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HANDBOOK ON

SOYBEAN PRODUCTION & UTILIZATION

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Handbook on

SOYBEAN PRODUCTION TECHNOLOGY AND PRODUCT UTILIZATION

November 2011

F O R E W O R D

Agreeably, soybean is of growing importance to people in other countries because of its versatility.

In the Philippines, however, soybean production is concentrated only in the provinces of Surigaro del Sur and Negros Oriental and consumed in small quantities as vegetable, backyard swine feeds and coffee substitute.

Record shows that inspite efforts made in cultivating hectarages for production and feed formulation using extruded beans, the soybean industry in Region 02 still needs to be properly developed and sustained.

As a matter of strategy, the agency has been taking the lead in the integration of soybean into cereal-based plantation and fruit-tree based farming systems and continues to work on development services for seed production, farm implements, machineries and equipment, post-harvest, bio-fertilizers and bio-control agents production plant establishment, credit facilitation, production marketing, and training, education and extension support.

As part of effective technology extension, this simplified handbook offers organic and conventional production technologies aimed at improving both quality and quantity of soybean produce.

Beyond production purposes, readers will be equipped with the many uses of soybean ranging from on-farm to food and feed production and even as a potential organic fertilizer using soybean wastes.

It is encouraged that this material be fully utilized by soybean growers, would-be growers as well as in households.

This material also seeks to provide the information needs of researchers, technicians, students, and other professional workers.

LUCRECIO R. ALVIAR, JR., CESO III
Regional Executive Director

ORGANIC PRODUCTION

VARIABLE COST	*Seed Yield=1.3 t/ha*		*Seed Yield=1.5 t/ha*	
A. Materials				
50kg Seeds @ P30/kg	1,500.00	35%	1,500.00	35%
10 bags Organic Fertilizer @ P200/bag	2,000.00	47%	2,000.00	46%
Seed inoculant	100.00	2%	100.00	2%
Bio-pesticides & Bio-control agents	500.00	12%	500.00	12%
Sacks @ P6/pc	180	4%	240.00	6%
Sub-total	**4,280.00**	**27%**	**4,340.00**	**25%**
B. Services and Labor				
Land preparation	2,800.00	17%	2,800.00	16%
Planting & fertilization	1,500.00	9%	1,500.00	9%
Weeding and cultivation	3000.00	19%	3000.00	18%
Pest Control	300.00	2%	300.00	2%
Harvesting & Threshing	2475.00	15%	3300.00	19%
- 12% of production value				
Cleaning and drying	450.00	3%	600.00	4%
Sub-total	**10,525.00**	**65%**	**11,500.00**	**67%**
C. Interest on Capital				
(30% per cropping of input costs)	**1,284.00**	**8%**	**1,302.00**	**8%**
TOTAL COST	**16,089.00**		**17,142.00**	
GROSS INCOME	**42,000.00**		**50,400.00**	
NET INCOME	**25,911.00**		**33,258.00**	
Break -even yield (kgs)	**804.45**		**857.10**	
Cost per kilo	**10.73**		**8.57**	
Return on Investment (ROI)	**161.05%**		**194.01%**	
Farm gate price: P28.00/kg				

SOYBEAN WASTE FOR ORGANIC FERTILIZER PRODUCTION

Fig. 23. Soybean hay as substrate for organic fertilizer production

Soybean plants leave huge amount of Nitrogen and other important nutrients to the soil after harvesting. Actually, for every 1.0 ton soybean seed harvested, about 60 kgs of nitrogen (N) is removed from the soil however, approximately 50 kgs of Nitrogen (N) is left in the soybean stover and roots; available for use of the next rotating crop like cereals. It is therefore advisable that soybean hay should be plowed under after harvest or piled in the field for use as substrate for organic fertilizer production.

