

## 5. Evaluation of processing potato clones in Indonesia

Rofik Sinung-Basuki, Kusmana, Ahmad Dimiyati, Nur Hartuti, Eri Sofiari and Upali Jayasinghe

### Introduction

Indonesia produces a very low output of processing potato and depends on imported raw materials for most of its requirements. Of seven brands of potato chip products sold in the market, six use imported products. The largest potato chip processor, Indofood Frito-Lay Company, imports up to 75 percent of its raw materials every year. Further, despite the invariably increasing demand for french fries, companies are only doing business as distributors or packinghouses of 100 percent imported frozen potato (Table 1). As a consequence of minimal competition posed to the entry of potato chips and other potato products from foreign countries, potato-based agroindustries in Indonesia have remained underdeveloped and uncompetitive.

To counter this, the private sector has exerted efforts to increase local production by introducing 15 processing potato varieties (see Appendix 1) since 1993. Unfortunately, most farmers have not accepted the varieties because they yielded low and were susceptible to late blight (Sinung-Basuki et al., 2000).

A three-year collaborative project between the Research Institute of Vegetables (RIV) and International Potato Center (CIP) financed by ARMP-II project was started in March 2000 to evaluate, select, and find promising processing potato clones from CIP to be released as new processing potato varieties.

At the end of 2000, researchers selected 12 processing potato clones for further evaluation (Table 2). The selection was based on findings of previous varietal trials, (Sahat, Kusmana and Chujoy, 1998; Kusmana, Chujoy and Sahat, 1999; Permadi and Sahat, 1999), potato quality testing (Asgar and Chujoy, 1999; Sinung-Basuki et al., 2000), and understanding of farmers' and industries' preferences in the choice of processing potato (Sinung-Basuki et al., 2000). This paper presents further evaluation of the 12 selected clones through a users' participatory approach.

### Methodology

#### **Principles of processing potato clones selection**

Selected clones are released as new varieties and are expected to be disseminated and adopted widely by users. Especially with processing potato varieties, the characteristics should be generally acceptable to farmers, industrial users and consumers. The Atlantic variety is one example of a potato variety that was not accepted by all the user groups. It is the most preferred by industrial users but most farmers have not planted it because of its low yield and susceptibility to late blight. Based on previous research results, the characteristics preferred by both farmers and industrial users in processing potato are as follows:

- High yielding:  $\geq$  20 t/ha
- Early or medium maturing: harvest at  $\leq$  90 days.

- Tuber sizes: 75% marketable size and 25% seed size, approximately.
- Resistance or tolerance to the leaf miner fly (*liriomyza*), late blight, and bacterial wilt.
- Seed can be used at least up to the 4<sup>th</sup> generation.
- Specific gravity:  $\geq 1.067$  for chipping potato and  $\geq 1.079$  for french fries.

Despite its susceptibility to late blight, wilt, and *liriomyza*, farmers prefer the Granola variety because it is high yielding, medium maturing, a high proportion of its harvest is consistently of marketable size and its seed can be used up to the 4<sup>th</sup> generation.

### **Users' evaluation of 12 processing potato clones**

Research was conducted from July to November 2001 in the following four locations: Pangalengan (1300 m asl), West Java; Garut (1300 m asl), West Java; Batur (1500 m asl), Central Java; and Tosari (1700 m asl), East Java. A modern potato chips processing factory, two potato chips home industries and 42 farmers were asked to evaluate the characteristics, yield, quality of tubers, specific gravity, performance, and taste of the processed products of 12 processing potato clones.

### **Farmers' observation plots simultaneously used as multilocation trial plots**

To evaluate the clones, farmers in each research location needed an observation plot to observe the potato plants from growth to harvest. The farmers' observation plots were designed and managed by researchers to ensure that the potato plants were maintained properly and were healthy until harvest time.

Randomised Complete Block Design was the experimental design used. There were 16 treatments with three replications each of the 12 selected clones. Four popular varieties served as control. Plant population was 20 per plot and plant spacing was 90 cm x 30 cm. Chicken manure at 20 t/ha, N= 320 kg/ha, P<sub>2</sub>O<sub>5</sub> = 321 kg/ha, K<sub>2</sub>O = 313 kg/ha and Mg = 51 kg/ha were applied by mixing them up with soil 1-2 days before planting. Soil hilling-up was done twice, i.e. 10 days after planting (DAP) and 14 DAP. Pest and disease control were done depending on the incidence of pests and diseases. Variables observed by researchers were plant height, number and diameter of main stems, virus symptoms (only in Pangalengan), yield and distribution of tuber sizes.

