フィリピン共和国
科 学 技 術 省

フィリピン共和国
地場産品競争力強化のための
包装技術向上プロジェクト

＜技術協力成果品(1)＞

各種計画及びスケジュール

平成 29 年 3 月
(2017 年)

独立行政法人
国際協力機構（JICA）

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1.1　全体作業工程

(Revised: 2017/3/10)

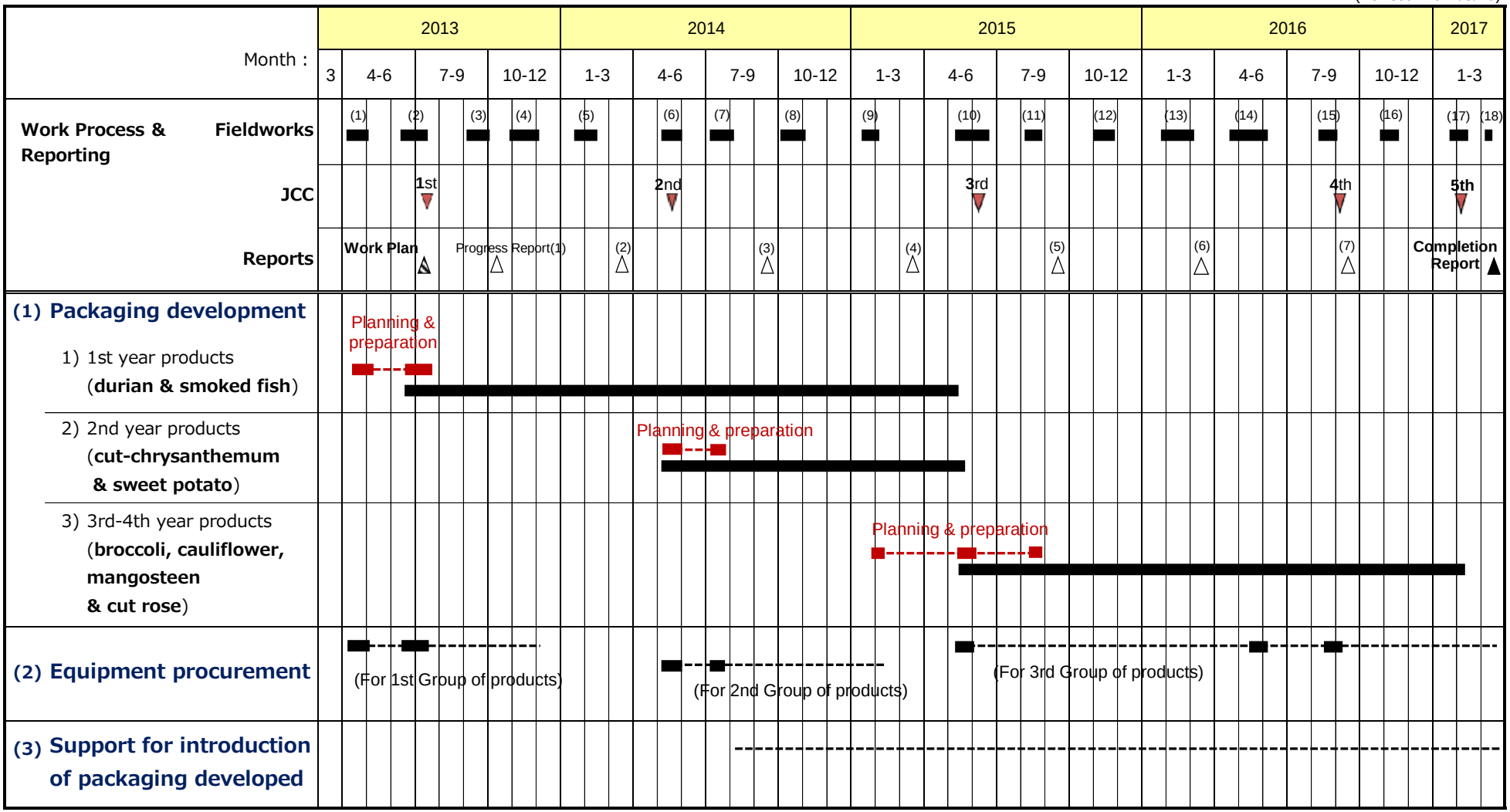

図 1　全体作業工程

1.2　作業工程計画

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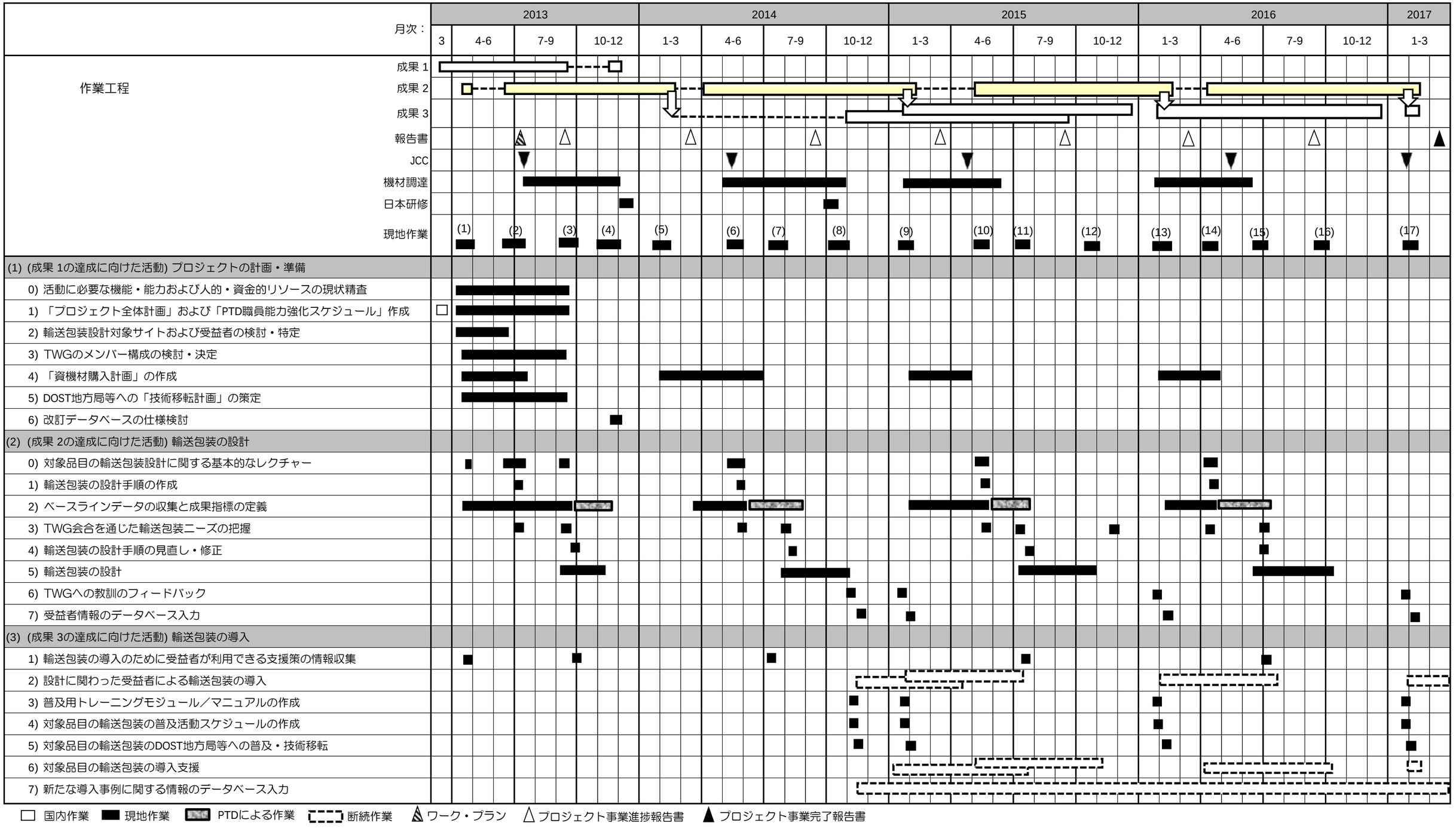
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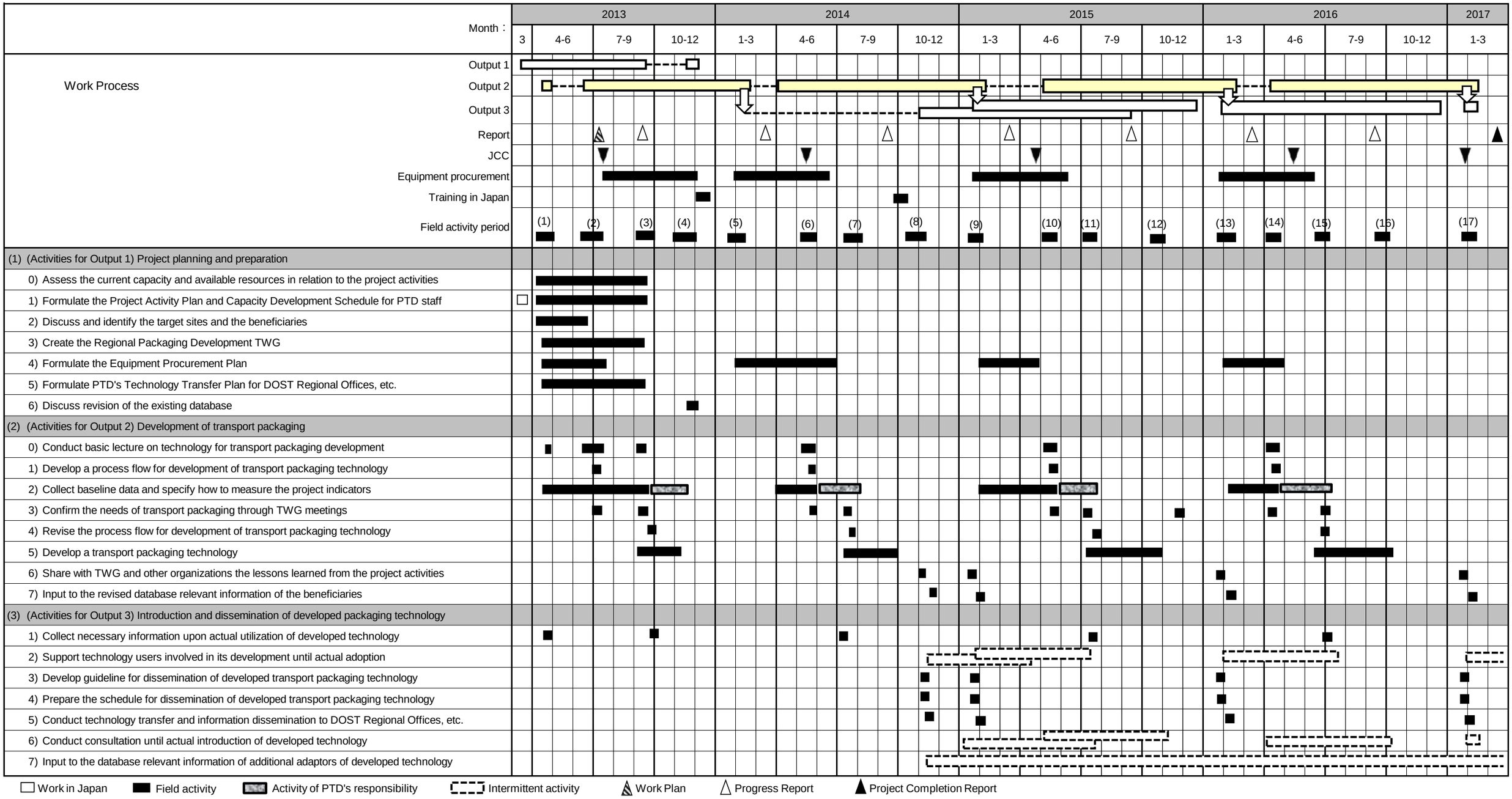
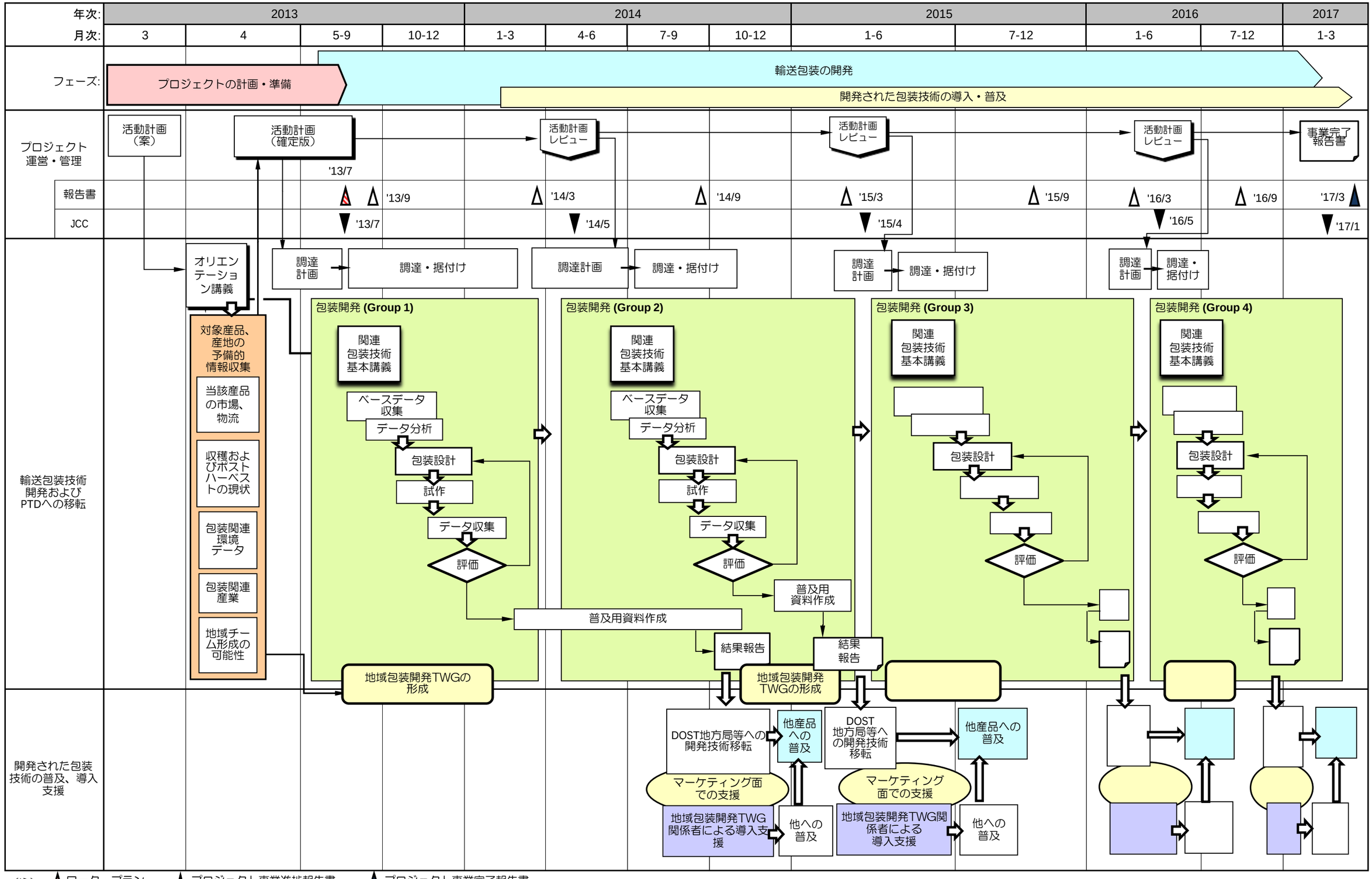
Table 3 Project Work Process Diagram