CONVENTIONAL PRODUCTION

VARIABLE COST	Seed Yield=1.5 t/ha		Seed Yield=2.0 t/ha	
A. Materials				
50kg Seeds @ P30/kg	1,500.00	9%	1,500.00	9%
2 bags 14-14-14@ P1,100/bag	2,200.00	13%	2,200.00	13%
1 bottle pesticide @ P500/li	500.00	3%	500.00	3%
Seed inoculants	100.00	1%	100.00	0.6%
Sacks @ P6/pc	180	1%	240.00	1%
Sub-total	**4,480.00**	**27%**	**4,540.00**	**26%**
B. Services and Labor				
Land preparation	2,800.00	17%	2,800.00	16%
Planting & fertilization	1,500.00	9%	1,500.00	9%
Weeding and cultivation	3000.00	18%	3000.00	17%
Pest Control	300.00	2%	300.00	2%
Harvesting & Threshing	2475.00	15%	3300.00	19%
- 12% of production value				
Cleaning and drying	450.00	3%	600.00	3%
Sub-total	**10,525.00**	**64%**	**11,500.00**	**66%**
C. Interest on Capital				
(30% per cropping of input costs)	**1,344.00**	**8%**	**1,362.00**	**8%**
TOTAL COST	**16,649.00**		**17,402.00**	
GROSS INCOME	**37,500.00**		**50,000.00**	
NET INCOME	**21,151.00**		**32,598.00**	
Break -even yield (kgs)	**817.45**		**870.10**	
Cost per kilo	**10.90**		**8.70**	
Return on Investment (ROI)	**129.37%**		**187.32%**	
Farm gate price: P25.00/kg				

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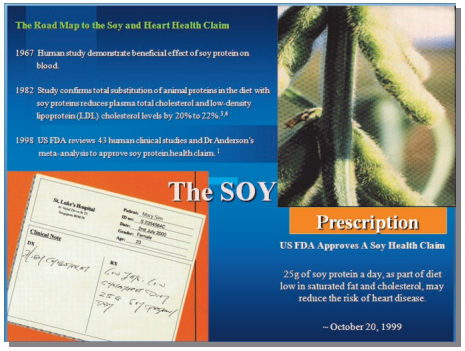
INTRODUCTION

Soybean or *"utaw"* is known in the world as "WONDER CROP" of the 20th century being one of the most versatile high value crops. Its seeds contain approximately 40 -45% protein, 20-25% edible oil, and a significant amount of vitamins A and E as well as minerals making it a valuable component of many foods and feeds preparation, thus a potential solution to twin problems of hunger and malnutrition in the Philippines.



In fact, the United States Food and Drug Administration (FDA) approved in 1999 a soybean health claim "THE SOY PRESCRIPTION" allowing medical practitioners to prescribe intake of 25 grams soybean daily to reduce risk of cardio-vascular diseases and several types of cancers (colon, breast, lung, prostate, uterus and stomach cancer).

As Nitrogen-fixing crop, soybean can fix up 275 kgs of Nitrogen gas from the air thus an excellent rotating crop and/or intercrop of cereals like corn and rice and other industrial crops (cassava, coffee, cacao, coconut and other fruit-trees) that eventually enrich soil fertility and break insects and diseases cycle. Despite the significant role of the crop in the food and feed industry and its local adaptability, production of soybean in the Philippines is very minimal and supply is 95-98% import-dependent (BAS, 2007).

This is the reason why soybean production should be an integral part of the cereals and plantation crops-based farming system wherein organic and conventional method of crop cultivation can be successfully practiced following these package of technology (POT).

bean into FULL-FAT SOYBEAN MEAL (FFSBM) as non-conventional feed ingredients is encouraged because it provides an energy level comparable to corn and four times as much protein. Village-level or small-scale FFSMB processing and feeding in poultry and swine involves the following:

1. **Dry heat through cooking and/or roasting.** This system uses gas flame or similar heat source to cook the beans by direct exposure to the flame/heat at brief interval. It is a process to inactivate the soybeans protease inhibitors (trypsin and chymotrypsin) that impair protein digestion and other toxic substances like hemagglutinins which reduce nutrient absorption in the intestine and goitrogens that cause thyroid gland enlargement

2. Grind the roasted/cooked bean

3. Use as feed ingredients by mixing with yellow corn and other grain by-products (corn and rice bran) together with recommended amount of mineral supplements like common table salt, premix (micro-minerals), calcium source (limestone and oyster shell) and molasses.