### **Experiment on generating basic technological components**

According to an expert from Indofood Frito-Lay Company, many farmers obtained low yields of Atlantic because in growing it, they applied agronomic practices suitable for Granola. From his long experience, he observed that the requirements of Granola and Atlantic in terms of land preparation, hilling-up, nutrient, plant spacing and maintenance were different. This information inspired researchers to conduct an experiment to generate basic technological components for growing potato processing clones.

Very little information is available about appropriate agronomic practices of growing processing potato. Even among RIV researchers, agronomic practices in planting Granola are also used in planting any potato variety including processing potato. Therefore, initial experiments were conducted to understand the effects of four basic technological components,

i.e. dosage of NPK fertilizer, plant spacing, age of harvest and the use of MgO fertilizer, on the yield and tuber size of processing potato.

### **Farmers' participation in evaluation**

Farmers who had experience in growing processing potato varieties were chosen as participants. They were asked to compare the superior and inferior characteristics of the processing potato clones to that of processing potato varieties that they experienced growing.

Farmer-participants were invited to the observation plot to evaluate the potato clones at the following three stages of plant growth: 30 days after planting (DAP), 60 DAP, and at harvest. Farmer's evaluation at 30 DAP and 60 DAP included criteria of plant vigour, plant height, canopy cover, plant stems and susceptibility to pests and diseases; and at harvest, yield and tuber size. In each stage of evaluation, farmers selected the three most preferred and three least preferred clones. At harvest, each farmer-participant received for free, a total of 30 kg fresh potato of the three most preferred clones they identified. The tubers were kept as seeds to be planted by the farmers in early year 2002.

### **Raw material suppliers' participation**

Two suppliers of raw materials to potato processors, one in Pangalengan and one in Garut, were chosen as participants. The suppliers were also the field staff of Indofood Frito-Lay Company who were in charge of collecting raw materials in the farmers' fields and taking these to the industrial processors regularly. They have had considerable experience in judging potato according to industry quality standards. The following were the industrial processors' criteria to evaluate the 12 potato varieties: 1) specific gravity of the potato clones ( $s.g \geq 1.067$ ); 2) fryer test (browning or not browning); and 3) percentage of damaged product after frying. After evaluation, the suppliers selected the best clones to use as raw materials of potato chips.

### **Large-scale industry participation in clones selection**

Indofood Frito-Lay company as the only large-scale potato chips industry established in Indonesia was chosen to participate in evaluating processing potato clones tested in this study. A sample of 25-kg fresh potatoes of each clone was sent to the factory to be evaluated using the factory's own tools and methods. The factory sent to the researcher a letter of recommendation indicating which clones were accepted or were rejected.

### **Small-scale industry participation**

The owners of potato chips home industries or home industry processors, one in Batur and one in Tosari, were chosen as participants in the fryer test using traditional equipment to evaluate the chips color (browning or not browning) and taste (bitter or not bitter and crispiness). After evaluation, the participants selected three best clones for use as raw materials for potato chip production.

## **Consumer participation**

At harvest, a sample of 4-kg fresh potatoes of each clone was processed into fried potato chips. Farmer participants who represented consumers evaluated the potato chips in terms of color and taste. Potato chips from Atlantic and Panda varieties were used as control. Consumers chose the potato clones which produced potato chips with better or comparable color and taste to those of the control group. At the end of the evaluation, consumers selected the three best clones as raw material in potato chip production.

## **Results**

### **Clones selected by farmers**

Farmer-participants in one location (Garut) only evaluated the clones at 30 DAP and 60 DAP because a lot of the plants in the observation plots were damaged and only a few plants could be harvested due to bacterial wilt disease. At the other locations observations at harvest were also possible.