1.3　業務フローチャート

2.3 業務フローチャート



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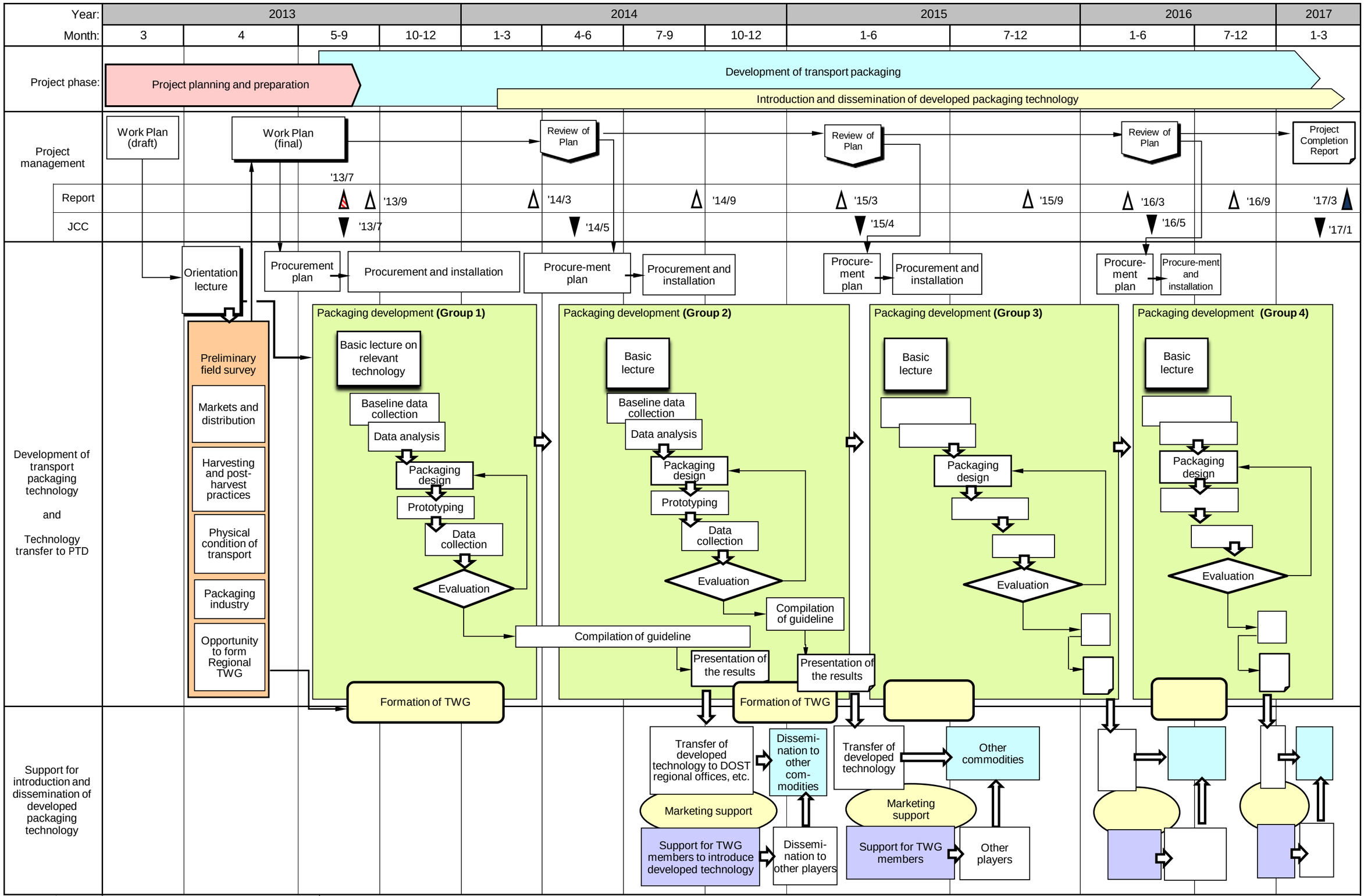


Figure 1 Project Flowchart

2　技術移転ならびにPTD職員能力強化計画

2.1　1 年次計画

2.1.1 作業計画概要

Annex 3 Research Plan

Module 1: Overview			Implementation timing
Introduction: Appropriate Transport Packaging			(F2)
	1)	Concept of "Appropriate Transport Packaging"	
	2)	Economics of the appropriate transport packaging development	
(1)	Packaging of agricultural products to preserve quality/freshness against the environmental change in the distribution and transportation process		(F2)
	1)	Characteristics of packaging of agricultural products	
	2)	Factors affecting the deterioration	
	3)	Packaging technologies against the deterioration factors	
(2)	Packaging of the agricultural products to protect the products against external forces in the distribution and transportation process		(F2)
	1)	External forces in the distribution and transportation process, and damages and losses caused by them	
	2)	Packaging technologies and materials against the damages	
		1 Moisture prevention and waterproof	
		2 Buffer packaging	
		3 Fixation	
	3)	Outline of the transport packaging design process	
		1 Outline of the design process	
		2 Factors to be taken into consideration	
		3 Evaluation tests	
		- Laboratory test vs. actual transport process test	
		- Comparative test vs. absolute test	
		- Testing procedure	

2.1.2 燻製魚

Module 2: Smoked Fish (Smoked fish frozen & packed in Bataan)(*1)

Objective of the Packaging Development		
(1)	Development of the packaging, which enables distribution of the product without freezing (targeting herring and mackerel), for:	
	1) Distribution cost reduction without using cold chain	
	2) Geographic expansion of the trading areas with extension of the shelf-life of the products	
	3) Improvement and preservation of the flavor of the product for value adding (to enable use of the packaging to be developed)	
(2)	Improvement and preservation of flavor of the packed and frozen smoked milkfish	
(3)	Development of cushioning materials which protect the product from damages caused by the external forces in the distribution process (*2)	

Target Packaging Technologies		
(1) & (2)	1) Heat-pasteurizing packaging	
	2) Anti-oxidization packaging	
(3)	Improvement of corrugated packaging and cushion materials (Provisional)	

Fact finding		Implementation timing
(1) & (2)	Analysis of current processing conditions	(F2 w/follow-up by PTD)
	1) Level and range of salt concentration of the products	
	2) Level and range of water activity of the products	
	3) Difference in flavor of the product according to the varied processing conditions	(F3 w/follow-up by PTD)
	4) Difference in flavor of the product according to the freshness of raw material fish	
(3)	Confirmation of the damages caused in the distribution and transportation process	(F3 w/follow-up by PTD)

		Trial and development	Implementation timing
(1) & (2)	1)	Transportation of raw material fish with ice-water	(F3)
	2)	Improvement of salting and water treatment of fish	(F3 w/follow-up by PTD)
	3)	Improved control of water activity of the smoked fish	
	4)	Boil pasteurization after packing the smoked fish	
	5)	Identification of boiling-resistant packaging materials	(F3 w/follow-up by PTD)
	6)	Sensory test of the products of the different treatment in the above	
	7)	Confirmation of the shelf-life of the product with the boil-pasteurization & anti-oxidization packaging	(F4 w/follow-up by PTD)
	8)	Economics and applicability of the developed packaging	
(2)	1)	Identification and evaluation of the cushion materials (Laboratory test & transportation test)	(F3 w/follow-up by PTD)
	2)	Design and performance evaluation of the corrugated packaging (Laboratory test & transportation test)	(F4 w/follow-up by PTD)
	3)	Economics and applicability of the developed packaging/ cushion materials	

Note: (*1) Since the proposed improvement practice in the above will not be effective to ensure the pasteurization of the products, according to the initial observation of the products and processing practice of Bataan, the target site needs to be changed.

(*2) Trial & development (3) is applicable only to the products of good value with the trial and development (1).

Research Title:	Development of the packaging, which enables distribution of the product without freezing (targeting herring and mackerel)
Category	■ Base-line / fact finding survey ☐ Trial & development ☐ Others (Specify):
Objective	To study the processing conditions currently practiced to assess the applicability of the proposed heat-pasteurizing packaging and anti-oxidization packaging in extending the shelf-life of the products without destroying the flavor

Research Plan:		Particular	Date	Person in charge	Venue	Materials and equipment	Condition
	1)	Measurement of the Aw of the samples					5 samples each per processor
	2)	Measurement of the salt concentration of the same samples used in 1) above					
	3)	From 1) & 2) above, confirmation of the decrease in Aw in proportion to the salt concentration					(If no correlation between the Aw and the salt concentration is found, the following works will be discontinued.)
	4)	Confirmation of the shelf-life of the current products					
	5)	Confirmation of the current processing & packaging practice					
		a) Method of transportation and storing of the raw material fish					
		b) Temperature for boil pasteurization					
		c) Method of salting					
		d) Packaging materials used (for individual and transport packaging)					

Research Title:	Development of the packaging, which enables distribution of the product without freezing (targeting herring and mackerel)
Category	☐ Base-line / fact finding survey ■ Trial & development ☐ Others (Specify):
Objective	Application of boil-pasteurization packaging and anti-oxidization packaging to the smoked fish for preserving the flavor without freezing, while improving the quality and flavor of the products with controlling water contents and salting, and other processing practices

Research Plan:		Particular	Date	Person in charge	Venue	Materials and equipment	Condition
	1)	Transportation of raw material fish with ice-water					
	2)	Improvement of salting and water treatment of fish					
	3)	Improved control of water activity of the smoked fish					
	4)	Sensory test of the products of the different treatment in the above					Comparison of the cases "with" and "without" of each treatment of 1)～3)
	5)	Boil pasteurization after packing the smoked fish					
		a) Identification of boiling-resistant packaging materials					
		b) Confirmation of the shelf-life of the product with the boil-pasteurization					Use of samples of the products selected in 4) above
	6)	Use of anti-oxidization packaging					
		a) Identification of anti-oxidization packaging materials					
		b) Confirmation of the shelf-life of the product with the anti-oxidization packaging					Use of samples of the products selected in 4) above
	7)	Evaluation of the economic viability of the proposed processing practice and use of the developed packaging					

Research Title:	Improvement and preservation of flavor of the packed and frozen smoked milkfish
Category	■ Base-line / fact finding survey ☐ Trial & development ☐ Others (Specify):
Objective	To study the processing conditions currently practiced to assess the applicability of the proposed processing practice and anti-oxidization packaging in enhancing the flavor of the product

Research Plan:		Particular	Date	Person in charge	Venue	Materials and equipment	Condition
	1)	Measurement of the Aw of the samples					5 samples each per processor
	2)	Measurement of the salt concentration of the same samples used in 1) above					
	3)	From 1) & 2) above, confirmation of the decrease in Aw in proportion to the salt concentration					(If no correlation between the Aw and the salt concentration is found, the following works will be discontinued.)
	4)	Confirmation of the shelf-life of the current products					
	5)	Confirmation of the current processing & packaging practice					
		a) Method of transportation and storing of the raw material fish					
		b) Temperature for boil pasteurization					
		c) Method of salting					
		d) Packaging materials used (for individual and transport packaging)					

Research Title:	Improvement and preservation of flavor of the packed and frozen smoked milkfish
Category	☐ Base-line / fact finding survey ■ Trial & development ☐ Others (Specify):
Objective	Application of anti-oxidization packaging to the smoked fish for preserving the flavor, while improving the quality and flavor of the products with controlling water contents and salting, and other processing practices

Research Plan:		Particular	Date	Person in charge	Venue	Materials and equipment	Condition
	1)	Transportation of raw material fish with ice-water					
	2)	Improvement of salting and water treatment of fish					
	3)	Improved control of water activity of the smoked fish					
	4)	Sensory test of the products of the different treatment in the above					Comparison of the cases "with" and "without" of each treatment of 1)～3)
	5)	Use of anti-oxidization packaging					
		a) Identification of anti-oxidization packaging materials applicable for frozen products					
		b) Confirmation of the shelf-life of the product with the anti-oxidization packaging					Use of samples of the products selected in 4) above under the freezed condition
	6)	Evaluation of the economic viability of the proposed processing practice and use of the developed packaging					

Research Title:	Study on conditions of transportation of the smoked fish without freezing
Category	■ Base-line / fact finding survey ☐ Trial & development ☐ Others (Specify):
Objective	1. To study the external forces which might cause damages of the smoked fish in the process of transportation 2. To study the factors to deteriorate quality of the smoked fish in the process of transportation (Non-frozen products)

Research Plan:		Particular (*)	Date	Person in charge	Venue	Materials and equipment	Condition
	1)	Confirmation fo the damages and deterioration of the quality of the products developed and packaged in the Research (1)-2					Through actual transportation tests
	2)	Measure the external forces affecting the products in the process of transportation 1. Vibration (with potentiometer / data logger) 2. Compression (through observation of stacking condition) 3. Handling, road condition, water and sunlight exposure, etc. (through observation)					
	3)	Measure the change in environmental conditions supposed to affect the products in the process of transportation 1. Temperature (with potentiometer / data logger) 2. Relative humidity (with potentiometer / data logger), etc.					

Note(s): (*) Implementation of 2) and 3) are subject to the results of the tests 1).