Fig. 22. Soybean Meal for feeds

TOKWA ADOBO

Ingredients:
12 pc tokwa, cubed, fried
½ tsp black pepper
2 pc onions
siling labuyo
3 tbsp vinegar salt to taste
3 tbsp soy sauce
vetsin to taste

Procedure:
Mix all ingredients. Serve.

TOKWA BALLS

Ingredients:
2 pc tokwa, mashed
1 pc egg
100 g pork
salt to taste
200 g snap bean (green)
2 tsp flour plus for coating
1 stalk green onion
soy sauce to taste
pepper to taste
vetsin to taste

Procedure:
Soak tokwa for 30 mins then mash. In a bowl, mix all ingredients. Form the mixture into balls then roll into flour. Deep-fry the balls until golden brown. Serve tokwa with sauted snap bean.

B. SOYBEAN FEED PRODUCT

Soybean has high potential for feeding purposes because of its high oil content. According to the American Soybean Associations (ASA), soybean oil is rich in linoleic acid which is necessary for membrane integrity. Other nutrients found in soybean include Vitamin E, lecithin and amino acids. Therefore, local processing of soy-

HOW TO GROW SOYBEAN

FIELD SELECTION AND LAND PREPARATION

Areas where corn and rice are successfully grown are suitable for soybean production. This means that soybean is a good rotating crop and intercrop of corn and upland rice. ***For organic soybean production***, soybean can be planted (as intercrop) in between rows of growing banana, coffee, coconut and other fruit-trees. In upland rice areas where soil chemical fertilizer application is not practiced, organic soybean production is likewise possible as rotating crop.

Soybean requires thorough land preparation. The field should be pulverized and should have good tilth for high seed germination, uniform emergence of seedlings, proper root development, better water-retention and weed control.

When using carabao-drawn plow, two or three plowings are done depending on soil type and moisture content. Heavy soils usually require more plowings than the light textured soils. One plowing of any soil type may be enough when using a tractor. Two or more harrowing may be needed to pulverize the field using carabao-drawn harrow. However, two harrowing may be sufficient when using a tractor. Furrows should be 40-50 centimeters (cm) apart and 4 to 6 cm deep.

Fig. 1. Land preparation at highlands

PLANTING SEASON

Soybean is photoperiod-sensitive crop. Short-days period (November to January) encourage reproductive growth but vegetative growth is favorable during long days (longer day-length) in the month of May-July. Therefore, high yield is obtained if adequate vegetative growth is attained before rapid reproductive growth. Depending on the climate type in target growing locations, soybean production during the dry season is successful only if soil moisture is available in sufficient amount and wet season production is recommended only in areas with short wet season (less than 4 months).

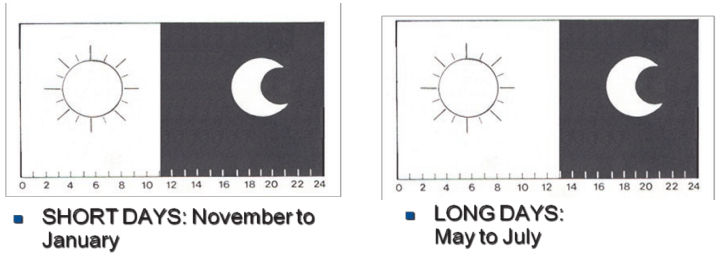


Fig. 2.Specific months and hours coverage of short and long days In the Philippines as reference in planting soybean

VARIETY SELECTION

Soybean varieties vary in their seasonal adaptability and reactions to major insects and diseases. Actually, varieties yielding well under longer daylength usually have low yield during shorter daylenght and varieties yielding well under shorter daylenght apparently have excessive vegetative growth during longer daylenght. Select the best variety for the target growing environment. The following are the varieties recommended for commercial production:

Table1. Soybean Varieties Recommended for Commercial Production in the Philippines

Official Name	Common Name	Breeding Institution	Recommended Environment		
			Northern & Central Luzon	Visayas	Mindanao
BPI Sy 4		BPI-Los Baños		X	X
PSB Sy 2	Tiwala 6	IPB-UPLB		X	Cotabato, Davao
PSB Sy 1	LG Soy 1	BPI-La Granja	X		X
PSB Sy 3	LG Soy 2	BPI-La Granja	X		X
PSB Sy 5		BPI-Los Baños	Dry Irrigated	X	Dry irrigated
PSB Sy 6	Tiwala 8	IPB-UPLB			
PSB Sy 7	Tiwala 10	IPB-UPLB		X	
NSIC Sy 8	Mapusyaw	BPI-Los Baños		X	X
	Manchuria	*Unknown*	X	X	Surigao

1 pc onion, sliced
5 cloves garlic, minced
2 pc carrots, slices thinly
3 stalks celery, fine cut
cooking oil
Patis and vetsin to taste

Procedure:

Saute garlic, onion and patis. Add the other ingredients. Simmer until cook.