Farmers' bases for selection of the most preferred clones differed at vegetative growth (30 and 60 DAP) and at harvest. At 30 and 60 DAP, farmers selected the clones based on the vigour of the plant, canopy cover and susceptibility to pests and diseases. However, at harvest, yield and distribution of tuber size became the dominant factors in the farmers' selection (Table 3). Three clones selected by majority of the farmers were: 380584.3, Merbabu-17 and FBA-4. All these were high yielding clones with  $\pm 75\%$  of the tubers at marketable size upon harvest (Table 4).

### **Clones selected by raw material suppliers of potato chips**

The suppliers measured the specific gravity of the tested clones using potato hydrometer and tested the performance of chips using frying tools. Potato that is ideally used as raw materials for potato chip processing should have three main characteristics: 1) specific gravity  $\geq 1.068$ , 2) not browning after frying, and 3) damage after frying at  $< 10\%$ . The suppliers selected TS-2 and MF-II as acceptable according to industry standards (Table 5).

### **Clones selected by large-scale industrial processors**

Only 25 kg samples of the clones preferred by farmers and suppliers were sent to the factory for evaluation. The clones were TS-2 (selected by suppliers), CFQ 380584.3 and FBA-4 (selected by farmers). Results of the factory evaluation confirmed the suppliers' choice. Among the clones, only TS-2 was accepted by the Indofood Frito-Lay Company (Table 6). Due to limited materials available MF-II clone was not sent to the factory for evaluation.

### ***Small-scale processors of potato chips***

Potato chips produced by small-scale processors in Batur were the same as that produced by Indofood Frito-Lay Company. After manually peeling up the fresh potato, these were sliced and fried. No pre-treatment was needed before frying. The small-scale industry owners selected

the clones of FBA-4 and 380584.3 as the best raw materials for potato chips home industry (Table 7).

In Tosari, traditional potato chips were made by peeling, slicing, rinsing, soaking in lime water, blanching, and drying to produce a whitish-dried potato chip ready for frying. The small-scale processors selected clones of FBA-4, VC.38.6, 380584.3 and AGB as the best raw materials for traditional potato chips processing (Table 8).

### **Clones selected by consumers**

Consumers compared the color and taste of both modern and traditional potato chips made from the tested clones with that made from Atlantic variety as the control. The consumers selected 380584.3 and FBA-4 as the best raw materials for potato chips processing (Table 9).

### **Discussion**

The objective of this research was to select processing potato clones preferred by all users, i.e. large-scale and small-scale industries, farmers, and consumers, to ensure wide adoption and dissemination when selected clones are recommended as new varieties for processing. This will ensure to a certain extent increase in production of processing potato to support the agroindustry in Indonesia and reduce reliance on imported raw materials.

Results of this research showed that home industries, farmers and consumers preferred clones 380584.3 and FBA-4 for processing into potato chips. Unfortunately, these clones did not meet the quality standards of the large-scale potato chips industry. In contrast, small industries, farmers and consumers (Table 10) did not prefer clone TS-2, which was chosen by a large-scale processor as a suitable raw material for potato chips processing.

Farmers did not prefer clone TS-2 because of its low yield. In this research all tuber seeds of all tested clones, including TS-2, were generation three while the tuber seeds of Atlantic and Panda used as control group in the experiment were generation one. This may have biased the results against TS-2 since the tuber seed generation of TS-2 was older than that of Atlantic and Panda. Thus, TS-2 was more susceptible to virus than the controls. Data from farmers' observation plots showed that at 60 DAP, 35 percent of TS-2 clone, 2 percent of Panda, and 10 percent of Atlantic were infected by Mosaic Virus (MV) (Table 11).

Theoretically, using virus-free tuber seeds and implementing appropriate technological components such as fertilisation, plant spacing and pest control would increase the yield of TS-2. Thus, the chance of TS-2 to be accepted by farmers is still open with the needed improvements in the technological component in place.

In this research, seed materials of MF-II clone were very limited. For the research to proceed, researchers explained to the farmers that they could not be given tubers of MF-II because they (researchers) needed to keep the harvest for use in subsequent experiments. As a consequence, farmers did not express preference for MF-II clone, because they knew that they would not be able to get the tubers. In fact, data from farmers' observation plots showed that MF-II clone was a high yielding clone (Table 4) and it was accepted by large-scale processors (Table 5). It seemed that MF-II clone was also a promising processing potato variety since it had potential to be adopted by farmers and large-scale industry.