Research Title:	Development of cushioning materials which protect the product from damages caused by the external forces in the distribution process
Category	☐ Base-line / fact finding survey ■ Trial & development ☐ Others (Specify):
Objective	- Reduce damages to the product during transportation

Research Plan:		Particular	Date	Person in charge	Venue	Materials and equipment	Condition
	1)	Define the required conditions (*Research No. Smoked Fish (3)-1*)					
	2)	Design a cushion materials					
	3)	Verify the economic viability of the designed models					
	4)	Verify the strength of the modelcushion materials through a drop test, a vibration test, a compression test and other relevant tests, and select viable models taking into account the economic conditions					
	5)	Verify the strength of the selected models through actual use					
	6)	Make final selection and evaluate the results					

2.1.3 ドリアン

Module 3: Frozen Durian (Harvested, frozen & packed in Davao) **(Ver. 2.0)**

(July 5, 2013)

Objective of the Packaging Development

(1) Better marketing of excess production in the peak season for alleviation of tumbling fresh durian price in the market

- 1) Freezing and storing fresh durian to be supplied in the market later and thus extending the season of the variety of durian
- 2) Mitigation of the smell of durian products which has made the consumer feel awkward to carry the product, with intention to open selling opportunities currently obstructed by the smell

(2) Expansion of the geographic area where frozen durian is marketed, through a packaging technology appropriate for long-distance transportation

Target Packaging Technologies

(1) 1) Individual packaging of frozen durian which best preserves the quality of the produce for months

2) Flavor-keeping packaging of frozen durian which prevents the smell from coming out

(2) 1) Corrugated box packaging of frozen durian appropriate for bulk transportation to urban outlets

2) A carryout box/bag for frozen durian packaged individually with flavor-keeping materials

Fact finding	Implementation timing
(1) Quality deterioration and consumer's appreciation under the current practice of freezing and storing fresh durian	(F2 w/ follow-up by PTD)
1. Conditions of freezing, storing, shipping and retailing	
2. Palatable quality of frozen durian (color, figure, taste, flavor and texture) before shipping	
3. Freeze-resistant and flavor-keeping properties of the current packaging	
(2) Quality deterioration under the current practice of transporting and hand-carrying frozen durian	
1. Conditions of shipping, transporting, retailing and hand-carrying	
- Temperature change - Mechanical shocks	
2. Quality deteriolation of frozen durian product (unfleezing and packaging damages) after transportation to Metro Manila	

Trial and development			Implementation timing
(1)		Enhancement of marketability of frozen durian through development of consumer packaging which has sufficient freeze-resistance and good flavor-keeping properties	(F3 w/ follow-up by PTD)
(2)	1)	Reduction of mechanical damages caused in the distribution process, through development of appropriate transport packaging	(F4 w/ follow-up by PTD)
	2)	Promotion of carryout purchase of frozen durian with flavor-keeping packaging, through designing a hand-carring box/bag which keeps the product cold	

No.: Frozen Durian (1)-1

Research Title:	Study on the current conditions, quality, and consumer's appreciation of frozen durian products
Category	■ Base-line / fact finding survey ☐ Trial & development ☐ Others (Specify):
Objective	To study the current conditions, quality, and consumer's appreciation of frozen durian sold in the local market as the base-line data to evaluate the effectiveness of introducing a packaging technology that provides better freeze-resistant and flavor-keeping properties

Research Plan:		Particular	Date	Person in charge	Venue	Materials and equipment	Condition
	1)	Survey through interview and actual measurement the current conditions of frozen durian production and storage from the following perspectives: 1. Speed of freezing (time required to become completely frozen) 2. Storage temperature and its fluctuation (*1) 3. Applied packaging (type of container and materials) 4. Time length of storage before shipping 5. Shelf life					1) Fresh durian frozen in a normal freezer 2) Fresh durian frozen in a quick-freezing machine (Rosario's)
	2)	Research the (expected) properties of packaging materials currently used for frozen durian: 1. Freeze resistance 2. Flavor permeability (oxygen and water vapor permeability)					1) Conventional plastic (clamshell) containers 2) Wrapping film and pouch used for the Rosario's product
	3)	Evaluate the palatable quality of frozen durian currently in the market (sensory analysis) (*2): - Color - Figure - Taste - Flavor - Texture					1) Fresh durian 2) Fresh durian packed in a plastic (clamshell) container, frozen in a normal freezer, and thawed at room temperature just before testing 3) Fresh durian vacuum-packed, frozen in a quick-freezing machine (Rosario's), and thawed at room temperature just before testing
	4)	Survey through interview (with traders and vendors) consumer's appreciation of frozen durian products: 1. What are advantages of frozen durian products 2. What are complaints about frozen durian products 3. What would make the consumer more willing to buy frozen durian					1) Fresh durian frozen in a normal freezer 2) Fresh durian frozen in a quick-freezing machine (Rosario's)

Note(s): (*1) You can assume temperature fluctuation by observing frost accumulation on the product.

(*2) Preferablly use the same varaiety for each condition

Research Title:	Study on optimum combination of wrapping film and pouch materials for flavor-keeping packaging of frozen durian
Category	☐ Base-line / fact finding survey ■ Trial & development ☐ Others (Specify):
Objective	To identify possible materials for flavor-keeping packaging of frozen durian

Research Plan:		Particular	Date	Person in charge	Venue	Materials and equipment	Condition
	1)	Identigy potential packaging meterials: 1. Wrapping film - (a) current material at Rosario's - (b) supposedly having better smell barrier and freeze-resistance, and is available in the Philippines - (c) supposedly most recommended 2. Pouch for vacuum-packing or shirink-packing - (d) current material at Rosario's - (e) supposedly having better smell barrier and freeze-resistance, and is available in the Philippines - (f) supposedly most recommended					
	2)	Prepare packaging samples (3 samples per combination of wrapping film and pouch materials): 1. Unshell durian fruit into pieces; 2. Wrap each piece with plastic film of a potential material; 3. Freeze the wrapped pieces in a quick-freezing machine; 4. Vacuum-pack or shrink-pack each of the wrapped piece with a pouch of a potential material; and 5. put the samples one by one in a glass jar and tighten the lid.					Every combination of the potential materials identified in 1) above: - wrapping film material (a), (b) or (c); and - pouch material (d), (e) or (f) [3x3=9 patterns]
	3)	Test the combinations of potential materials for smell proofness: - conduct a sensory analysis EVERY WEEK up to 2 months after the sample preparation					1) Frozen 2) Chilled (refrigerated) 3) Room temperature
	4)	Select a few combinations of potential materials for further trial and development.					

Research Title:	Development of consumer packaging for frozen durian with sufficient freeze-resistance and good flavor-keeping properties						
Category	☐ Base-line / fact finding survey ■ Trial & development ☐ Others (Specify):						
Objective	To enhance marketability of frozen durian						
Research Plan:		Particular	Date	Person in charge	Venue	Materials and equipment	Condition
	1)	Confirm the required conditions (*Research No. Frozen Durian (1)-1*)					
	2)	Procure the packaging materials selected in *Research No. Frozen Durian (1)-2-1* , and determine the specifications of the packaging: 1. Wrapping film: thickness, size, shape, folding procedure, etc. 2. Pouch: film thickness, pouch size, seal type, filling method, etc.					
	3)	Verify the economic viability based on price/costs of the designed packaging and the findings of *Research No. Frozen Durian (1)-1* .					
	4)	Verify the strength of the models through relevant laboratory testing, and select possible models also taking into account the economic viability					
	5)	Verify the strength of the selected models through actual use					
	6)	Make final selection and evaluate the results					

Research Title:	Study on the transport and hand-carrying conditions of frozen durian and damages caused under the current practice						
Category	■ Base-line / fact finding survey ☐ Trial & development ☐ Others (Specify):						
Objective	To study the transport and hand-carrying conditions of frozen durian and damages cansed under the current practice as the base-line data to evaluate the effectiveness of introducing transport packaging and/or a hand-carrying box/bag						
Research Plan:		Particular	Date	Person in charge	Venue	Materials and equipment	Condition
	1)	Study the current practice of outer (transport) packaging of frozen durian: 1. Type and material of the container 2. Cushioning and packing methods 3. Size, weight, capacity/content of the container and determinants of the unit volume					1) Bulk transport by air cargo 2) Carry-on or check-in luggage after purchase at the airport
	2)	Measure the transport environment supposed to affect the quality of frozen durian: 1. Temperature change during transportation (with data logger) 2. Vibration, shock, dropping, etc. (with potentiometer / data logger) 3. Handling, stacking, flight condition/turbulance, etc. (through observation)					1) Bulk transport by air cargo 2) Carry-on or check-in luggage after purchase at the airport
	3)	Evaluate the damages to frozen durian after transportation to Metro Manila: - Unfreezing and frost accumulation - Pinholes, breakage, and other damages to the inner package					1) Bulk transport by air cargo 2) Carry-on or check-in luggage after purchase at the airport

Research Title:	Development of appropriate transport packaging for frozen durian
Category	☐ Base-line / fact finding survey ■ Trial & development ☐ Others (Specify):
Objective	To better preserve the quality of frozen durian and improve efficiency of cargo transportation

Research Plan:		Particular	Date	Person in charge	Venue	Materials and equipment	Condition
	1)	Define the required conditions (Research No. Frozen Durian (2)-1)					
	2)	Design a few models of transport packaging of frozen durian					
	3)	Verify the economic viability of the designed models					
	4)	Verify the strength of the model boxes through a drop test, a vibration test, a compression test and other relevant tests, and select viable models taking into account the economic conditions					
	5)	Verify the strength of the selected models through actual use					
	6)	Make final selection and evaluate the results					

Research Title:	Development of a hand-carrying box/bag for frozen durian which is efficient and effective in promoting carryout purchases by the consumer
Category	☐ Base-line / fact finding survey ■ Trial & development ☐ Others (Specify):
Objective	To enhance consumer's appreciation of the frozen durian product through improved handiness and effective presentation

Research Plan:		Particular	Date	Person in charge	Venue	Materials and equipment	Condition
	1)	Define the required conditions (Research No. Frozen Durian (1)-1 & (2)-1)					
	2)	Design a few models of hand-carrying box/bag					
	3)	Verify the economic viability of the designed models					
	4)	Verify the strength of the model boxes through a drop test, a vibration test, a compression test and other relevant tests, and select viable models taking into account the economic conditions					
	5)	Verify the strength of the selected models through actual use					
	6)	Make final selection and evaluate the results					

2.1.4 甘藷

Module 4: Sweat Potato (Produced in Tarlac and/or Bicol) **(Ver.2.1)**

(July 4, 2013)

Objective of Packaging Development and Improvement of Post-harvest Treatment

(1) Protection of sweet potato from mechanical damages in the harvest and post-harvest process

- Application of appropriate handling and packaging practices to protect sweet potato from mechanical damages in the harvest and post-harvest process.

(2) Value adding to sweet potato through appropriate post-harvest treatment

1) Curing sweet potato of the mechanical damages caused in the harvest and farm-to-storage transport process

2) Increasing sweetness of sweet potato through maturation during the storage

(3) Market development of the value-added sweet potato

Target Packaging Technologies and Post-harvest Treatment

(1) Use of a container suitable for the harvest and post-harvest process, including curing and maturing treatment.

(2) 1) Intensive curing right after harvest under the optimum conditions of temperature, humidity, and time period (*1)

2) Long-term storage under the controlled temperature and humidity to foster maturation (*2)

(3) Corrugated box packaging for shipping, storage-to-retail transport, and retailing

Fact finding		Implementation timing
(1)	Harvesting conditions and mechanical damages under the current practice	(F2 w/follow-up by PTD)
	1. Harvesting conditions (Air temperature and produce temperature)	
	2. Mechanical damages during harvesting	
(2)	1. Current curing practice (conditions and effects by variety of sweet potato) (*1)	
	2. Current storage and maturing practice (conditions, damage / quality deterioration, and maturing effects by variety of sweet potato) (*2)	
(3)	1. Storage-to-retail transportation conditions and damages under the current practice	
	2. Packaging currently used for shipping and retailing in the middle to high-end markets	
	3. Retail prices of sweet potato in the middle to high-end markets by grade under the current grading system	

Trial and development			Implementation timing
(1)		Reduction of mechanical damages caused in the process of harvesting, post-harvesting, and storage, through introduction of an appropriate container to be used throughout the process until repackaging before shipment	(F3 w/follow-up by PTD)
(2)	1.	Quality improvement through defining the optimum curing condition (*1)	(Initial trials under the PTD's project)
	2.	Quality improvement through defining the optimum storage and maturating condition (*2)	
(3)		Enhancement of marketability of value-added sweet potato through designing a corrugated box to be used for shipping through retailing	(Initial trials under the PTD's project)

Notes: (*1) Initial setting for trial will be 30 ℃ with the relative humidity 90% or higher

(*2) Initial setting for trial will be 13 ℃ (12～15 ℃)

No.: Sweet Potato (1)-1

Research Title:	Study on the harvesting conditions and mechanical damages to sweet potato under the current practice (in Albay)
Category	■ Base-line / fact finding survey ☐ Trial & development ☐ Others (Specify):
Objective	To study the harvesting conditions and mechanical damages under the current practice as the base-line data to evaluate the effectiveness of using a container in the harvest and post-harvest process

Research Plan:		Particular	Date	Person in charge	Venue	Materials and equipment	Condition
	1)	Confirm the grading system currently used (*1)					
	2)	If the current grading system is not sufficient to measure the level of mechanical damage, devise the grading system for the present research purpose					
	3)	Classify sweet potato samples according to the above grading system and count the samples classified in each grade					1) Immediately after harvested and packed in a sack (3 sacks) 2) When the produce arrives at the warehouse or local consolidating point (3 sacks)
	4)	Measure the atmosphere temperature at the harvest site					5 locations in a field
	5)	Measure the surface temperature of the produce just before packing in a sack					5 pieces at the different locations in a field

Note(s): (*1) Need to confirm how the damage to the produce is evaluated by the buyers

Research Title:	Study on the current practice of storage, and effectiveness of using a container for reduction of mechanical damage to sweet potato in the harvest and post-harvest process (in Albay)
Category	☐ Base-line / fact finding survey ■ Trial & development ☐ Others (Specify):
Objective	To know the required conditions and effectiveness of a container to be used in the process of harvesting, post-harvesting and storage

Research Plan:		Particular	Date	Person in charge	Venue	Materials and equipment	Condition
	1)	Measure the effectiveness of using containers in the harvest and post-harvest process (*1): [1] prepare plastic containers currently available in the market, place sweet potatoes in the container right after digging, and carry the produce kept in the container all to the warehouse or local consolidating point; while [2] classify sweet potato samples according to the same grading system as used in *Research No. Sweet Potato (1)-1* , and count the samples classified in each grade .					1) Immediately after harvested and put in a container (3 containers) 2) When the produce arrives at the warehouse or local consolidating point (3 containers)
	2)	Measure the atmosphere temperature at the harvest site					5 locations in a field
	3)	Measure the surface temperature of the produce just before putting in a container					5 pieces at the different locations in a field
	4)	Observe and record the current conditions of the warehouse 1. Stacking or piling-up height 2. Temperature and humidity 3. Unloading, handling, piling and shipping practice, and equipment used					

Note(s): (*1) Except using a plastic container from right at the digging point, handling practices must be maintained as usual. For example, if they normally cover the harvested potatoes with potato leaves, do the same for this survey.

Research Title:	Development of a container to be used in the process of harvesting, post-harvesting and storage of sweet potato						
Category	☐ Base-line / fact finding survey ■ Trial & development ☐ Others (Specify):						
Objective	To reduce mechanical damages to the produce caused in the process of harvesting, post-harvesting and storage						
Research Plan:		Particular	Date	Person in charge	Venue	Materials and equipment	Condition
	1)	Confirm the required conditions (*Research No. Sweet Potato (1)-2-1*)					
	2)	Procure / develop the container(s): 1. Plastic container available in the market 2. Bamboo container available in the market 3. Bamboo container designed for the project 4. Others					
	3)	Verify the economic viability based on price/costs of the target containers and the findings of *Research No. Sweet Potato (1)-2-1* , and select possible models of the container					
	4)	Verify the strength of the target containers through a compression test, a vibration test, and other relevant tests, and select possible models also taking into account the economic viability					
	5)	Verify the strength of the selected models through actual use					
	6)	Make final selection and evaluate the results					

No.: Sweet Potato (2)-1

Research Title:	Study on the current practice of curing, storing and maturing sweet potato (in Bicol)
Category	■ Base-line / fact finding survey ☐ Trial & development ☐ Others (Specify):
Objective	To study the curing, storing and maturing conditions and their effects under the current practice as the base-line data to evaluate the effectiveness of introducing optimum conditions

Research Plan:		Particular	Date	Person in charge	Venue	Materials and equipment	Condition
	1)	Survey through interview the current practice of curing, storing and maturing sweet potato by variety - The time length from harvesting to shipping					5 growers each for major varieties: 1) Kinerots (Super bureau) in Tarlac, and 2) Tres Colores in Albay
	2)	For any storing practice existing currently, measure the conditions and effects under the current practice: 1. Temperature 2. Relative humidity 3. Damage / quality deterioration (sprouting, dehydration, molds, insects, etc.) 4. Curing effects (through observing cork layer formation and measuring the level of damage according to the grading system devised in *Research No. Sweet Potato (1)-1*) 5. Maturing effects (through measuring sweetness before and after storage)					If there is no curing and maturing practice in the production sites currently, then; measure the change in damages and sweetness at the time of arriving at the storage or consolidation point, and at the time of shipping
	3)	Research for literature on curing, storing and maturing sweet potato in the Philippines and abroad.					