TOKWA AT BABOY SISIG

Ingredients:
1 kg pork mascara (balingit)
½ kg tokwa, fried and diced
3 pc green onion, sliced
1 pc onion, diced
10 pc calamansi
1 tsp black pepper, ground
1 tsp sugar
Salt and vetsin to taste
chili

Procedure:

Clean the pork mascara thoroughly. Boil in water with salt and vetsin until soft. Dice into small pieces. Mix all ingredients and serve.

TOKWA KILAWIN

Ingredients:
12 pc tokwa, cubed in small pieces
6 pc calamansi (juice extracted)
3 pc onions, finely cut
2 pc siling labuyo
Salt, vetsin, soy sauce to taste

Procedure:

½ tsp chili powder
½ L cooking oil
2 tbsp margarine
Soy sauce, salt and pepper to taste

Coating Mixture:

4 pc eggs, beaten
2 c bread crumbs
Salt and black pepper to taste

Procedure:

Toss all ingredients in a bowl expect the coating mixture and cooking oil. Mix well. Form into balls. Dip balls into beaten eggs and roll in coating mixture of bread crumbs, salt and pepper. Form into patties. Fry until golden brown.

SOY UKOY

Ingredients:

½ kg soybean sapal
1 c shrimp
1 c soybean flour
2 stalks celery
2 pc onion, chopped
2 pc sweet potato/squash, grated
Cooking oil
Salt, pepper and vetsin to taste

Procedure:

Mix all ingredients and form into patties. Deep-fry the mixture until golden brown.

4. Tokwa-based Recipes

TOKWA CON SHRIMPS CHINESE STYLE

Ingredients:

¼ kg tokwa cut into cubes, fried
¼ kg fresh shrimp, shelled
¼ tbsp leek, finely cuy

Variety facts:

Official Name	Common Name	Seed size, g/100 seed	Maturity, days	Seed Storability	Reaction to Insect Pest
BPI Sy 4		14-18	< 90	Good	Tolerant
PSB Sy 2	Tiwala 6	<14	< 90	Poor	
PSB Sy 1	LG Soy 1	<14	90-100	Fair	Tolerant
PSB Sy 3	LG Soy 2	<14	< 90		
PSB Sy 5		18-22	< 90	Poor	
PSB Sy 6	Tiwala 8	<14	90-100	Good	Tolerant
PSB Sy 7	Tiwala 10	<14	90-100	Good	Tolerant
NSIC Sy 8	Mapusyaw	14-18	90-100	Poor	Susceptible
	Manchuria	<14	< 90	Good	Tolerant

CULTURAL PRACTICES

Seed Inoculation

Before planting, soybean seeds should be dressed with Rhizobium strain of bacteria to enhance root nodulation and ensure high population of bacteria in the nodules that help plants fix more Nitrogen from the air. To inoculate the seeds:

⇒ put 10 kgs of seeds in a basin and moisten with a glass of water
⇒ add/pour 100-grams pack inoculant and mix thoroughly until the seeds are evenly coated and appear almost dry
⇒ do not expose inoculated seeds to direct sunlight, exposure will destroy the rhizobia and render inoculation ineffective
⇒ sow immediately the inoculated seeds in the furrows

Fig. 3.Seed inoculation with Rhizobium bacteria

Fertilizer Application

1. **Organic Production**

- Apply 10 bags organic fertilizer per hectare along the furrows before seed sowing
- Spray organic foliar fertilizers 2-3x, favorably at vegetative stage (10-15 DAE), flowering stage (25-30 DAE) and pod-formation stage (40-45 DAE) using any or combination of locally available organic foliar fertilizers as follows:
  - Fulvic or Humic Acid
  - Bacterio-Mineral Water (BMW)
  - Vermi Tea
  - AMWAY Nutriplant AG
  - other locally available organic foliar fertilizers