This research encountered difficulties in evaluating the processing potato clones as raw materials for french fries. First, it was difficult to select representatives from the french fries

processors as participants because they are only distributors and packagers of imported french fries. However, using quality standards of raw materials for french fries as published by Indofood Frito-Lay Company, clones TS-2 and I-1085 may be appropriate for the purpose (Table 11).

## **Conclusions**

1. Clones 380584.3 and FBA-4 were preferred by farmers, home potato chip processing industries and potato chip consumers. These clones show promise for release as new processing potato varieties especially for potato chips home industries.
2. Clone 380584.3 was a high yielding and early maturing variety that can be harvested at 85 DAP.
3. Clone FBA-4 may be developed for the modern potato chips industry processors with improved postharvest handling.
4. Clones TS-2 and MF-II were accepted by modern potato chips industry processors as raw materials. These clones are promising for release as new potato processing varieties. TS-2 yield was comparable and MF-II yield was higher than that of existing processing potato varieties, Atlantic and Panda.
5. Clones TS-2 and I-1085 were suitable raw materials for french fries making and show promise for release as new processing potato varieties.
6. Farmers did not accept TS-2 because of its low yield. The use of improved technology, i.e. clean seeds, wide plant spacing, and application of MgO fertilizer may increase the yield and lead to its acceptance among the farmers.

## **Future Research**

In the future, we plan to continue this study with the following activities:

1. Monitor the actual adoption process of potato clones selected through farmer-led experimentation.
2. Conduct multilocation trials of the clones of 380584.3, TS-2, FBA-4, MF-II and I-1085 in 12 locations to hasten the process of new variety release.
3. Re-evaluate farmers' acceptance of TS-2, MF-II and I-1085 using improved technology of clean seed, wide plant spacing and MgO fertilizer application.
4. Conduct collaborative research with the private sector to develop clones 380584.3, TS-2, FBA-4, MF-II and I-1085 for commercial purposes.

## **References**

Adiyoga, W., R. Suherman, A. Asgar and Irfansyah. 1999. Potatoes in West Java: A rapid appraisal of production, marketing, processing, and consumer preferences. International Potato Center (CIP). 39 p.

- Asgar, A. dan L. Marpaung. 1998. Pengaruh umur panen dan lama penyimpanan terhadap kualitas kentang goreng (The effect of harvesting date and storage duration on the quality of fried potato). *Jurnal hortikultura* Vol.8 No.3. Badan Litbang Pert., Puslitbanghort, Jakarta. p. 1208-1216.
- Asgar, A. and E. Chujoy. 1999. Chipping quality of 45 potato clones in potato research in Indonesia, Research results of a series of working papers, 1999. Collaborative research between the Research Institute for Vegetables (RIV) and The International Potato Centre (CIP). CIP-RIV, Lembang, Indonesia. p. 30
- Balithort Lembang dan IPB. 1993. Laporan akhir: penelitian pendukung pengendalian hama terpadu pada sayuran dataran tinggi, Studi baseline identifikasi dan pengembangan teknologi pengendalian hama terpadu pada sayuran dataran tinggi (survei explorasi), Buku 2: Kentang. Balithort Lembang - Fakultas Pertanian. IPB. p. 36.
- Gould, W.A. 1995. Specific gravity - its measurement and use. *Chipping potato handbook*, SFA 1995.
- Hartuti, N. and R.M. Sinaga. 1998. Kripik kentang salah satu diversifikasi produk. (Potato chips, an alternative of product diversification). Monograf No. 12. Balitsa, Puslitbanghort, Badan Litbang Pertanian. 17 hal.
- Huarte, M.A., A.O. Mendiburu, M.C. Monti and I.P. Butzonitch. 1986. Serrana Inta: A widely adapted virus resistant potato cultivar from Argentina. *American Potato Journal*. Vol 63. p. 695-699.
- Sahat, S. Kusmana and E. Chujoy. 1998. Evaluation of 38 potato clones and cultivar in Java, Indonesia, 1995 -1998. In: *Potato research in Indonesia, research results in a series of working papers, 1998*. Collaborative research between the Research Institute for Vegetables (RIV) and the International Potato Center (CIP). CIP-RIV, Lembang, Indonesia. p. 15
- Sinung-Basuki, R. 1998. Persepsi petani dan industri pengolahan terhadap varietas/klon kentang temuan balitsa (Perception of farmers and processing industry on potato variety/clone from RIV). Laporan hasil penelitian balitsa APBN T.A. 1997/1998. Diseminarkan dalam: Seminar laporan hasil penelitian T. A. 1997/1998. Bag. Pro. Penel. Tanaman Sayuran Lembang T.A. 1998/1999. 9 hal