No.: Sweet Potato (2)-2

Research Title:	Study on optimum conditions for curing, storing and maturing sweet potato (from Albay)						
Category	☐ Base-line / fact finding survey ■ Trial & development ☐ Others (Specify):						
Objective	To know the suitable conditions and effectiveness of curing, storing and maturing sweet potato						
Research Plan:		Particular	Date	Person in charge	Venue	Materials and equipment	Condition
	1)	Prepare sweet potato samples: 1. Visit a farm and harvest sweet potato to obtain samples with the following harvesting method: 1) currently practiced method, 2) using containers at the harvest 2. Transport the samples from the producing site to the trial site with currently practiced transportation metho for the sample 1), and using the container for the sample 2). 3. Prepare the samples for the present trial: - Number each piece of samples for identification - Randomly select 10 fixed samples for weight measurement					Approx. 100 pieces of one variety of sweet potato for each of the harvesting method
	2)	Store all of the samples under controlled temperature and humidity for 4 days and measure the curing effects EVERY DAY from the following perspectives: 1. Cork layer formation of selected 5 fixed pieces with bruises and cuts (observation and picture-taking) 2. Weight of the 5 fixed pieces selected in 1. above 3. Weight of the 10 fixed pieces determined in 2) above 4. Temperature and humidity of the storage					Control the temperature at 30℃ and the relative humidity at 90%
	3)	Keep the 5 pieces with bruises and cuts selected in 2) above under the curing condition up to additional 10 days (2 weeks in total) and continue EVERY DAY measurement/observation of: 1. Cork layer formation 2. Weight 3. Temperature and humidity of the storage					Control the temperature at 30℃ and the relative humidity at more than 90%
	4)	Move all the samples EXCEPT those for 3) above to the long-term storage under controlled temperature and humidity for up to 6 months and measure the maturation effects EVERY WEEK from the following perspectives: 1. Sugar content (Randomly select 3 pieces, pick out a 1cm^3 dice from the core of each piece, measure the sugar content with the refraction meter, and record the identification number and the sugar content) 2. Weight of the 10 fixed pieces determined in 2) above 3. Temperature and humidity of the storage					Control the temperature at 13℃ and the relative humidity at more than 90%
	5)	Survey and record the farm gate price of the variety under the present trial at following points of time: 1. When the samples are harvested 2. When the samples are moved to the long-term storage 3. Every time of the weekly measurement of maturation effects					1) in Albay 2) in Tarlac

Note(s): 1 If good results are not obtained from the above 1) ～4) trial, retry changing the temperature and humidity conditions

2 Samples are to be test-marketed at "AgriLink", October 2013.

Research Title:	Study on conditions of transportation, distribution and retailing of sweet potato, in the middle to high-end markets
Category	■ Base-line / fact finding survey ☐ Trial & development ☐ Others (Specify):
Objective	1. To study the damages caused in the process of transportation, distribution and retailing 2. To study the issues in the process of transportation, distribution and retailing on deterioration of quality of the sweet potato. (Both are in view of the sweetbpotato marketed in the middle to high-end markets.)

Research Plan:		Particular	Date	Person in charge	Venue	Materials and equipment	Condition
	1)	Confirm the grading system currently used (*1)					
	2)	Classify sweet potato samples according to the above grading system and count the samples classified in each grade					1) Just before shipping from the warehouse or local consolidating point in the producing site (5 boxes) 2) When the sweet potato arrives at the retailer (5 boxes)
	3)	Measure the external forces affecting the produce in the process of transportation, distribution and retailing 1. Vibration (with potentiometer / data logger) 2. Compression (through observation of stacking condition) 3. Handling, road condition, water and sunlight exposure, etc. (through observation)					
	4)	Measure the change in environmental conditions supposed to affect the produce in the process of transportation, distribution and retailing 1. Temperature (with potentiometer / data logger) 2. Relative humidity (with potentiometer / data logger), etc.					

Note(s): (*1) Need to confirm how the damage to the sweetpotato and sweetness is evaluated by the buyers and middle to high-end consumers.

Research Title:	Study on the current retail packaging of sweet potato targeting the middle to high-end markets
Category	■ Base-line / fact finding survey ☐ Trial & development ☐ Others (Specify):
Objective	To know the required conditions of the packaging to be used in the process of transportation, distribution and retailing of the sweet potato targeting the middle to high-end markets

Research Plan:		Particular	Date	Person in charge	Venue	Materials and equipment	Condition
	1)	Study the current practice of packaging at the retail shops targeting the middle to high-end markets: 1. Requirements to sweet potato to be accepted by the middle to high-end consumers 2. Retail packaging 3. Where the produce is retail-packaged 4. Price difference compared with the low-end markets 5. Purchase volume and determinants of the volume 6. Estimated market size for the middle to high-end produce 7. Basic profiles of the middle to high-end consumers					
	2)	Study the requirements to the retail packaging of the sweet potato 1. Size and weight of the contents; reason of the current size and weight 2. Conditions/assumptions of the display space 3. Consumer/retailor preference for carryout packaging 4. Public regulations, retailor policies, and other considerations					

Research Title:	Development of a corrugated box good for transportation, distribution and retailing of sweet potato
Category	☐ Base-line / fact finding survey ■ Trial & development ☐ Others (Specify):
Objective	1. Reduce damages to the produce during transportation and distribution 2. Ease handling and prevent damages at retail shops 3. Differentiate the presentation of good quality sweet potato at retail shop display (supermarkets, etc.)

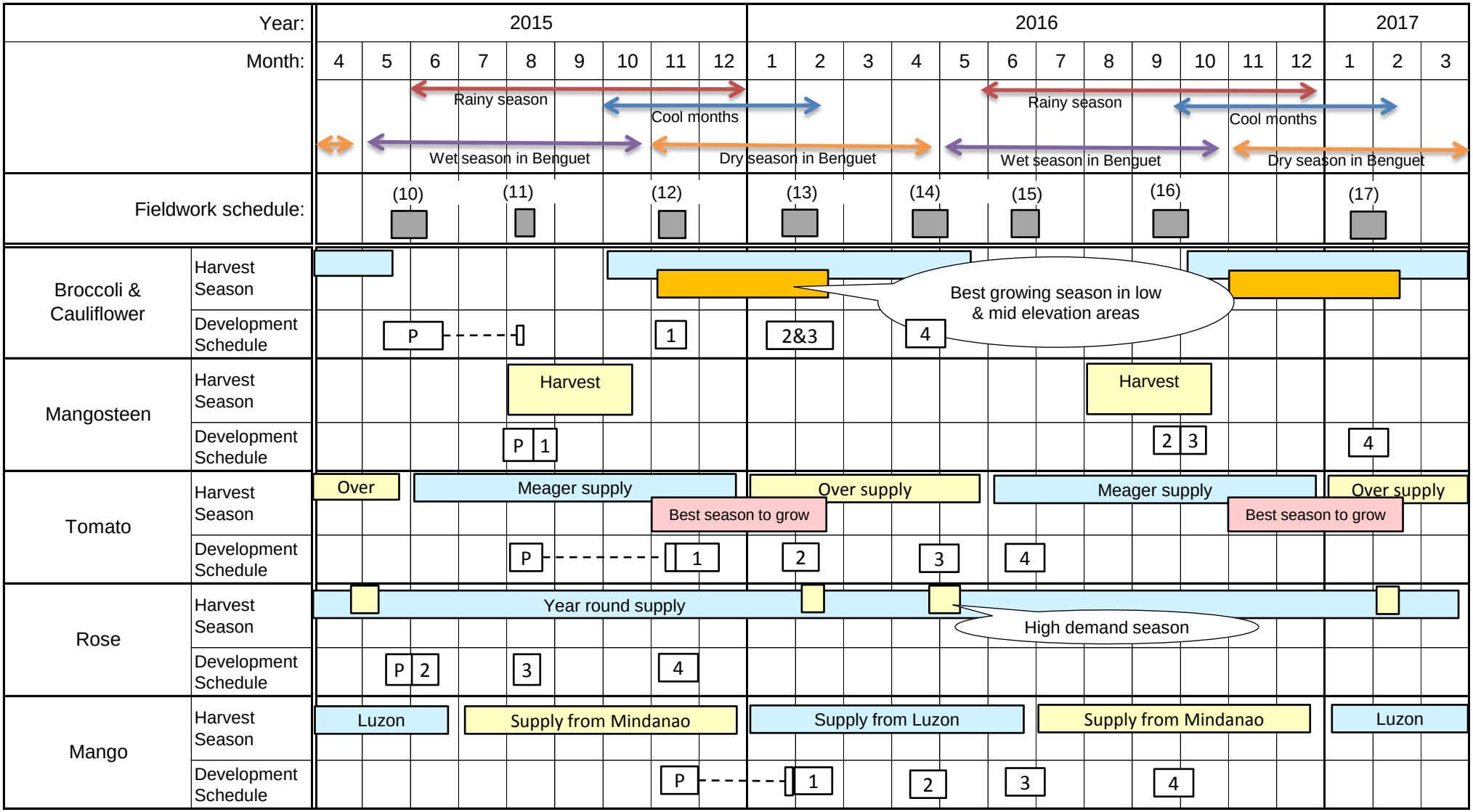
Research Plan:		Particular	Date	Person in charge	Venue	Materials and equipment	Condition
	1)	Define the required conditions (*Research No. Sweet Potato (3)-1-1&2*)					
	2)	Design a corrugated box(es)					
	3)	Verify the economic viability of the designed models					
	4)	Verify the strength of the model boxes through a drop test, a vibration test, a compression test and other relevant tests, and select viable models taking into account the economic conditions					
	5)	Verify the strength of the selected models through actual use					
	6)	Make final selection and evaluate the results					

Note(s): To be test-marketed at "AgriLink", October 2013.

2.3　3-4 年次計画

2.3.1 作業計画概要

Overall Package Development Schedule



Note: For contents of the development steps, see Table 3.

Package Development Process

Steps	Activities
Preparation 1	1 Understanding the issues and the package development needs of the product at the target production site, through survey and consultation with the stakeholders 2 Setting the package development target with taking into account the conditions at the target production site
Preparation 2	1 Lecture on the factors affecting the quality deterioration and damages/losses, and potential packaging technologies and post-harvest treatment to meet the needs of the potential users of the package 2 Lecture on packaging and post-harvest treatment practiced in Japan 3 Design of the Step 1 experiment plan in detail, for collecting the baseline data and confirming the extent of effectiveness of individual measures against the factors affectig quality deterioration and damages/losses. 4 Preparation for implementation
Step 1	1 Conduct of the Step 1 experiments 2 Review and evaluation of the results of the Step 1 experiments 3 Preparation and conduct of the supplementary experiments of the Step 1 experiment, if necessary
Step 2	1 Preparation of the Step 2 (laboratory-based) experiments, which is to verfy the effectiveness of proposed packaging & post-harvest treatment for improving or solving the problems defined, on the basis of the results of the Step 1 experiments. 3 Implementation of the 2nd Step experiments. 4 Review of the experiment results and evaluation of the effectivenes of the proposed packaging and post-harvest treatment in view of defined package development target 5 Preparation and conduct of the supplementary experiments for the Step 2 experiment, if necessary 6 Design and preparation of the actual transportation test, based on the results of the 2nd Step experiments
Step 3	1 Implementation of the actual transportation test 2 Review of the experiment results and evaluation of the effectivenes of the proposed packaging and post-harvest treatment. 3 Preparation and conduct of the supplementary experiments of the actual transportation tests, if necessary 4 Summary of the packaging development results
Step 4	1 Presentation of the package development results to the TWG, and collect responses from the possible package users 2 Preparation of the package development guideline for futher support for the potential users to apply the results, reflecting responses from the potential package users

2.3.2 ブロッコリ・カリフラワー

[Broccoli & Cauliflower]

September 2016

Experimental Plan of Broccoli/Cauliflower for Package Development and Improved Post-harvest Treatment (ver. 8.0)

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1 Verification Tests of Broccoli/Cauliflower for Freshness Preservation

(1) Objective

Findings from the previous verification tests

In the past laboratory-based experiments conducted in April/May 2016, we could obtain the following results:

1) 2 days longer shelf-lives with equilibrium gas condition with LLDPE (20 μ m) under 30, 20 & 13℃ compared with that of no package
2) However, package of LLDPE (20 μ m) is not favorable in view of marketability due to poor visibility of the content broccoli
3) At the same time, even in the bag with 5 holes we observed dew condensation, which is also not favorable in view of marketability, although rotting was observed only after the end of the shelf-life

Besides the above, through the actual transportation tests, which were conducted also in April/May 2016, use of Green Pack EG showed a good result in prolonging the freshness of broccoli.

Based on the above, the current experiment is to try to:

1) Find out the package of the broccoli with better visibility with using OPP (20 μ m) (anti-fogging type) with different numbers of pin-holes on the film

2) Reduce the dew condensation in the package placing water-absorbing sheet inside the package, and

3) Verify applicability of the package to cauliflower[1].

(2) Cases for verification tests of freshness preservation

1) Broccoli

Stored Temperature	w/o packag'g	w/ packaging					
		LLDPE (20μm)	OPP (20μm)				
			w/o hole	w/ holes (Number of holes)			
				4	8	12	16
Room temperature 25ºC	3pcs	1pcs x 3bags			1pcs x 3bags	1pcs x 3bags	
13ºC Chamber	3pcs		1pcs x 3bags	1pcs x 3bags	1pcs x 3bags	1pcs x 3bags	1pcs x 3bags
							w/WAS 1pcs x 2bags

Total required samples of broccoli: 32 pcs x 1.4=45pcs

2) Cauliflower

Stored Temperature	w/o packag'g	w/ packaging					
		LLDPE (20μm)	OPP (20μm)				
			w/o hole	w/ holes (No. of holes)			
				4	8	12	16
Room temperature 25ºC	3pcs	1pcs x 3bags			1pcs x 3bags	1pcs x 3bags	
13ºC Chamber	3pcs			1pcs x 3bags	1pcs x 3bags	1pcs x 3bags	1pcs x 3bags
							w/WAS 1pcs x 2bags

Total required samples of cauliflower: 29 pcs x 1.4=41pcs

(3) Procurement and transportation of samples for verification tests of freshness preservation:

1. Select samples of medium size broccoli and cauliflower

[1] Applicability tests of Green Pack EG will be conducted under the experiments of the transport-package, which is described in the later part of this paper.