Fig. 4.Basal application of organic Fertilizer

Fig. 5. Foliar fertilizer spraying

2. **Conventional Production**

In the absence of soil analysis, apply in basal method (by spreading along the furrows prior to seed sowing) 2 bags complete (14-14-14) fertilizer. While soybean is good in utilizing residual fertilizer, increase the fertilizer dosage of preceding or rotating cereal crops like corn and rice by adding the 2 bags 14-14-14 standard recommendation for soybean to maximize use of expensive chemical fertilizers. In this way, yield of both the cereal and soybean planted in same parcel of land will be enhanced although the inorganic fertilizer is directly applied to cereal but benefited the succeeding soybean crop in the form of more residual macronutrients.

Seed Sowing and Seeding Rate

Seed sowing involves 2 methods namely; hill method and drill method. In hill method, drop 2 seeds/hill at 10 cm apart along the furrows of 40-50 cm distance. Drill method requires dropping

SOY BALLS

Ingredients:

5 c soybean sapal
½ c flour
3 pc onion, chopped
2 pc egg, beaten
1 pc red bell pepper, chopped finely
½ L cooking oil
2 c breadcrumbs
Pepper and salt to taste

Procedure:

Toss all ingredients in a bowl except oil and flour. Mix thoroughly. Form the mixture into balls approximately 2 tbsp. Roll the balls into flour. Fry until golden brown. Serve with sauce.

For Sweet and Sour Sauce:

3 c water or meat broth
6 tbsp flour
4 tbsp tomato catsup
3 tbsp sugar
3 medium-size onion, sliced
3 medium-sized red & green bell pepper
6 tbsp vinegar
3 tbsp cooking oil
Salt, pepper, soy sauce to taste

Procedure:

Mix water, catsup, vinegar, soy sauce, sugar and salt. Set aside. In a casserole, heat the oil and add the onions. Put the red and green pepper. Add the mixed ingredients and cook for 3-6 minutes. Add the flour dissolved in 6 tbsp water. Simmer for 2 minutes.

SOY BURGER

Ingredients:

5 c soybean sapal
5 cloves garlic, minced
2 pcs egg, slightly beaten
3 pc onion, chopped
6 stalks green onions
2 medium-sized red pepper, chopped

Optional:

2 c cornstarch
2 tbsp powdered

1 pc medium-sized singkamas (shredded)

Vetsin to taste

Procedure:

Put all ingredients in a bowl and mix well except cooking oil. Wrap 1 tbsp of mixture with lumpia wrapper. Deep-fry the mixture until golden brown.

SOY EMBOTIDO

Ingredients:

1 kg soybean sapal
1 kg ground pork
1 kg ground hotdog
4 pc onion, finely chopped
1 bot pickle relish, 500 g
4 pc egg, beaten
1 box cheese, small
2 pc bell pepper, finely chopped
4 pc carrots, chopped
¼ c sugar
8 tbsp soy sauce
½ c garlic
½ L cooking oil
½ c catsup
¼ kg raisins

Procedure:

Toss all ingredients in a bowl except for the cooking oil and mix thoroughly. Wrap in an aluminum foil at least 10 inches long and 2.5 inches diameter. Steam for 10-15 minutes or until cooked. Without removing the foil, fry in hot cooking oil. To check if it is cooked, embutido should be golden brown. Serve with catsup or sauce.

SOY MARUYA

Ingredients:

1 kg soybean sapal
1 pc coconut, grated
2 tbsp baking powder
2 c flour
2 c sugar
cooking oil

Procedure:

Mix all the ingredients together and form into patties. Deep-fry the mixture until golden brown.

of seeds of about 15-20 seeds per linear meter. Depending on planting method, variety seed size and growing environment, 30-50 kgs seeds/hectare is required to achieve population density of 150,000-250,000 plants/ha.