**Table 1. Imports of processing potato raw materials to Indonesia, 1995-2000**  
**Quantity = T (x 1000 tons) and Value = \$ (million US\$)**

	1995		1996		1997		1998		1999		2000	
	T	US\$	T	US\$	T	US\$	T	US\$	T	US\$	T	US\$
Frozen Potato *)	9.7	8.8	11.8	11.7	23.1	23.0	6.9	4.8	6.5	4.2	10.4	7.7
Chipping potato **)	1.2	-	1.6	-	1.2	-	0.5	-	2.2	-	2.3	-

Sources: \*) Adiyoga, Fuglie and Suherman (2001) ; \*\*) Agro Dept. PT Indofood (1998).

Notes : Quantity of imported chipping potato is much higher than what is reported since at the end of 2001, Lay's- USA started operating in Indonesia.

**Table 2. Characteristics of 12 selected potato clones**

No	Name	Specific gravity (s.g)	Yield (t/ha)
1	FBA-4	1.075 s)	23.5 *)
2	TS-2	1.081 a)	26.9 **)
3	VC.38.6	1.067 s)	23.2 *)
4	MF-II	1.073 a)	31.2 **)
5	Serrana	1.095 s)	20.9 *)
6	CFQ-69-1	1.069 a)	28.6 **)
7	380584.3	1.070 a)	27.9 **)
8	AGB-69-1	1.053 a)	32.0 **)
9	378501.3	1.075 a)	28.4 **)
10	VC.24.16	1.059 a*)	23.5 *)
11	377785.4	1.069 i)	40 ***)
14	I 1085	1.086	-

Sources:

\*) Kusmana, Chujoy and Sahat (1999).

\*\*\*) Kusmana and Chujoy (1999).

s) Sahat and Chujoy (1998).

a) Asgar and Chujoy (1999).

i) PT Indofood th 1995

**Table 3. Potato clones preferred by farmers in Pangalengan, Garut, Batur and Tosari**

No	Clones/ Varieties	Pangalengan (1300 m dpl)			Garut (1250 m dpl)			Batur (1550 m dpl)			Tosari (1700 m dpl)		
		n=14 11	n=9	n=	n=12	n=6	nd	n=7 6	n=7	n=	n=11 9	n=12	n=
		30 DAP	60 DAP	Har- vest	30 DAP	60 DAP	Har- vest	30 DAP	60 DAP	Har- vest	30 DAP	60 DAP	Har- vest
1	FBA-4	5	2	0	1	2	nd	2	2	4	9	8	8
2	TS-2	0	0	1	0	1	nd	0	0	0	0	1	0
3	MF-II	1	2	0	nd	nd	nd	nd	nd	nd	nd	nd	nd
4	Serrana	2	1	2	2	4	nd	1	0	0	0	0	0
5	VC.24.16	5	0	0	5	2	nd	0	0	0	1	0	0
6	VC.38.6	6	0	0	6	1	nd	0	0	0	1	6	0
7	380584.3	8	8	11	5	1	nd	5	4	6	8	5	7
8	AGB-69-1	0	0	1	3	0	nd	0	0	0	2	2	3
9	378501.3	1	0	0	1	1	nd	0	0	0	0	0	1
10	CFQ-69-1	3	0	7	0	0	nd	2	2	0	0	0	0
11	377785.4	1	0	0	1	3	nd	3	1	2	6	2	0
12	Granola	0	0	2	0	0	nd	0	1	0	0	0	0
13	Panda	0	2	0	0	0	nd	2	5	3	0	0	0
14	I 1085	0	0	1	0	0	nd	0	1	0	0	2	0
15	Atlantic	0	2	2	3	1	nd	1	0	0	0	1	0
16	Merbabu-17	6	9	10	1	1		5	4	1	4	4	5
	Preferred I	CIP-7 = 100%			nd			380584.3 = 100%			FBA-4 = 89%		
	Preferred II	Granola L = 91%			nd			FBA-4 = 67%			380584.3 = 78%		
	Preferred III	CFQ-69-1 = 64%			-			Panda = 50%			Granola L = 56%		

\*) Farmers' selection at harvest. No available data at harvest in Garut (nd).