- Maximum size should be the size that can be put in the pouch
- Mushroom cut (Length of stem is shorter than the height of flowers)

2. Pack in corrugated box with ventilation holes
3. Place horizontally in 2 layers in corrugated box. Use crumpled newspaper as a cushioning material.
4. Transport directly from the production site to PTD by the reefer van at low temperature of 10ºC
5. At PTD, select the products of no damage only, for experiments

(4) Observation

Frequency of observation: Every day except for Sunday

1) Broccoli

At each observation:

1. Change in weight (also observe the weight when the luster is lost)
2. Change in color (yellowing, and browning of cutting edge of stems)(**); Also measure L, a, b with color meter
3. CO_2 and O_2 content inside pouches
4. Wilting (**)
5. Decay and molds (**)
6. Smell sensor (Using gas sampler)

If O_2 content is 2% or lower, open the pouch and measure the following:

1. Brix
2. Odor/smell

Note: (**) Please take picture at each observation.

2) Cauliflower

At each observation:

1. Change in weight (also observe the weight when the luster is lost)
2. Change in color (yellowing, and browning of cutting edge of stems): take picture and measure L, a, b (**)
3. CO_2 and O_2 content inside pouches
4. Wilting (**)
5. Decay and mold (**)
6. Smell sensor (Using gas sampler)

If O_2 content is 2% or lower, open the pouch and measure the following:

1. Brix
2. Odor/smell

Note: (**) Please take picture at each observation.

(5) Test to define the end of marketability of cauliflower:

1. Procure 14 pcs of good quality cauliflower from a supermarket, and pack 1 pcs each in an 20 μ m OPP pouch with 8 holes.
2. Store all the pouches under the ambient temperature of 25℃. Check color, smell, and measure O_2 concentration, every day
3. Transfer 2 pouches of them every day to 13℃ refrigerator.
4. On the 7th day, make sensory tests after blanching (under the ambient temperature).

Total required samples of cauliflower: 14pcs x 1.4=20pcs

2 Verification Tests of Broccoli/Cauliflower for Reduction of Damages during Transportation

(1) Objective

Through the actual transportation tests and the laboratory-based tests conducted in April/May 2016, following packaging and/or method of packaging showed good effects in terms of reduction of damages of broccoli during transportation process:

1. Use of corrugated box, or plastic crate (in replacement of the currently used big PE bag, or reuse corrugated box)
2. Vertical placement of broccoli in 1 layer, and horizontal placement of broccoli in 2 layers (compared with the current practice of random placement)
3. Use of crumpled newspaper as cushioning material

Based on the above, the current experiment is to try to verify the applicability of the effective methods for cauliflower.

(2) Actual Transportation Tests

1) Record of environment condition during transportation using data logger

- Fix the Data Logger in a corrugated box (dummy box)
- Place the dummy box at the rear part of loading platform of a truck
- Environment data to be recorded (Change over time): 1) Drop shock value, 2) Vibration shock value, 3) temperature, 4) Humidity

2) Cases to be set for collecting data on damage during transportation process:

Package & method of placement	PE bag	Plastic crate		Corrugated box	
	Random (Current practice)	Random	Horizontal	Horizontal	Vertical
w/o crumpled newspaper (Current practice)	1 case[*1)] (20 kgs)	1 case[*2)] (20 kgs)			
w/ crumpled newspaper		1 case[*3)] (20 kgs)	2 cases[*4)] (24pcs in 2 layers each)	2 cases[*5)] (24pcs in 2 layers each)	
In one HDPE bag w/ green pack EG				2 cases[*6)] (24pcs in 2 layers each)	1 case[*7)] (12pcs[(*)] in 1 layer each)

Notes: [(*)] To be adjusted according to the size of the cauliflower

[*1)～*7)] See explanatory table on the next page.

No	Specification of packages					Volume (kg/Pcs)	Placement	No. of sample to be prepared
	Material	Intermal size	Paper grade	Cushion material	Freshness keeping agent			
1	Big PE bag					20kg	Random	1
2	Plastic crate w/ cover (Corrugated sheet)	L560×W360×H290				20kg	Random	1
3	Plastic crate w/ cover (Corrugated sheet)	L560×W360×H290		Crumpled newspaper T:40㎜		20kg	Random	1
4	Plastic crate w/ cover (Corrugated sheet)	L560×W360×H290		Crumpled newspaper T:40㎜		24 pcs	Horizontal 2 Layers	2
5	Corrugated box (BC flute) w/ hole w/ cover	L510×W340×H280	B200g×S120g×S120g ×S120g×B200g	Crumpled newspaper T:40㎜		24 pcs	Horizontal 2 Layers	2
6	Corrugated box (BC flute)	L510×W340×H240	B200g×S120g×S120g ×S120g×B200g		(Green Pack EG, w/large PE bag)	24 pcs	Horizontal 2 Layers	2
7	Corrugated box (C flute)	L600×W450×H180	B200g×S120g× B200g		(Green Pack EG, w/large PE bag)	12 pcs	Vertical 1 Layer	1

Total required samples of cauliflower: 253 pcs (Calculated on the assumption of 550g/pcs)

(3) Procurement and Transportation of the Samples

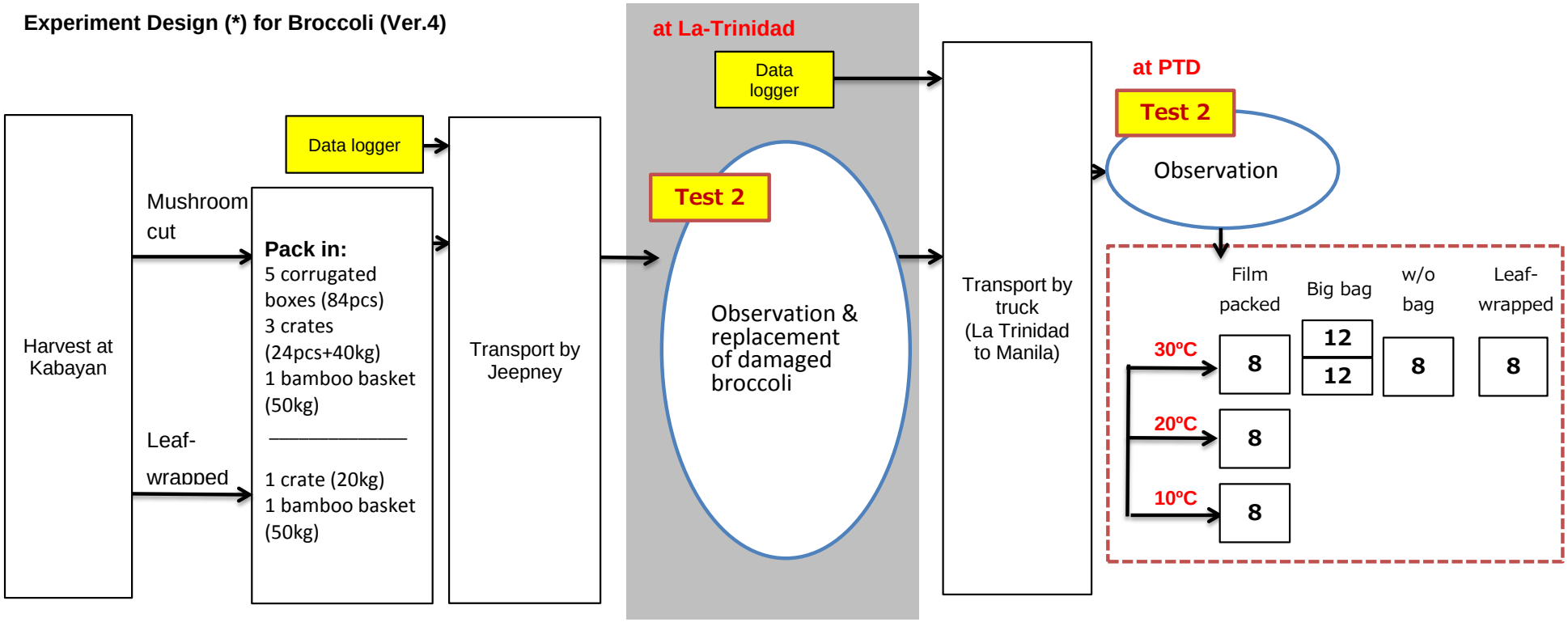
1. Farm to La Trinidad Trading Post: Follow the current practice in terms of post-harvest practice and packaging (assuming that the produce is marketed to supermarket/ institutional buyers)
2. Pack at the Trading Post (Cold Chain) according to the cases set
3. All in mushroom cut
4. To be transported by track (current practice)
5. Addition of 40 pcs of samples for laboratory based tests (to be transported by the reefer van)(packed in the same manner as the samples for freshness preservation experiments)

(4) Observation

1) Observation on the following at Cold Chain before packing, and at PTD immediately after unloaded from the track
   a) Mechanical damages
      Measurement criteria of damages:
      1. Grade A: No damage
      2. Grade B: Less than 10mm of damage
      3. Grade C: Less than 20mm of damages
      4. Grade D: Less than 30mm of damages
      5. Grade E: More than 30mm of damages and/or broken
   b) Quality deterioration in appearance (take picture)
      1. Change in color (Use the color meter and measure L-value)
      2. Turn black
      3. Off-Odor production
      4. Hardness of buds
      5. Hardness of edge of stems
      6. Drop of water
   c) Weight

2) Continued observation on the following at PTD
   - To be stored in the chamber of 25℃
   - In addition to the observation on the change of appearance, measure the change in respiration at 2 hours, 4 hours and 8 hours after arriving at PTD

Experiment Design (*) for Broccoli (Ver.4)



Note: (*) Sample only.

2.3.3 マンゴスチン

[Mangosteen]

August 21, 2016

Experimental Plan of Mangosteen for Package Development and Improved Post-harvest Treatment (ver. 3.1)

1 Verification Tests of Mangosteen for Freshness Preservation

(1) Objective

In the past laboratory-based experiments conducted in August 2015, and the succeeding experiments in September and October 2015, we could not obtain the reliable results in terms of freshness preservation effects of the proposed packaging because of inconsistent trial results among the trials.

Based on the above, we will undertake the verification tests of the proposed package of films, which we hope are effective also for mangosteen based on the experiments conducted on broccoli, mango and tomato, focusing on the following:

1. Packaging effective against transpiration
2. Packaging effective for preservation of freshness
3. Packaging effective against the dew condensation
4. Definition of the end points of marketable mangosteen, in terms of color, hardness and quality of edible part

In this trials, the mangosteen is assumed to be sold in domestic market (not in wet markets but higher end consumer markets such as souvenir markets, supermarkets, restaurants and other institutional users).

Also, we will verify the effectiveness of storing at low temperature of 13℃ in prolonging its freshness, expecting good taste for some days after putting them out of the refrigerator, with packed in a film bag. This is to verify the effectiveness of film packaging against the general observation that mangosteen, which were kept in a refrigerator, can be easily damaged its quality once it is brought out of refrigerator.

(2) Test to define the end of marketability of mangosteen:

1. Procure 14 pcs of good quality mangosteen from a supermarket, and pack 2 pcs each in an 20 μ m OPP pouch with 4 holes.
2. Store all the pouches under the ambient temperature of 30℃.
3. Transfer 1 pouch of them every day to 13℃ refrigerator.

4. On the 7th day, make sensory tests under the ambient temperature.

Total required samples of mangosteen: 14pcs x 1.4=20pcs

(3) Cases for verification tests of freshness preservation:

Stored Temperature	w/o packag'g	w/ packaging					
		LLDPE (20μm)	OPP (20μm)				
			w/o hole	w/ holes (No. of holes)			
				4	8	12	16
Room temperature 30ºC	3pcs	1pcs/bag x 2bags			1pcs/bag x 2bags	1pcs/bag x 2bags	1pcs/bag x 2bags
		2pcs/bag x 2bags			2pcs/bag x 2bags	2pcs/bag x 2bags	2pcs/bag x 2bags
20ºC Chamber	3pcs	2pcs/bag x 2bags	2pcs/bag x 2bags	2pcs/bag x 2bags	2pcs/bag x 2bags	2pcs/bag x 2bags	2pcs/bag x 2bags
							w/WAS 1pcs/bag x 2bags
					3pcs/bag x 2bags	3pcs/bag x 2bags	3pcs/bag x 2bags
							w/WAS 3pcs/bag x 2bags
						5pcs/bag x 2bags	5pcs/bag x 2bags
							w/WAS 5pcs/bag x 2bags

Total required samples of broccoli: 90 pcs x 1.4=126 pcs

(4) Cases for verification tests of freshness preservation under the low temperature of 13℃ for 3 weeks:

Stored Temperature	w/o packag'g	w/ packaging					
		LLDPE (20μm)	OPP (20μm)				
			w/o hole	w/ holes (No. of holes)			
				4	8	12	16
13ºC Chamber	3pcs	3pcs/bag x 2bags		3pcs/bag x 2bags	3pcs/bag x 2bags	3pcs/bag x 2bags	3pcs/bag x 2bags
					w/WAS 3pcs/bag x 2bags		w/WAS 3pcs/bag x 2bags

Total required samples of mangosteen: 39 pcs x 1.4=55pcs

(5) Procurement and transportation of samples for verification tests of freshness preservation (except for the test to define the end of marketability):

1. Harvest samples of 2nd stage of maturation (Light greenish yellow with 50-100% scattered pink spots)
2. Medium size mangosteen
3. Pack in reuse-corrugated box for banana (currently used corrugated box), putting cushioning material of polyurethane foam, AirCap, or crumpled newspaper, etc.
4. Transport by land using an ordinary car from the production site to Davao Airport and from Manila Airport to PTD
5. At PTD, select the products of no damage only, for experiments

(6) Observation:

At each observation:

1) Change in weight
2) Change in hardness
3) Change in color (Take picture, Observation and measure L.a.b and x,y,z by color meter)
4) CO_2 and O_2 concentration inside pouches
5) Smell sensor (Using gas sampler)

Only when O_2 content is 2% or lower (Open the pouch and measure the following):

1) Taste
2) Brix
3) Others

Note: (**) Please take picture at each observation.

2 Drop Tests of Mangosteen to observe the change in hardness with mechanical shock

(1) Objective

Rind of mangosteen is known to become harder with external mechanical shock, after 2 hours after receiving the mechanical shock. Consumers are reluctant to buy mangosteen of hard rind, since they believe quality of mangosteen will be deteriorated as the rind becomes harder. However, according to the drop test

conducted in August 2015, hardness of rind has not changed significantly after 2 hours of dropping. In addition, respiration rates of mangosteen after 2 and 4 hours of dropping, there was no consistent change in respiration rates. Respiration rates of some the samples became higher, but get back to normal soon.

The current drop test is to confirm the change in hardness of the rind with drop tests up to 24 hours after dropping.