Fig. 6. Drill method of planting

Fig. 7. Hill method of planting

Cultivation and Weed Management

Significant soybean yield reduction is caused by weeds which are also the host-plants of insects and diseases. Weeds that emerged during seedling and vegetative stage (2^{nd} to 4^{th} week after planting) can cause significant crop damage and consequently yield reduction. To control weeds:

⇒ cultivate the plants (off-barring and hilling-up) at 15 and 25 days after planting.

⇒ practice narrow or closer furrow spacing (30-40 cm apart) to allow thick soybean population that compete with weeds more effectively due to early closing of leaf canopies that eventually do not allow enough light penetration for weed seeds emergence and growth.

Fig. 8.Hilling-up

Water Management

Soybean yield is generally higher if soil moisture is sufficient at seedling, vegetative, flowering and pod formation stage. Proper time of planting should be practiced to avoid drought and additional expenses for furrow irrigation. Follow the planting calendar based on regional rainfall pattern.

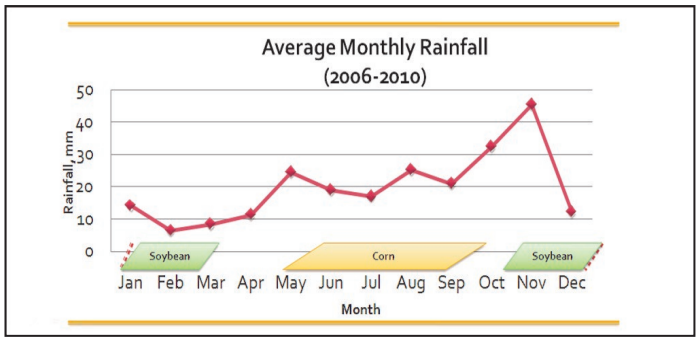


Fig. 9. Example of Soybean-corn cropping pattern based on rainfall pattern in Region 02

CROP PROTECTION

Insect Pest Management

Fig. 10. Bean fly

Fig. 11.Leaf miner

Fig. 12.cutworm

Soybean is attacked by several injurious insects like aphids, beanfly, leaf miner, leaf folder, pod borer, cutworm and stink bug. Proper attention should be given to prevent and control infestations as follows:

SOYBEAN COFFEE

Ingredients:

1 c soybean

Procedure:

Clean the soybean. Remove dust and other foreign materials. Roast in a frying pan for 30 min at low heat until medium brown. Grind finely with a meat grinder or blender. Brew like ordinary coffee.

3. Pulp or Sapal-based Recipes

SKINLESS LONGANISA

Ingredients:

½ kg soybean sapal
100 g sugar
½ kg ground pork, lean meat
½ tsp vetsin
1 c corn starch
½ c garlic
½ c soy sauce
1 tsp salt
1 tsp ground pepper
Wrapping paper cut into 4x6 inches

Procedure:

Mix all the ingredients well. Wrap 36g mixture in the paper to produce 7 pc skinless longanisa per ¼ kg mixture.

SOY LUMPIANG SHANGHAI

Ingredients:

5 c soybean sapal

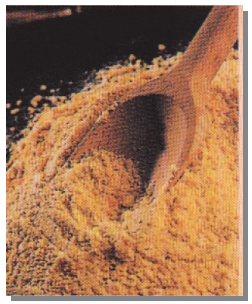
2 pc eggs, slightly beaten
½ c corn starch
3 pc onions, chopped finely
2-3 stalks celery
½ L cooking oil, for frying
Pepper to taste
½ c carrots, shredded
50 pc lumpia wrapper
Salt to taste

time. Allow to cool to 70°C. Dissolve calcium sulfate in a cup of water and add to the soymilk. Allow to coagulate for 10-20 minute.

Del Monte vinegar can also be used as substitute for calcium sulfate at the rate of 1 c per 8 c of soymilk. Put only the vinegar when the soymilk reached the boiling point. Stir and allow to gel.

Remove whey carefully. Transfer into the milder lined with cheese cloth until full. Allow to drain. Wrap with cheesecloth. Remove retainer. File-up filled molders on top of the other or put weight on top to press the curd. Cut the curd in 2 in square and place in cold water. Store in refrigerator.