**Table 4. Yield and percentage of marketable tubers of 12 tested clones and 4 control varieties from farmers' observation plots in three locations**

No	Clone/Var	Pangalengan		Batur		Tosari	
		Total yield t/ha	% marketable size	Total yield t/ha	% marketable size	Total yield t/ha	% marketable size
1	FBA-4	33.1	40	24.7	56.7	28.9	65.1
2	TS-2	31.6	83	16.0	73.3	11.2	88.7
3	MF-II	41.1	71	-	-	-	-
4	Serrana	27.8	72	18.8	66.7	13.7	79.9
5	VC.24.16	19.6	38	16.7	50.0	22.9	70.6
6	VC.38.6	24.3	34	9.2	60.0	32.9	68.5
7	380584.3	44.4	71	34.5	76.7	29.6	82.9
8	AGB-69-1	41.8	72	14.7	76.7	29.9	67.7
9	378501.3	26.7	48	14.3	66.7	9.2	69.3
10	CFQ-69-1	36.7	84	21.2	73.3	12.8	56.8
11	377785.4	29.1	66	25.6	80.0	28.2	77.7
12	Granola	34.2	79	17.2	60.0	18.1	70.1
13	Panda	25.2	64	20.1	73.3	16.6	73.0
14	I 1085	35.3	87	15.0	66.7	19.0	77.4
15	Atlantic	28.5	60	9.1	76.7	13.4	89.3
16	Merbabu-17	57.9	54	32.0	70.0	25.4	77.1
	LSD	11.7	17.1	6.28	0.11	7.407	16.79
	CV	21.3	16.3	19.48	9.28	21.31	13.52

**Table 5. Potato clones preferred by suppliers as potato chips raw materials**

No		Pangalengan				Garut			
		Harvest at 85dap		Harvested at 100 dap		Harvest 100 dap			Reject / Accept
		S.G.	Chips color	S.G.	Chips color	S.G.	Chips color	% damaged	
1	FBA-4	1.079	-	1.084	-	1.073	N.B	27	x R
2	TS-2	1.085	-	1.095	-	1.085	N.B	1	v Acc
3	MF-II	nd	-	nd	-	1.072	N.B	9	v Acc
4	Serrana	1.061	-	1.065	-	1.063	B	-	
5	VC.24.16	1.061	-	1.065	-	1.059	B	-	
6	VC.38.6	nd	-	1.064	-	1.062	B	-	
7	380584.3	1.063	-	1.067	-	1.057	B	-	
8	AGB-69-1	< 1.060	-	< 1.060	-	1.055	B	-	
9	378501.3	1.073	-	1.084	-	1.077	N.B	37	x R
10	CFQ-69-1	1.064	-	1.067	-	1.063	B	-	
11	377785.4	< 1.060	-	1.065	-	1.056	B	-	
12	Granola	1.063	-	nd	-	1.056	B	-	
13	Panda	1.075	-	1.082	-	1.076	N.B	6	v Acc
14	I 1085	1.075	-	1.084	-	1.074	N.B	31	x R
15	Atlantic	1.078	-	nd	-	1.080	N.B	0	v Acc
16	Merbabu-17	nd	nd	1.060	-	1.058	B		

Notes:

N.B = not browning

B = browning

R = rejected as raw material

Acc = accepted as raw material

**Table 6. Evaluation of the potato clones as potato chips raw materials by large-scale processor (Indofood Frito-Lay Company)**

Parameter	Standard	Tested Clones			
		TS-2	380584.3	CFQ-69-1	FBA-4
Size	5-7 cm				
- Oversize	5%	7.44	-	-	-
- Undersize	5%	11.58	-	-	2.4
Specific Gravity	Min 1.067	1.089	1.067	1.067	1.081
- Defect	Max 13%	-	-	-	-
- Water content	-	79.4	83.3	83.3	80.1
- Total Solid	Min 16.7	20.6	16.7	16.7	19.9
Fryer test					
- Internal defect %	-	12.1	40.6	98.1	45.7
- External defect %	-	3.04	2.0	0.6	2.0
Appearance	Max 16%	9.1	37.6	45.1	42,7
Conclusion		Accepted	Rejected	Rejected	Rejected