(2) Drop Tests

Hours after dropping	Dropping height		
	1.5m	2.0m	3.0m
2 hours	4 pcs	4 pcs	4 pcs
4 hours	4 pcs	4 pcs	4 pcs
8 hours	4 pcs	4 pcs	4 pcs
24 hours	4 pcs	4 pcs	4 pcs

Total required samples of mangosteen: 48 pcs x 1.4=68 pcs

(3) Procurement and transportation of samples for verification tests of freshness preservation (except for the test to define the end of marketability):

- Same as the samples for freshness preservation tests

(4) Observation

1. Change in hardness
2. Respiration rates (measure the decrease in oxygen concentration in 2 hours from 2 hours before the specified time); namely,

Specified time (In terms of hours after dropping)	Decrease in oxygen concentration in-between	
	From: (In terms of hours after dropping)	To: (In terms of hours after dropping)
2	0	2
8	6	8
12	10	12
24	22	24

3. Observation of condition of aril

September 2016

Trial Plan for Development of New Type of Frozen Mangosteen Product (Ver.2.0)

Objective:

Develop a new type of frozen mangosteen product for value adding and expansion of the mangosteen market.

Target frozen mangosteen product:

- Open the pericarp and use small arils, which have no seed (Arils with seeds are expected to be used for other purpose)
- The arils are frozen and packed in film pouch
- The product should be good shape and natural color of white until it is consumed

Preparation of the samples:

1) Harvest: Mangosteen of **Stage 4 or 5**
2) Open the pericarp and take out the small arils of no seed (be careful not to break/deform the arils to maintain the image of mangosteen)
3) Dip in a solution containing 0.25% calcium chloride and 0.50% citric acid for one minute
4) Blast frozen and put in pouches, and heat sealed
5) Pack the pouches in a Styrofoam box for transportation
6) At PTD, store in a freezer (-18℃)

Type of the pouch:

1) Plastic pouch (form-fill-sealed) currently used for packaging of frozen mangosteen arils
2) Aluminum foil laminated pouch (for protection from light)

Number of the samples:

	Plastic pouch (form-fill-sealed)	Aluminum foil pouch
Dip in a solution before freezing	2 pouches	2 pouches (1 sealed, and 1 w/o sealed)
w/o dipping in a solution	2 pouches	2 pouches (1 sealed, and 1 w/o sealed)

Note: 1 pouch is assumed to contain arils from 6 pcs of mangosteen: 6 pcs x 8 pouches x 1.4= 68 pcs. (Adjust the volume of contents according to the size of the pouch currently used.)

Observation:

- Observation at least one time every week
  - Change in color (take picture, and measure using the color meter)
- In November during the next fieldwork period, conduct the Sensory Test

Plan of Drop Test and Vibration Test of Mangosteen

1 Drop Test

(1) Dropping direction and package (corrugated box) to be used:
See Figures 1 and 2

(2) Dropping height：

	Dropping height (cm)	Quantity (pcs)	
		Boxes	Pcs
1	40	3	12
2	80	3	12
3	100	3	12
4	150	3	12
Total No. of mangosteen required		12 boxes	48 pcs

(3) Observation/measurement： 2 hours after dropping

1) Hardness by feel by hand:
- Level 1: Very hard
- Level 2: Hard
- Level 3: Not so hard

2) Change in respiration: See Figure 3

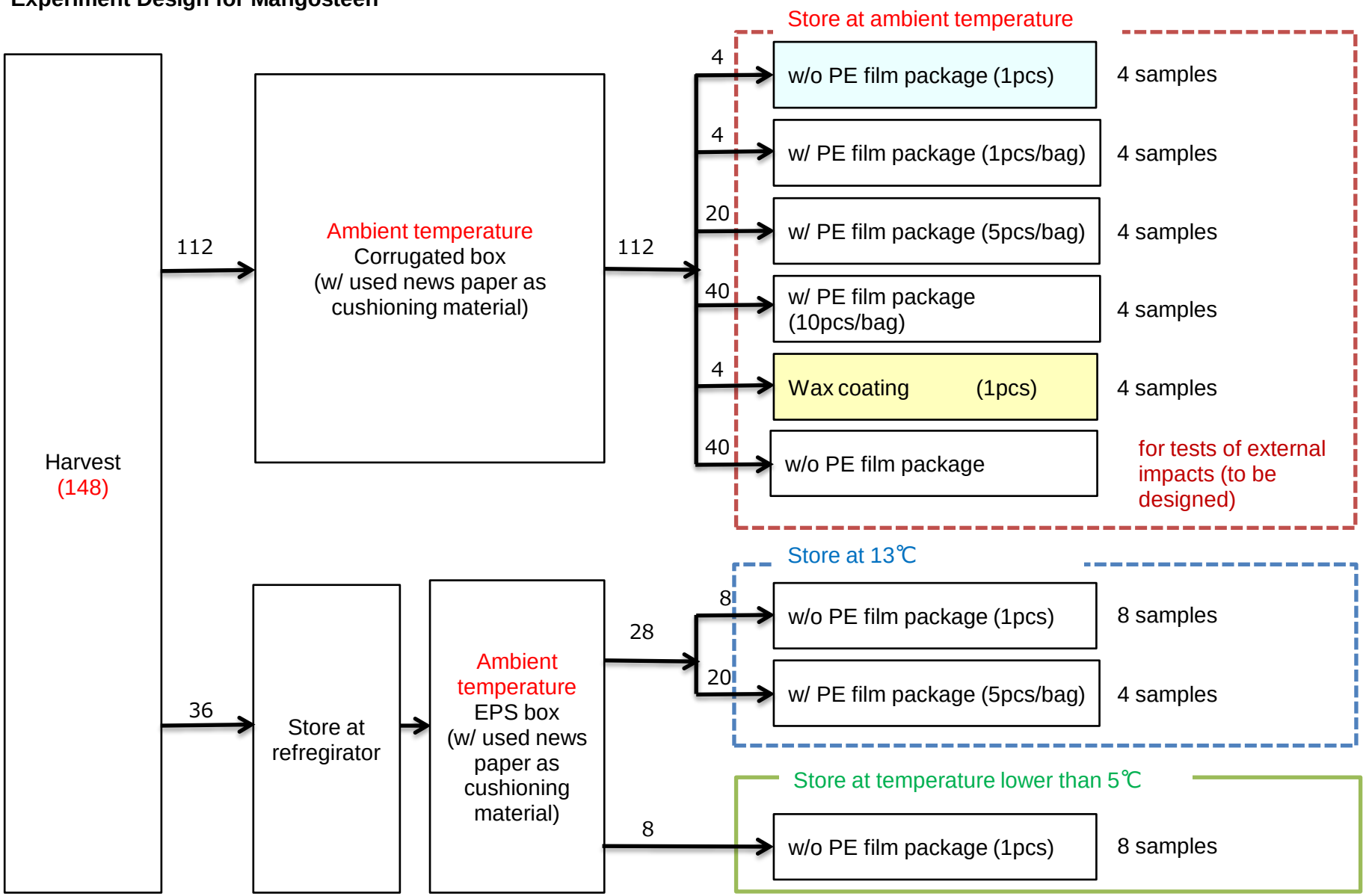
3) Other observation indexes of quality:
① Appearance: damages by visual observation
② Change in texture of the pericarp and aril (edible part) by visual obsertvation
③ Taste:
- Level 1: Good (same as that of w/o dropping)
- Level 2: Some deterioration, but acceptable
- Level 3: Not acceptable

2 Vibration Test

(1) Vibration condition:
- Level 2 (ISTM) for 20 minutes
- Package (corrugated box) to be used: see Figure 4

(2) Observation/measurement： 2 hours after vibration
⇨ See (3) of dropping test

Experiment Design for Mangosteen



2.3.4 トマト

Verification Tests for Salad Tomato for Package Development and Improved Post-harvest Treatment (Ver.3)

1 Verification Tests for Freshness Preservation and Inhibition of over-maturation

1) Collection of samples:

- Salad tomato harvested from *green house* at half-ripen and *pink-color* stage
- Transport directly from the production site to PTD by the reefer van at low temperature of 10ºC
- Packed in corrugated box with ventilation holes
- Packed in 1 layer with cushioning materials

2) Cases for verification tests of longer shelf-life, after transported to PTD by the reefer van:

Stored Temperature	w/o package	w/ film package			
		Individually			
		For prevention of transpiration	For restraining respiration		
		OPP w/big holes	OPP w/o hole sealed bag	HDPE (12μm) sealed bag	PVC wrap
Room temperature 30ºC	✓ (Current practice)	✓		✓	
20ºC Chamber	✓	✓	✓	✓	✓
13ºC Chamber	✓	✓		✓	

Notes:

1) All harvested at the half-ripen pink-colored stage; Select the products of no damage only, after transported to PTD

2) 2 pcs/bag x 7 bags for 8 cases, and (2 pcs x 7)/case for the 3 cases of w/o package (154 pcs in total). Total number of tomato required: 200 pcs including spare for samples.

3) Observation:

1) Change in weight

2) Change in color (to be recorded with picture)

3) O_2/CO_2 content inside pouches

4) Brix
5) Visual observation
6) Sensory test

2 Verification Tests for Reduction of Damages during Transportation

2.1 Measurement of environment conditions during actual transportation

・Using the data logger, measure the following:
- Change in temperature and relative humidity
- Shock and vibration

Routes:
1) Kabayan to La Trinidad (by Jeepney)
2) La Trinidad to Manila (by Truck)

2.2 Selection of Appropriate Containers and Packing Method for Transportation of Broccoli

1) Cases for experiments (Route: Kabayan to La Trinidad, by Jeepney, and La Trinidad to Manila under the ambient temperature)

Package to be used:	Bamboo basket (Current practice)	Plastic crate		Corrugated box w/ ventilation hole
		(Current practice)		
w/ individual film packaging				✓[a] 24pcs/box
1 layer				✓[b] 12pcs/box
2 layers			✓[c] 24pcs+/crate	✓[a] 24pcs/box
3 layers		✓ 25kg/crate		
Randomly	✓ 50-60kg	✓ 25kg/crate		

2) Observation at La Trinidad and in Manila on the following, immediately after unloaded from Jeepney or truck
- Mechanical and physiological damages (change in color, hardness, etc.)(with picture also)
- Weight (the weight should be also measured when loaded at Kabayan in advance)

3) Specifications of packages

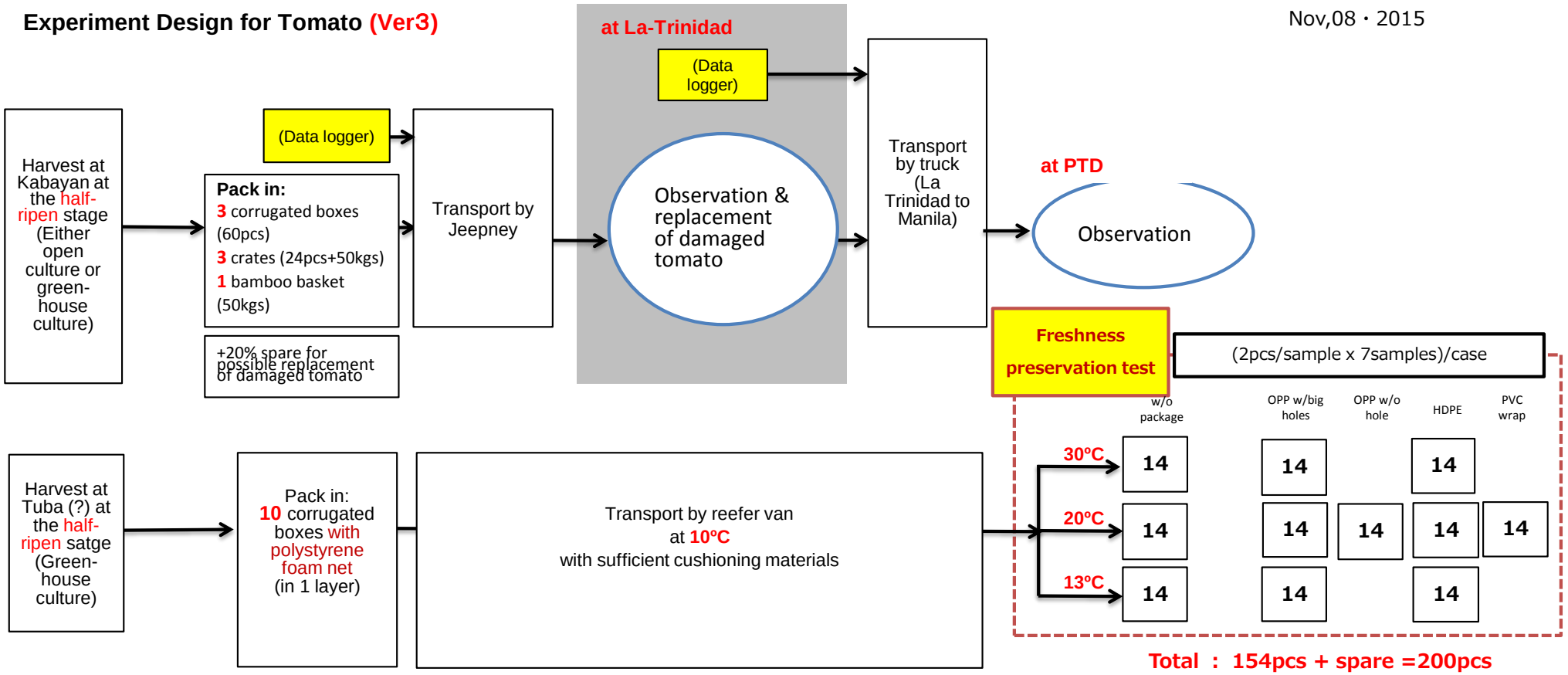
		Materials	Inside Size	No. of tomato to be packed/ container (Pcs, kg)	Gross Weight (kg)	Number of Package (boxes/crates/ baskets)	
						Jeepney & Truck	Reefer Van by PTD
[a]	Corrugated box ※1 w/cover	K200XS125XK200 (C Flute)	L420×W265×H160	30pcs/ box	7.6	2	
[b]	Corrugated box ※1 w/cover	K200XS125XK200 (C Flute)	L420×W265×H80	15pcs/ box	3.8	1	15
[c]-①	Plastic crate	2 Layers	※2 L420×W265×H160	30pcs/ crate	7.6	1	
[c]-②	Plastic crate	1) 3 Layers 2) Randomly	※3 L570×W370×H290	Approx. 25kg/ crate	25	2	
[d]	Bamboo basket	Bamboo	※4 As it is	Approx. 50kg/ basket	50～60	1	
[e]	Net cushion ※5	Foamed polypropylene	65 ϕ ×70	1	0.25		200
[f]	Cushioning Mat ※6	Foamed polypropylene	L800×W800×T70				2

＜※ Notes＞

1. [a][b] The cover is placed at the top of the corrugated boxes of the top layer in the reefer van, to prevent the tomato from jumping out of the box.
2. [c]-① If the exact sized plastic crates are not available, that of the approximate size is acceptable.
3. [c]-② The Inside Size of the plastic crate indicated here refers to the standard product size of Manly Plastics, INC (PL-1). The plastic crate of the other suppliers with the approximate size of that is also acceptable.
4. [d] Bamboo basket to be used is the one which is actually used by the farmers.
5. [e] Net cushion to be used is the one which was obtained in Japan.
6. [f] The Cushioning Mat will be placed on the floor of the reefer van to protect the tomato from the vibrational impacting during the transportation.