2. Flour-based Recipes



SOYBEAN FLOUR

Ingredients:

1 kg soybean
5 L water

Procedure:

Clean and wash soybean thoroughly. Boil soybean for 10 minute. Drain and remove seed coat. Sundry and put the seeds in an oven until crispy. Grind and shift. Store or keep in a sealed plastic bag or wide-mouthed bottle.

SOYBEAN POLVORON

Ingredients:

2 c soy flour
2 c powdered milk
½ c white sugar
6 tbsp margarine, melted

Procedure:

Roast flour for 15 min or brown. Mix with milk, sugar and margarine in a bowl. Form mixture with the use of molder. Wrap in Japanese paper.

Biological control measures for organic production

⇒ apply 200 cards/ha trichogramma (split application at 10 meters x 10 meters field application distance per application) by hanging on the soybean plants' branches at vegetative, flowering and pod formation to pod-filling stages. Trichogramma species available for corn production can be used for soybean and helps in the parasitization of egg masses of commonly observed pod and leaf feeding lepidopterous insect pests.

Fig. 13. Trichogramma card hanged in soybean plant at vegetative stage

⇒ Release 4 colonies of earwigs per hectare to control population of newly-hatched defoliators and pod feeders (larval stage). Earwig application can be done by releasing the colonies at the 4 corners of the production site but releasing corners must be near to the center of the production area to ensure equal distribution of earwig population.

Fig. 14. Earwig application

⇒ Spray water-dissolved metarrizhium (28 packs/ha) to control stink bugs. Follow mixing ratio of 1 pack metarrizhium:10 liters water and add/mix 1 table spoon detergent powder

Fig. 15. Meta ready for mixing

⇒ Source-out bio-control agents at DA-Regional Crop Protection Center or Bio-control Production Laboratories nearest to your production site.

⇒ Practice clean culture in the field to minimize attack of insects.

For conventional soybean production, synthetic insecticides may be used to control aphids and beanfly at vegetative stage.

Close monitoring of pests is very important to effective pest control.

Disease Management

The common diseases of soybean plants are soybean rust and mosaic.

Soybean rust is most common during the cool dry months and it attacks plants during early pod development to maturity. They appear as small pinhead brown blisters or pustules that are more evident under surface of the leaf than in any part.

Fig. 16. Soybean rust

Soybean mosaic, on the other hand, is transmitted through seeds and sap by soybean aphid. This is severe during wet season causing stunted plant growth and few seeds developed per pod.

As preventive and control measures, use resistant soybean varieties, do not use disease-infected seeds, maintain weed-free production farm and practice crop rotation (cereals-soybean rotation).

Fig. 17. Soybean mosaic

HARVESTING

The maturity of soybean plant is determined by the yellowing and shredding of the leaves and by the change of color of the pod (from green to brown or dark brown) at about 80-90 days after planting depending on the variety. This is done by cutting the

½ c cooking oil ¼ tsp vanilla or any other flavoring

Procedure:

Mix flour, sugar and baking powder in a bowl. Make a hollow and put 2 eggs. Add soymilk, oil and vinegar one at time. Mix in one direction. Add soybean sapal and vanilla or any other flavoring. Mix until smooth. Grease pan with cooking oil and heat. Pour ½ cup mixture. Turn when bubbles come out. Serve with butter.

SOY PASTILLAS

Ingredients:

12 c soymilk 2 c water
2 bars gulaman, white 3 c brown sugar
1 c sago, cooked 3-5 pc pandan or 1 tsp vanilla
1 tsp vanilla

Procedure:

Cut gulaman into small pieces and dissolve in boiling 12 c soymilk. Stir well to melt. Pass the mixture through cheesecloth and put in a molder. Set aside to form a curd.

Caramelize brown sugar over a slow fire. Add 2 c water and boil. Let cool. To serve, put taho, gulaman and syrup in a cup. To improve the taste, commercial flavor like fruit jelly or jam may be added.

TOKWA

Ingredients:

2 kg soybean
10 L hot water
10 L water (for soaking the soybean)
¼ c calcium sulfate or Del Monte vinegar

Procedure:

Prepare soybean as in the preparation of soymilk up to filtration step. Put soymilk in a vat and heat to boil for 15 min. Stir from time to

SOYFLAN

Ingredients:

1 ¾ c soymilk
12 tbsp refined sugar
4 tbsp brown sugar
1 can condensed milk
10 egg yolk
½ tsp salt
4 pc calamansi, rind

Procedure:

Put the brown sugar in three molders and heat under low flame until it get caramelized/dissolved. Cool then mix all ingredients and strain. Put the mixture in the molders and cover it with aluminum foil. Boil water in the steamer and cook the mixture at low flame for approximately 30 min or until the leche flan does not stick when pricked with a toothpick.