Primary data

**Table 7. Modern potato chips home industry processors' evaluation of potato clones as potato chips raw material**

	Clones/ variety	Chips color	Chips Taste	As raw material
1	FBA-4	Good	Good	Good V
2	TS-2	Less good	Not as good	Not as good
3	MF-II	nd	nd	nd
4	Serrana	nd	nd	nd
5	VC.24.16	nd	nd	nd
6	VC.38.6	nd	nd	nd
7	380584.3	Good	Good	Good V
8	AGB-69-1	nd	nd	nd
9	378501.3	Less good	Good	Not Good
10	CFQ-69-1	Less good	Not as good	Bad
11	377785.4	Bad	Not as good	Not Good
12	Granola	nd	nd	nd
13	Panda	nd	nd	nd
14	I 1085	nd	nd	nd
15	Atlantic	Good	Good	Good (Control) V
16	Merbabu-17	nd	nd	nd

Primary data

Notes :

nd = no data.

**Tabel 8. Evaluation of potato clones for potato chips processing by traditional home industries**

No	Clones / variety	Dried chips	Fried chips		As raw material
		Color	Color	Taste	
1	FBA-4	Good	Good	Tasty and crispy	Good
2	TS-2	nd	nd	nd	nd
3	MF-II	nd	nd	nd	nd
4	Serrana	nd	nd	nd	nd
5	VC.24.16	nd	nd	nd	nd
6	VC.38.6	Good	Good	Tasty and crispy	Good
7	380584.3	Good	Good	Tasty and crispy	Good
8	AGB-69-1	Good	Good	Tasty and crispy	Good
9	378501.3	nd	nd	nd	nd
10	CFQ-69-1	nd	nd	nd	nd
11	377785.4	nd	nd	nd	nd
12	Granola	nd	nd	nd	nd
13	Panda	nd	nd	nd	nd
14	I 1085	nd	nd	nd	nd
15	Atlantic	Good	Good	Tasty and crispy	Very Good
16	Merbabu-17	Good	Good	Tasty and crispy	Very Good

Primary Data

**Table 9. Consumers' evaluation of potato clones tested as potato chips raw materials**

No	Clones/ Verities	Modern potato chips		Traditional potato chips
		Pangalengan (n=10)	Batur (n=6)	Tosari (n=4)
1	FBA-4	0	4 = 67%	4 = 100%
2	TS-2	0	0	0
3	MF-II	0	0	0
4	Serrana	0	0	0
5	VC.24.16	1 = 10%	0	0
6	VC.38.6	0	0	0
7	380584.3	9 = 90%	5 = 83%	4 = 100%
8	AGB-69-1	0	0	1 = 25%
9	378501.3	1 = 10%	5 = 83%	0
10	CFQ-69-1	7 = 70%	0	0
11	377785.4	3 = 30%	0	0
12	Granola	2 = 20%	0	0
13	Panda	2 = 20%	0	0
14	I 1085	1 = 10%	0	0
15	Atlantic	2 = 20%	0	0
16	Merbabu-17	1 = 10%	0	3 = 75%
	Preferred I	380584.3	380584.3	380584.3
	Preferred II	CFQ	378501.3	FBA-4
	Preferred III	-	FBA-4	Merbabu-17

primary data

**Table 10. Summary of processors, farmers, and consumers evaluation of potato clones for use as raw materials for making potato chips**

No	Clone / Variety	As raw material of modern potato chip processors				As raw material of traditional potato chip processors			
		Farmers	Industry		Consumers	Farmers	Industry		Consumers
			Large scale	Small scale			Large scale	Small scale	
1	FBA-4	V	X	V	V	V	V	V	
2	TS-2	-	V	X	-	-	-	-	
3	MF-II	-	V	-	-	-	-	-	
4	Serrana	-	-	-	-	-	-	-	
5	VC.24.16	-	-	-	-	-	-	-	
6	VC.38.6	-	-	-	-	-	V	-	
7	380584.3	V	-	V	V	V	V	V	
8	AGB-69-1	V	-	-	-	V	V	-	
9	378501.3	-	-	X	V	-	-	-	
10	CFQ-69-1	V	-	X	V	V	-	-	
11	377785.4	-	-	-	-	-	-	-	
12	Granola	-	-	-	-	-	-	-	
13	Panda	V	V	-	-	V	-	-	
14	I 1085	-	-	-	-	-	-	-	
15	Atlantic	-	V	-	V	-	V	-	
16	Merbabu-17	V	-	V	V	V	V	V	