Experiment Design for Tomato (Ver3)

Nov,08・2015



2.3.5 切り花（バラ）

Rose 2nd experiment plan

2015.08.26.
H. OHSUGA

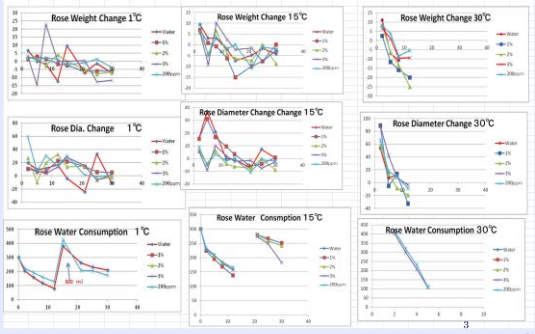
PTD experiment May, 2015.

Vase life study for rose.

Solutions	Vase life, days		
	30 ℃	14 ℃	1 ℃
Water only	12	24th day * Discoloration of buds	15 *dropping buds (was still preserved for further observation)
1%	12	24th day *discoloration on buds	25-30
2%	12	24th day *discoloration on buds	25-30
3%	12	24th day *discoloration on buds	25-30
3% + 200ppm Al_3SO_4	12	24th day *discoloration on buds	25-30

Results of May experiments

Effect of Glucose is not clear redline : water only



Analysis of the May experiments

b. Finding from the 1st Rose experiment

- 15℃ and 30℃ : Effect of chemical agents is not clear.
- 5℃ : Effect of chemical agent is clear
  (1)against drop of flower, and
  (2) for prolonged freshness.
- Particularly the effect on weight change and change in flower diameter were clear
- Nevertheless, difference in effctiveness among the individual agents tried was not clear.
- The difference in the extent of freshness keeping effect of these chemical agents to rose could not be defined from the experiments..

2. Speciality of rose

- Sensitive to ethylene but STS effect is very small
  In some literature- no effect
- Low resistance to antimicrobial agent.

3. Assumption to May experiment(1)

a. The reason why buds dropped.(5℃、water only)
Water shortage. possible

- It occurs by
  Bacteria
  Air in the vessel of the stem
  Perspiration
- Countermeasure to each
  Antimicrobial agent
  Cut back
  Water uptake agent : Surface active agents

3. Assumption to May experiment(2)

b. The reason why discoloration of buds occurred. (15℃、 all)

Water and nutrition shortage. possible

Same as above(a)

c. The reason why no difference between water only and with glucose.

Variety of rose in Philippines is a group of the foundation seed .(strong variety)

possible

Bad effect of glucose (in some case over 2~3% of glucose, buds will drop), ?

Harvesting in early bud stage buds dose not bloom. ?

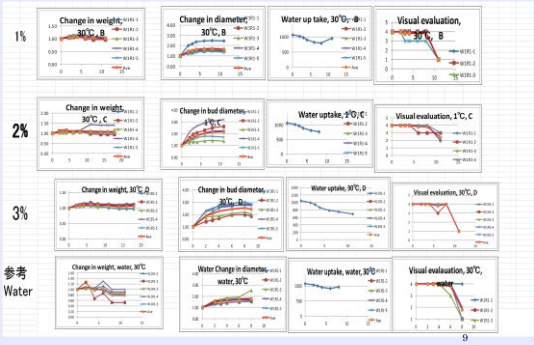
7

AUGUST EXPERIMENT

8

Results of August experiments Red line: Average

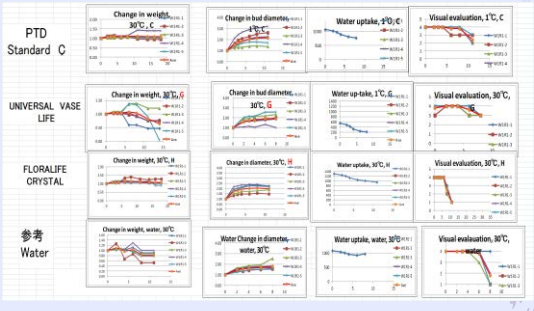
Effect of glucose ; not clear



9

Results of August experiments Red line: Average

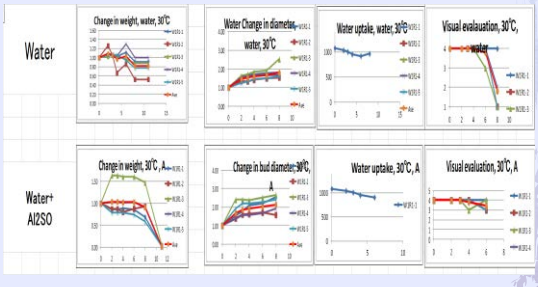
Chemicals in the maket ; Floralife: Bad



10

Results of August experiments Red line: Average

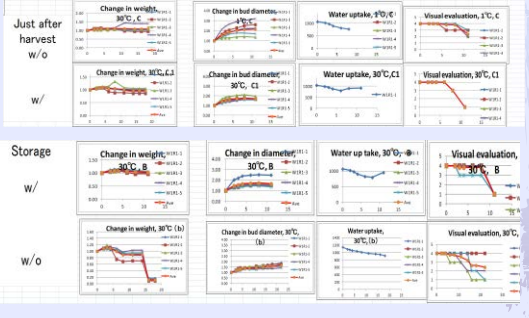
Effect of Al2SO; Visual is Good



11

Results of August experiments Red line: Average

Effect of NaClO; Weight change and Visual



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Evaluation sheet (OHSUGA)

14℃　○: effective　△: no effect　×: bad effect

red letter is 'not goog' run

Weight		Wilting of Petal Large	Pud Diameter Large	Weight Change Middle	Water uptake Small	Total
Pre-treat NaCl O	C1	△	△	△	△	
W/O Glucose	Water,only A	×	△	△~×	△	
Glucose 1%	B, b	△	△~×	△~×	△	
Glucose 3%	D	×	△	△	△	
W/O NaClO	A, b	△	△~×	△~×	△	
Acid	E F	×	△	△	△	
W/O Al2SO3,	Water only、G,H	×	△	△	△	
Low Al2SO3	b	△	×	△	△	
Agents	G,H	×	△	△	△	
Good impression		B,b,C		W, b ,C1		
Bad impression		E,F,G,H	b	A,B		
Selection	△ : B,C,C1	×:W,A,b,D,E,F,G,H				

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Resules of May experiments

Effect of each chemical agent

- Glucose: Nutrition
  not clear
- Al2SO3: Water purification
  Effective to visual evaluation
- NaClO: Antimicrobial agent
  Effective to weight change and visual
- Acid: Buffer for NaClO
  Not clear
- Standard sol.(4 component)
  Same or better than commercial solution

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Recommending antimicrobial of Japanese laboratory

- Speciality of rose
  Low resistance to antimicrobial agent」
- Glucose + Al2SO3+Citric acid + Antimaicrobial agent(Trade name: RegendMK Dow, Kethon Room&haas and Aisosil)
  main chmical agent is
  5-chloro-2-metyl-4-isothiazoline-3-one and 2-metyl 4-isothiazoline-3-one
- Laboratory : TUKUBA, HOKKAIDO Pref. SHIZUOKA Pref.
- Sensibility to ethylene
  little high and STS is effectve
  no effect TUKUBA

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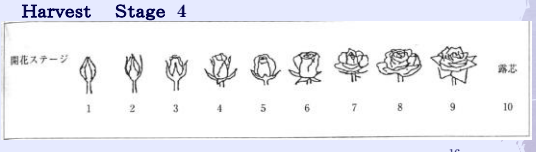
Confirm Experiment Plan

- Test plan
  Run1 Water
  Run 2 Water+ Glucose2%+Al2SO3
  + NaClO + citric acid Aug. run C
  Run 3 in the case PTD can get RegendMK
  Kethon orAisosil, change NaClO to this
  Temp: ambient and 15℃, 1℃ ?
  Stem every 10 stems, Total 40 stms
  Harvest Stage 4



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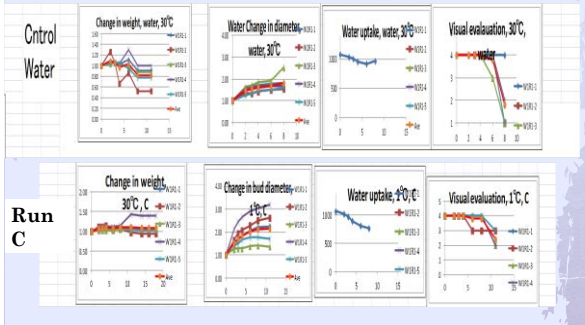
Water only and RunC



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Check items

- Check items
  Blooming Stage
  Bent neck
  Flower falling
  Wilting of petal
  Blueing of petal
  Leaf yellowing
  (index L*. b*.[a*]$^{-1}$
  Flower color ,
  (L*,a*,b*, ⊿E)
- CIE Lab
  L*:Lightness
  a*{red/green)
  b*(yellow/blue)

Measuring

- Weight change
- Bud diameter
- Water uptake

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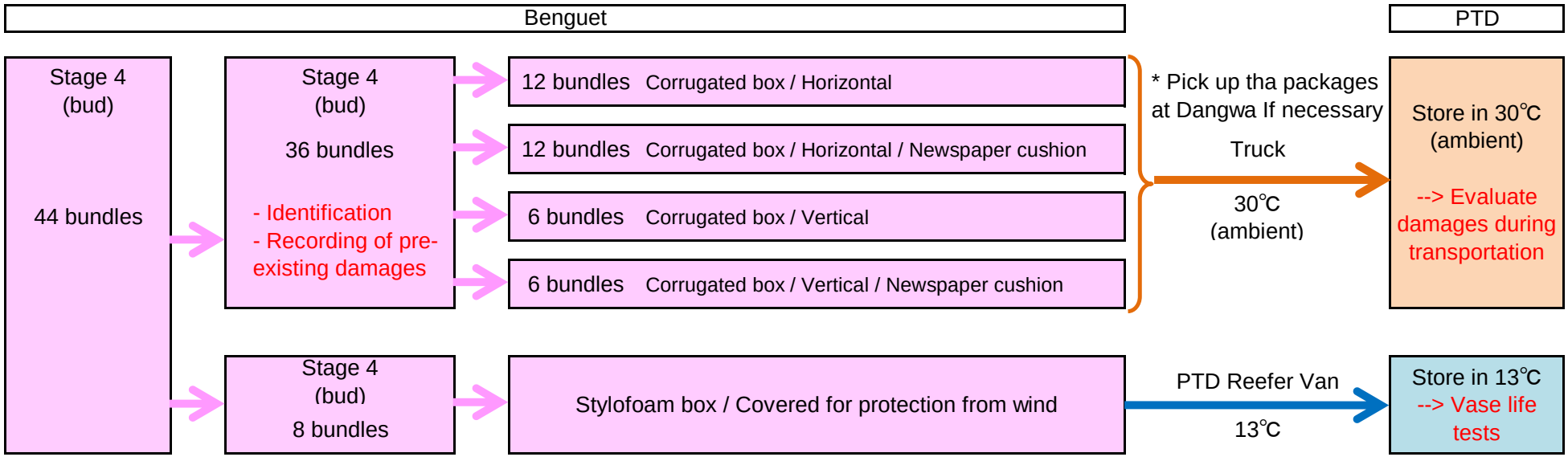
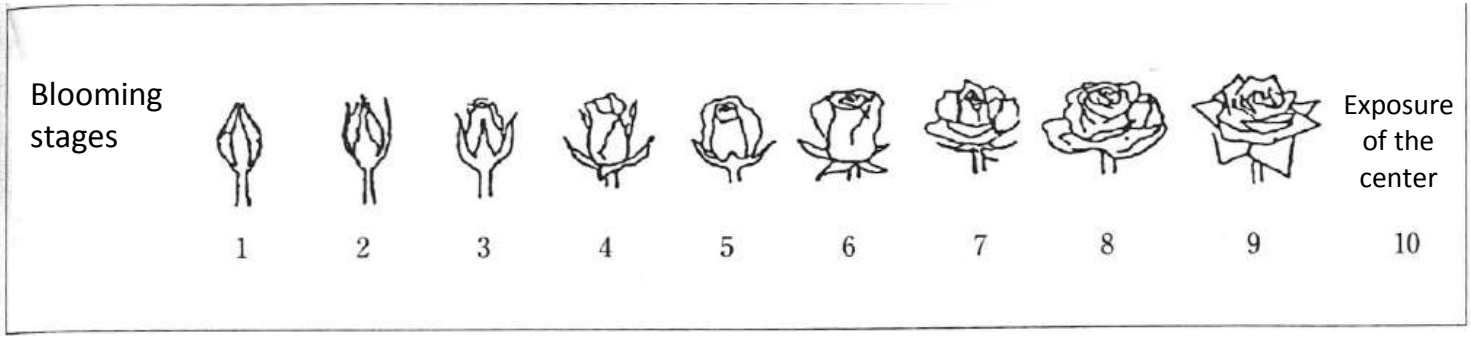
Sample procurement (May 1-3, 2016) of Rose





2.3.6 マンゴ

[Mango]

September 2016

Verification Tests for Mango for Package Development and Improved Post-harvest Treatment (Ver.4.0)

1 Verification Tests for Control of Maturation

(1) Objective of the tests

According to the previous trials, which was conducted in April/May 2016, on packages for maturation control under the ambient temperature, use of film packaging showed possibility of inhibition of maturation compared with the case without film packaging where the color of mango has changed to yellow in 2 to 3 days after harvest, and there observed significant weight loss compared with that of film-packaged. In the case of film-packaged mongo, maturation (or yellowing) of mango fruits was inhibited significantly, but preservation of freshness was interrupted with lack of oxygen in the film bag, even with that of 5 holes on the film, resulting in off-odor production. It was also observed that after-ripening cannot be made for the mango which was kept in green for long time.

The last verification test tried to verify the effect of ethylene absorbing agent also. However, the effect was insignificant in the case of trials under the ambient temperature (or 30℃), whereas it was significant in the case of those stored in 20℃ chamber. However, the effect of latter could not be defined whether the ethylene was created from the sample mango or not, since it seemed to have been affected by ethylene in the storage environment in the chamber maybe because of storage of big volume of mango in the same chamber for other purpose.

From the above, we could conclude that:

1. Film packaging can inhibit the maturation with control of gas concentration
2. Influence of ethylene produced by the sample mango itself is not significant on maturation under the ambient temperature

Based on the above, the current tests are prepared to verify:

1. Effectiveness of film packaging in controlling maturation, if the holes on the film function without being blocked by dew condensation
   a) The test targets the mango for domestic higher-end markets of supermarkets, restaurants, and other institutional consumers, instead of that of wet-markets
   b) The package to be introduced should be good for marketing (in terms of appearance also), and is proposed to use OPP gusset bag with micro-perforation and string-drawing type sealing, which can be displayed as standing pouch.

c) Use of water absorbing sheet for avoiding dew condensation and preventing the holes from being blocked by the dew condensation.