SOYMILK BREAD PUDDING

Ingredients:

1 c soymilk
2 c bread, cubed
2 pc egg
1 box raisins, small
¼ c cheese, grated
1 tbsp margarine
½ c sugar
1 c pineapple juice
1 can pineapple tidbits, small
½ c condensed milk

Procedure:

Soak bread in soymilk. Set Aside. Mix all ingredients in a bowl. Add bread to the mixture. Spread grease to pan with margarine and pour the mixture. Bake the mixture for 30-40 min or until the mixture does not stick when pricked with a toothpick.

SOY HOTCAKE

Ingredients:

2 c soybean sepal
2 tbsp baking powder
2 tbsp vinegar
2 pc egg
2 c flour
1 c soymilk
2 c sugar
1 c butter (star margarine), optional

stalk at the base or uprooting during early morning hours or late in the afternoon to reduce shattering losses. If everything goes well, a yield of at least 1.5 metric tons per hectare may be realized.

Expose the newly harvested soybean plants to direct sunlight or in a dry floor before threshing. Do not stock-pile wet harvest to avoid the seeds from getting moldy.

Fig. 18. Harvesting matured soybean plant by cutting the stalk

THRESHING AND DRYING

Threshing can be done using any of the following methods:

α. Beating with stick – place the pods on a cement floor or any hard surface and beat the pods. Other method is to fill a storage sack about 1/3 full of pods and beat the sack gently with either a stick or a filial.

β. Mechanical Thresher – adjust ordinary rice thresher by using drum pulley with bigger diameter to reduce its speed to 3500-4000 rpm in order to suit with soybean threshing to minimize cracked seeds.

Sun-dry newly threshed soybean seeds by spreading evenly on a cement floor, tarpaulin, bamboo mats and trays. One or two continuous drying can bring the seeds moisture level into 10-12 percent.

Fig. 19. Threshing using mechanical thresher

Fig. 20.Solar dyring using tarpaulin

CLEANING AND SORTING

Clean seeds with the use of winnowing pan or hand-operated blower. Sort seeds to remove defective seeds and other impurities from good ones using spiral separator. Pack seeds in 50-kg clean jute sacks.

Store on wooden pallets in a cool dry shed to prevent insect infestation and mold growth. With proper handling and care, minimum storage period is from 3-4 months. With the use of air-tight containers and under controlled room temperature, the crop could
last for 10 months with 100% seed
viability and 85% germination.

Fig. 21.Sorting using spiral separator

SOYBEAN FOOD AND FEED PRODUCTS PREPARATION

Tagged as **"king of beans"** and viewed as functional food, soybean is a powerhouse of health benefits in humans. Actually, soybean and its products have shown to play a major role in the prevention of chronic diseases such as cancer, cardiovascular diseases, diabetes mellitus and osteoporosis. Human clinical studies have shown that soy protein with its naturally occurring isoflavones and other bioactive components can lower blood cholesterol and beneficial in preventing or treating other chronic health problems like bone heal, and relief of menopausal symptoms. Consumption of inexpensive soy-protein foods is therefore encouraged to enjoy healthy life.

A. SOYBEAN RECIPES

1. **Milk-based Recipes**

SOYMILK

Ingredients:

1 kg soybean
1 tsp vanilla or 2-3 pandan leaves
5 L hot water
5 L water (for soaking the soybean)
2 ½ cup sugar

Procedure:

Clean soybean very well and wash thoroughly. Soak soybean in 5 L water for 8-12 hr. Rinse well and grind finely while adding hot water at a time. Strain the mixture through cheese cloth and extract the milk.

To serve as beverage, boil the milk for 10-15 minutes. Stir from time to time. Add sugar and vanilla or pandan leaves while mixing. Cool the milk and put in bottles or any suitable container then refrigerate.