Notes:

V = preferred

X = not preferred

**Table 11. Virus infection on potato clones at 60 DAP, Pangalengan**

	Replication I				Replication II				Replication III				Average	
	MV	PLRV	% MV	% PLRV	MV	PLRV	% MV	% PLRV	M	PLRV	% MV	% PLRV	% MV	% PLRV
FBA-4	5	0	25	0	2	0	10	0	0	1	0	5	11.6	1.6
TS-2	7	0	35	0	13	1	65	5	1	0	5	0	35	1.6
MF-II	20	0	100	0	9	0	45	0	20	0	100	0	81.6	0
Serrana	0	0	0	0	0	0	0	0	0	0	0	0	0	0
VC.24.16	5	0	25	0	1	0	5	0	8	0	40	0	23.3	0
VC.38.6	4	0	20	0	0	0	0	0	1	0	5	0	8.33	0
380584.3	0	0	0	0	0	0	0	0	1	0	5	0	1.66	0
AGB-69-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
378501.3	5	1	25	5	3	2	15	10	14	1	70	5	36.6	6.6
CFQ-69-1	3	0	15	0	0	0	0	0	1	0	5	0	6.66	0
377785.4	3	0	15	0	2	0	10	0	3	2	15	10	13.3	3.3
Granola	1	0	5	0	0	1	0	5	0	0	0	0	1.66	1.6
Panda	0	0	0	0	0	0	0	0	1	0	5	0	1.66	0
I 1085	3	0	15	0	4	0	20	0	0	0	0	0	11.6	0
Atlantic	3	0	15	0	0	0	0	0	3	0	15	0	10	0
Merbabu-17	0	0	0	0	0	0	0	0	0	0	0	0	0	0

primary data.

**Table 12. Characteristics of tuber quality of clone TS-2 and I-1085 as raw materials for french fries**

Parameter	Standard	TS-2	I-1085
Size	-20% : 170 gram 40% : 199 - 284 gram 40% : > 284 gram	89% : 206 g	77% : 153 g
Shape	Long	Elliptic	Obovate
Depth of eyes	Shallow	Shallow	Shallow
Specific gravity	Min 1.079	1.089	1.084
Total solid	Min 20.5%	20.6	21%**)
Variety	Preference: RBB	-	-

\*\* ) Estimated using table from Gould (1995)

**Appendix 1. List of processing potato varieties introduced by private sector with location and number of farms planting in 2000**

No	Potato Variety	Year introduced	Location of introduction	Private sector	Number of farmers planted in 2000
1	Atlantic	1993	Batur, Dieng, Garut, Pangalengan, Pasuruan	Indofood, PT Rafina, Revina, PT Pusri Jateng	4
2	Kennebec	1994	Batur, Dieng, Garut	Indofood	0
3	Russet Burbank	1994	Batur, Garut, Tosari	Indofood	0
4	Dunja	1994	Batur, Dieng	Indofood	0
5	Red Pontiac	1994	Batur	Selektani	0
6	Hertha	1995	Batur, Dieng	Selektani	3
7	Diamant	1995	Batur, Garut	Selektani, PT. CTU	0
8	Agria	1994	Batur	Selektani	6
9	Desiree	1994	Dieng, Batur	Selektani	0
10	Condor	1994	Batur	Selektani	0
11	Famosa	1994	Batur	Selektani	0
12	Sante	1994	Batur, Garut	Selektani	0
13	Pepo	1997	Garut	Indofood	0
14	Columbus	2000	Garut, Dieng, Pangalengan	Sucofindo	24
15	Panda	2000	Garut	Indofood, PT Polindo Agro Nusa	2
16	Recolta	2000	Garut	Sucofindo	1
17	Aster	2000	Garut	Indofood	Trials
18	Karlana	2000	Garut	Indofood	Trials
19	Mata Merah	2000	Garut	Indofood	Trials