2. Assurance of after-ripening of green mango after keeping them in low temperature of 13℃ for 3 weeks

a) The test targets the mango for export markets of long distance (such as countries in Middle East), where the mango will be transported in refrigerated container of 13℃ with control of moisture content at RH 90% or higher

b) Big bag of PE with holes to avoid oxygen deficiency is used against transpiration

(2) Cases for verification tests

1) Verification tests of controlling maturation according to the number of holes on the surface of OPP

Stored Temperature	w/o package	w/ package (Gusset type pouch) OPP (30μm)		
		4 holes	6 holes	8 holes
Room temperature 25ºC *1)	3 pcs		3 pcs/ pouch x 3 pouches wo/WAS	3 pcs/ pouch x 3 pouches wo/WAS
			3 pcs/ pouch x 3 pouches w/WAS	3 pcs/ pouch x 3 pouches w/WAS
13ºC *2) Chamber	3 pcs	3 pcs/ pouch x 3 pouches wo/WAS	3 pcs/ pouch x 3 pouches wo/WAS	3 pcs/ pouch x 3 pouches wo/WAS
		3 pcs/ pouch x 3 pouches w/WAS	3 pcs/ pouch x 3 pouches w/WAS	3 pcs/ pouch x 3 pouches w/WAS

Note: WAS=Water absorbing sheet

*1) Assuming room temperature of supermarket

*2) Assuming not-well-controlled temperature of refrigerated show cases

Total requirement of the samples: 3 pcs x 3 pouches x 10cases, 3 pcs x 2, total 96 x 1.4 = 134pcs

2) Assurance test of after-ripening of green mango after keeping them in low temperature of 13℃ for 3 weeks and 4 weeks

- Put the samples in water solution of Ethrel after storing 3 weeks and 4 weeks under the low temperature of 13℃, and observe the occurrence of after-ripening: 2 pcs of samples kept without package are used as the contrast (without putting them in the Ethrel water solution).

Stored Temperature	w/o package	w/ package PE bag with big hole
13℃ Chamber	4 pcs	3 pcs/ pouch x 2 pouches
	4 pcs	3 pcs/ pouch x 2 pouches

・Store in 13℃ chamber for 3 weeks (2 pouches + 4pcs) and 4 weeks (another 2 pouches + 4pcs)

Total requirement of the samples: 20 x 1.4=28 pcs

(3) Samples:

・ Export grade in green
・ Medium size (800g/3 pcs)
・ w/o VHT

(4) Observation:

1 Change in weight
2 Change in O2 & CO2 concentration in bag #)
3 Color and appearance with picture, and measurement with the color meter
4 Respiration and transpiration
5 Sensory tests
6 At the end of the tests, measure the water absorption performance of the sheet

#) Not applicable to "Assurance test of after-ripening after keeping in low temperature"

For the film to be used, please measure the following:

1 Oxygen permeability
2 Water vapor permeability

(5) Time schedule for observation

Day 1	Day 2	Day 3	Day 6	Day 10	Day 15	Day 20	Day 25	Day 30
Wed	Thur.	Fri.	Mon.	Fri.	Wed.	Mon.	Fri.	Wed.

2 Verification Tests for Reduction of Damages during Transportation

According to the observation on occurrence of damages during transportation from Zambales to Manila conducted in April/May 2016, we could not find any strong need of trials to reduce mechanical damages during transportation, with insignificant occurrence of mechanical damage. The major reason of reject by the buyer at their plant in Manila was found damages caused by flow of latex from calyx.

Conclusion on the trial plan:

1) No trials to reduce the mechanical damages during transportation
2) Conduct the trial to stop flow of latex from calyx covering the calyx with a small stopper tube of various types
   - Cut back the calyx shorter to adjust the length of the calyx
   - Put a stopper tube on the calyx
     (Put a small cotton ball at one end of the stopper tube in advance as one of the different types of stopper tubes.)
     Compare the effectiveness, workability and economic viability of the different types of stopper tubes, and evaluate the feasibility

3　資機材購入計画

3.1　1 年次調達予定資機材リスト

List of Equipment to be Procured
調達予定資機材 リスト

Ref. No.	Item		Used for 用途
コンサルタントにより調達を行う資機材 Proposed Equipment to be procured by the Consultants in 2013			
1	Hot water bath with temperature controller and circulator （恒温水槽）		Smoked fish （燻製魚加工条件の変更による品質維持実験）
2	Vacuum packaging m/c (Nozzle type) (ノズル式真空包装機)		Frozen durian （冷凍ドリアン強化包装実験）
3	Quick freezing m/c （冷凍ストッカー：急速冷凍機能付き）		Frozen durian （冷凍ドリアン強化包装実験）
4	Chest freezer （チェストフリーザー）		Frozen durian （冷凍ドリアン強化包装実験）
5	Potentiometer (Ultra compact : Temperature Data Loggers) （超小型温度記録計）		Frozen durian （冷凍ドリアン輸送時温度測定）
6	Refraction meter (屈折糖度計)	1) Range(Minimum): Material metal, 0～20%	Sweet potato 果実・甘藷用（甘藷：糖度測定）
		2) Range(Minimum): Material plastic, 0～33%	Sweet potato （甘藷：糖度測定）
		3) Material: Plastic,Scale:Sodium chloride, Range 0.0 to 10.0g/100g	Smoked fish （塩濃度測定）
		4) Measurement Range: Brix 0.0 to 53.0%	Sweet potato （甘藷のキュアリング最適温度の決定試験における糖度測定）
7	Simple ambient temperature and humidity meter （携帯タイプ温度・湿度計）		Sweet potato Frozen durian Smoked fish （各種環境における温度・湿度測定）
8	Oxygen Monitor (High functionality) （高機能酸素濃度計）2 Units		Sweet potato Vegetable Cut flowers （呼吸量変化を測定）
9	Smell sensor （ニオイセンサー）		Frozen durian Smoked fish （臭い強度の測定。官能試験の客観的検証）
10	Distribution Environment Recorder ピックアップセンサー 加速度計測解析システム		全対象産品 Transport Packaging （輸送途中における外力測定。包装開発シュミレーション試験用。）
11	ON/LLDPE film PET/ON/LLDPE film KON/LLDPE film CN/LDPE 試作用包装材料		Frozen durian Smoked fish （個装の試作・試験用）
JICAフィリピン事務所により調達を行う資機材 Proposed Equipment to be procured by JICA Philippines Office in 2013			
1	Refrigerated truck （輸送実証試験用小型冷凍冷蔵車）		Sweet potato Frozen durian Smoked fish （野菜、魚類の低温輸送による損耗減少試験用）

3.2　2 年次調達予定資機材リスト

List of Equipment to be Procured
調達予定資機材 リスト

Ref. No.	Item	Specifications	Used for	Estimated price (Unit: Yen)
			Total	**4,520,000**
1	Temperature controlled chamber with humidity control （恒温恒湿器） (2 セット)	使用温度・湿度範囲: 室温+10～85℃、45～95%RH 温度精度、分布精度: ±1.0℃、±5℃ 湿度精度、分布精度: ±5%RH、±10%RH 有効寸法 (mm): 各500x350x600以上 AC 220V	切り花長期保存テスト 甘藷貯蔵テスト	4,400,000
2	Portable moisture analyzer for corrugated boards （小型水分計（紙・段ボール用）） (1セット)	測定対象: 紙、段ボール 測定範囲: 段ボール原紙 6～20% 測定精度: 標準誤差 0.4% (水分15%以下) 電源: 乾電池 取扱説明書: 英文対応	切り花、甘藷輸送用段ボールの水分測定	120,000

3.3　3-4 年次調達予定資機材リスト(第 1 次)

List of Equipment to be Procured
調達予定資機材　リスト

Ref No.	Item	Specifications	Used for	Estimated price (Unit:Yen)
			Total	1,730,000
1	色彩計（測色計）	携帯型、デジタルタイプ 測定径 約φ 8 mm 以上 表示 色彩値、平均値 表色系・色空間 L*a*b*、XYZ、マンセル（D65）を含む 使用温湿度範囲 0 ～ 40℃ またはそれ以上	切り花、野菜果物の色による鮮度判定	550,000
2	ナトリウム濃度計（屈折濃度計）	携帯型 濃度測定範囲 Brix : 0.0～90.0%以上 (温度補正付) 分解能 Brix : 0.1% 測定精度 Brix : ±0.2% 温度補正範囲 10～100℃	魚加工品調味液濃度調整	140,000
3	食品乾燥機	Power Source: 200V Min. 24時間タイマー付き 最高加熱能力 80℃ 乾燥棚: 10段程度 (60cm x 120cm)	試料（魚加工品）の水分含有量減少	600,000
4	果物硬度計 (2セット)	(1) 対象果物 マンゴスチン、リンゴなど 最小目盛0.1N/cm^2 精度 ±0.5N/cm^2 先端部直径φ3.5mm 以上 携帯型 (2) 対象果物 トマト、マンゴ、バナナなど 最小目盛0.01N/cm^2 精度±0.5N/cm^2 先端部直径 φ3.5mm 程度 携帯型	果物、果菜の熟度判定	90,000
5	ヒートシーラー (1セット)	Power Source: 220V Seal Length (mm): 300 Seal Width (mm): 10 Sealing Type: Single side heating (Under) 足踏型	試験用フィルム包装シール	350,000

3.4　3-4 年次調達予定資機材リスト(第 2 次)

List of Equipment to be Procured
調達予定資機材 リスト

Ref No.	機材名	主たる仕様/要件	本プロジェクトにおける用途	PTD現有機材、他の手法による代替の困難な理由	購入予定価格 (円)
1	スチーマー	温度: 70-100℃。スチーム温度は調整可能であること。 3層で約30匹程度の魚を一度にスチーム処理できる大きさの棚式トレイ。	本プロジェクトにおいて開発した燻製魚製品とその保存包装の、実際への適用を支援するためのトレーニングに使用	これまでTESDAの保有するスチーマーおよび燻製器を借用して開発を進めてきたが、スチーム温度、燻製温度の調節ができないため出来上がり製品の水分含量および水分活性にぶれがみられた。今回、当該製品を実際に適用することを希望する中小企業に対し、そのプロセス等を指導するにあたり、スチーム管理、燻製温度管理を徹底するため、これらを調整できる機器が必要となった。また、本機器を現地製作することで、小規模企業でも購入可能な機器のモデルとして示すことも期待している。	250,000
2	燻製器	3層で約30匹程度の魚を一度に燻製できる水平置き棚式トレイ。 のぞき窓があること。LPGのバーナー火力は手で調節可能であること。頂部に煙突があり、ダンパーで内部の煙の排出を調節できること。 下部には移動用のブレーキ付き車がついていること。			470,000
3	輸送環境記録計用ケーブル	輸送環境記録計 (ショック・マネジャー)のピックアップセンサー用予備ケーブル。長さ3m。	本プロジェクト第1年次調達機材である輸送環境記録計 (ショック・マネジャー) の、損傷を受けて使用できなくなったピックアップセンサー用ケーブル代替のため。	本プロジェクト第1年次調達機材である輸送環境記録計 (ショック・マネジャー) は輸送包装テストのために非常に高い頻度で使用しているが、そのピックアップセンサー用ケーブル1本が保管中に鼠により損傷を受け、このため現在は2セット備え付けられていた残る1セットで対応している。しかし1セットでは測定に機動性をとれないので追加購入が必要となった。	30,000
4	pHメーター	測定方式: ガラス電極法 (イオン電極法によるイオン測定機能付き) 測定範囲: pH -2～16 温度測定範囲: 0～100℃ 精度: 0.01 pH	本プロジェクト対象野菜、果物、魚の、調理・加工品pH確認に使用。 本プロジェクトにおいて開発した燻製魚製品とその保存包装の、実際への適用を支援するためのトレーニングにあたり、調味液のpH確認に使用。	農産物・食品包装開発プロセスでのpH測定の頻度は非常に高いが、これまでは簡易の携帯型pHメーターを使用してきた。しかし、今回、開発した燻製魚の実際への適用指導などにおいて、食品安全上の理由から、より精度が高いpHメーターによる測定が不可欠となった。 また、同燻製魚製品の調味液の繰り返し使用は実際の適用上不可欠であり、その塩濃度を確認することが製品の味の調整上不可欠である。しかし、黒色の、他の糖質成分を含む調味液の塩濃度測定は簡易な測定手法では困難であり、イオン電極による測定が必要で、本器はその目的にも使用できる。	280,000
5	真空オーブン	容積: 20 L 性能: 10^{-2} 温度範囲: 室温 +20℃～200℃	本プロジェクト対象農産品試料の水分含量測定に使用。	食品等の水分含量測定に使用する、使用頻度の高い機器であるが、これまではPTD開設時に他の機関から移設した極めて旧式のオーブンを使用してきた。しかし、乾燥能力が低いため、測定に1試料平均16時間と時間がかかり、実験の効率が極めて悪い。このため、より高速な乾燥能力 (1試料の測定時間約2時間程度と期待される) を持った真空機能付きのオーブンが必要となった。	670,000

6	包装グラフィックデザイン用パソコンおよび画像処理ソフト	現在グラフィックデザイン業界で一般的に使用されている、オンラインによるアップグレードに対応できる画像処理ソフト (Adobe Creative Cloud (Photoshop, Illustratorなど)) の期間使用料、および同ソフトを搭載できるパソコン、ディスプレイ、停電時バックアップ。	本プロジェクトで開発した包装の、実際への適用を支援するための包装グラフィックデザイン開発に使用。	本プロジェクトで開発された包装の実際への導入にあたっては、その技術的特徴をアピール出来る包装に付するグラフィックデザインを開発、その適用がスムーズに実現できるよう支援している。しかしながら現在のデザイン室のソフトウエアおよびPCは、今日業界で標準的に使用されている最新バージョンへのアップグレードがサポートされていない。したがって、新たに追加されているオブジェクトやカラーリング等に対する各種のエフェクト機能が使えていない。このため、現時点で当業界で標準的に使われているソフトウエアへのアップグレードと、それに対応するOSを搭載したPCの導入は、今後、顧客である中小企業の包装改善に貢献する上で対応が必要となった。	590,000
7	アルミ箔プラスチック袋	サイズ:220×380 優れた遮光性有 紫外線などの遮断性有 ガスバリアー性有 耐・防湿バリアー性有 水分保持作用	冷凍マンゴ保存試験実施のため	現段階ではフィリピンで流通していない。	45,000
8	PVDC加エナイロン フィルム	ロールタイプ:2,000巻 ナイロンベース ONUグレードPVDCコートタイプ 酸素バリア性:50ml(20℃×90%RH)	開発済み冷凍ドリアン保香包装の実際のユーザーへの適用試験を行うため (内袋)	現段階ではフィリピンで流通していない。	40,000
9	ナイロン・ポリエチレン規格袋	サイズ : 220×300 ナイロンポリ三方規格袋 ボイル８０℃４０分可 脱酸素剤・ガス充填可 変色防止用	開発済み冷凍ドリアンの保香包装の実際のユーザーへの適用試験を行うため (外袋)	現段階ではフィリピンで流通していない。	30,000
10	吸水シート	サイズ:100×200及び130×180 2層タイプマット 高吸収不織布を使用(ドリップ吸収) 吸収力(強)	ブロッコリ等の鮮度保持包装における結露対策試験に使用するため	現段階ではフィリピンで流通していない。	5,000
				購入予定価格合計 (円)	2,410,000