurances from seed suppliers, but nevertheless demanded a high level of technical support.

Cluster Three (opportunistic buyers) were the largest of the three clusters identified (78). These farmers were the smallest potato farmers. Like their colleagues in Cluster Two, most farmers in this cluster had only undertaken primary schooling. While these farmers had a high need for technical support and offer quality, they sought only modest levels of reassurance. In part, such was because they retained seed for the least number of crops.

Managerial implications.

Unlike most of the developed world where a formal seed certification system will provide some assurance to the farmer that the incidence of major pests and diseases and other atypical seed characteristics are within acceptable tolerance limits, no seed certification system has yet been successfully implemented in The Philippines. Consequently, the decision to purchase seed tubers will evoke significant risk, both in the short-term and the long-term, for most potato farmers in the highlands of Northern Luzon..

In purchase situations where major problems exist, reliability and price become particularly important (Lehmann and O'Shaughnessy 1974). Puto, Patton and King (1985) suggest that in circumstances where the purchasing decision is characterized by a high degree of inherent risk, buyers may reduce uncertainty by gathering additional information or spreading the risk by using multiple suppliers. Conversely, Anderson, Chu and Weitz (1987) suggest that buyers can reduce risk by either purchasing from well known, reputable suppliers, or purchasing only from those firms with which they have previously dealt. Because of the considerable risk involved in purchasing seed potato tubers, reputation and price were found to be the major variables influencing a potato farmer's decision to purchase seed tubers.

Reputation was found to be comprised of two interrelated components; the seed supplier's credibility and the seed supplier's ability to provide seed which satisfied the farmer's needs. All farmers sought to procure seed which was competitively priced, substantially free of pests and diseases, of the desired size and physiological age. While this would suggest that seed suppliers should emphasize low price and high product quality, such a marketing strategy is considered unsustainable (Berry and Parasuraman 1991). Just as no one product can satisfy the needs of all potential buyers, no one marketing strategy will appeal to all buyers. If switching costs are low, if farmer's are dissatisfied with current seed suppliers and if better alternatives are available, farmer's can be expected to readily change suppliers. Conversely, over many years and after many transactions, favorable experience may lead to strong source loyalty (Cunningham and White 1973). For familiar products and buying situations, Kool, Meulenber and Broens (1997) suggest that farmer's may decide to purchase rather quickly, merely examining prices and the availability of alternatives. The results of the cluster analysis suggest that the majority of Filipino potato farmers (Cluster Three) have adopted just such an approach towards the purchase of seed. In part, this may be due to the farmer's inability to perceive any tangible difference in the functional criteria between alternative suppliers.

However, if by customizing the product offer it becomes possible to not only differentiate the product offer but to add value to the transaction, it might also be possible to attract and retain valued customers. Value comes in many forms including technology, information and market access (Wilson 1995). With only limited land and very little opportunity to bring any additional land into production, potato farmers in the highlands are actively seeking methods of increasing productivity per unit area. However, many farmers are constrained by the lack of knowledge and are generally reluctant to adopt new varieties or to purchase seed from relatively unknown suppliers without having first seen the crop. Here, product demonstration and trial aims to reduce a potential buyers perceived risk of adoption. While the need for technical support was rated highly by all potato farmers, it was most highly rated by the participants of Cluster One. While the literature suggests that advice and technical support are most appreciated by inexperienced customers (Matthyssens and van den Bulte 1994), the results produced a very different outcome; here it was apparent that the more education farmers have, the more assurance and technical support they seek from seed suppliers. Since they were also the larger farmers, it would appear as if, because of the consequences of making a poor decision, conscientious farmers wanted to be more involved in both the production and marketing of their potato crop. Such educated farmers, while still aggressively seeking to procure the most price competitive and reliable supply of seed, were considered the most likely to appreciate superior quality seed and the most willing to pay for it. Thus, from the perspective of a potential seed supplier wishing to enter the market, this group of farmers were considered to be the most likely target market.

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