Province/Village	Jambi	S. Sumatra	E. Java		Bali
Operation	Sumber Madju	Sinar Bulan	Karya Tani	Sumber Malmur	Kailo Paksa
6. Pest-Control					
1) Method	Hand sprayer	Hand sprayer	Hand sprayer	Hand sprayer	Hand sprayer
2) Frequency	6	3	5	6	2
3) Required labour (man·day/Ha)	20	9	13	12	3
7. Weeding					
1) Frequency	2	3	1	1	2
2) Required labour (man·day/Ha)	35	15	30	70	8
8. Reaping, Drying					
1) Method	with sickles	with sickles	with sickles	with sickles	with sickles
2) Number of Days for Drying (days)	3	7	4	7	3
3) Required labour (man·day/Ha)	18	25	25	42	17
9. Threshing, Cleaning					
1) Method	Beating	Beating	Beating	Beating	Beating with club
2) Required labour (man·day/Ha)	7	31	20	28	7
10. Yield per unit (Kg/ha)	1,900	1,500	1,350	1,400	1,000
11. Total Labour Required (man·day/Ha)	106	139	180	166	57

In the case of 1), tractors are used for plowing and land preparation, while human power is adopted in the case of 2). There is a big gap between the two in the labour required for plowing and land preparation operation. But the cases where tractors are used are extremely rare. More labor is required in the case of 1) for other operations than is required in that of 2), and it is 24% lower than 2) with the proportion of 106 persons per day per hectare in 1) to 139 persons in 2).

There is also a gap between up-land and paddy fields, even though the drill seeding method is adopted in the same way. Generally speaking, it is easier to implement operations in up-land and less labour is required than in paddy fields. In comparison of broadcast seeding with drill seeding method, the former required less labour, since it saves labour for plowing and seeding operations. In comparison of broadcast seeding methods with plowing and without plowing, there cannot be seen a fixed tendency since they are influenced by fertilization, culturing control are harvesting operations after seeding.

4) *Comparison of required labour broken down by operation in soybean seed farms.*

Table 3.21 shows the comparison of required hours for soybean production broken down by operation. The operations have been carried out at Seed Farm of PT. Patra Tani in Palembang under the mechanic system, while only a part of operations have been mechanized at EEC Seed Farm in Jambi. Therefore, there is a remarkable gap between the two. The gap is small in the required labour between the Seed Farm in Jambi and the above-mentioned farmers. This is because the Seed Farm inputs a lot of labour in the sorting of seeds, and the figure of 170 persons/day/ha is near the required labour at the farmers' stage.

Table 3.21 Comparison of Required Labour broken down by Operation in Soybean Seed Farms

(Hours/ha)

	Jambi EEC Seed Farm	PT. Patra Tani (Palembang)
1. Plowing, land-Preparation	2.75 (Tractor)	2.5 (Tractor)
2. Fertilization	14.0 ((Human power)	1.0 ((Machine)
3. Seeding	14.0 (Machine)	0.9 (Machine)
4. Pest Control	60.0 (Machine)	1.6 (Machine)
5. Weeding	665.0 ((Human power, 3 times)	0.4 (Machine + Herbicide)
6. Removal of Stubbles	21.0	4.0 (Machine)
7. Harvest (Reaping, Transporting)	315.0 (Human power)	1.0 (Machine)
8. Drying 9. Threshing	12.0 (Machine)	24.0 (Machine)
10. Sorting 11. Packing	86.1 (Human power)	
Total	1189.85 (170 persons 7 hours/day)	35.9 (5 persons 7 hours/day)
Yield	Crude seeds 1,000 kg/ha Sorted seeds 800 kg/ha	1,200 - 1,500 kg/ha

3.3.5 Diseases & Insects

Many reports have been compiled so far regarding diseases and insects of soybean in Indonesia, and the following Table shows the major diseases and insects of soybean in East Java which was compiled by Malan Food Crop Research Institute. It is judged that the major diseases and insects of soybean in all the country may accord with these, taking into consideration several reports and the investigation results of this time.

Table 3.22 Major Diseases and Insects Soybean in Indonesia

Category	Scientific Name	Common Name
Insects	Ophiomyia phaseoli	Beanflies
	Melanagromyza sojaE	Beanflies
	Melanagromyza dolichostigma	Beanflies
	Biloba subsecivella	Pulse miner
	Phaedonia inclusa	Leaf beetle
	Longitarsus suturellinus	Leaf beetle
	Empoasca sp.	Leafhopper
	Riptortus linearis	Pod bug
	Nezara viridula	Green stink bug
	lamprosema indicata	Leafroller
	Etiella zinckenella	Pod borer
	Spodoptera spp.	Armyworm
	Chrysodeixis chalcites	Looper
	Tetranychus bimaculatus	Red spider mite
Fungi	Sclerotium rolfsii	Sclerotial blight
	Phakopsora pachyrhizi	Rust
Bacteria	Xanthomonas phaseoli	Bacterial pustule
	Pseudomonas solanacearum	Bacterial will
	Pseudomonas glycinea	Bacterial blight
Virus		Soybean stunt
		Bean yellow mosaic
		Indonesian soybean dwarf
		Soybean yellow mosoic
		Soybean moisaic
		Cowpea mild mottle

Source: Malan Food Crop Research Institute, 1986

According to the interviewed results to the farmers and extension officers in five provinces where the studies were conducted this time, armyworms have been recognized as the most harmful insect in all the provinces and they have caused serious damages to the farmers. The next harmful insects are miners, webworms and stinkbugs and they have inhabited in every province though there may be some difference up to provinces.

On the contrary, diseases do not seem to have caused serious damage and actually the farmers who were interviewed were not paying special attention to diseases of plants.

Apart from diseases or insects, serious damage has been caused by wild animals such as wild boars etc. in Sumatra island and by rats in East Java Province, and the farmers have racked their brains to cope with this problem.

3.3.6 Production Cost

In recent years production volume of soybean has increased sharply by the stimulus of high level of soybean price. The growth rate of production per kg is high especially in Java island.

According to the table of production cost of soybean per kg by region, the cost in Java island was higher than in outer territories in 1981, but the situation reversed in 1985. Fundamentarily there is no way but to increase yield per hectare to increase soybean production in Java island where expansion of farmland has already reached its limit. Judging from the present situation that intensive land use has already well-developed there, increase of production in this direction will lower the efficiency of marginal investment and will make the production cost higher in a long run. There is another way that is changing land use from the cultivation of competing crops to that of soybean. But this change depends on relative profitability of both crops, therefore the key factor of expanding soybean cultivation is whether high price level of soybean will continue or not in the future.

On the other hand, in outer territories excluding Bali there are some limitations such as deficiency of agricultural infrastructures, crop protection problem, low availability of agricultural inputs and high transportation cost to increase soybean production. But they are endowed with plenty amount of unused land, therefore if proper land is selected deliverately, production of soybean can be increased without raising production cost per kg and without sacrificing the profit of competing crops. Particularly in North Sulawesi the production cost per kg is the lowest in Indonesia even adding high transportation cost, so she can be evaluated as most efficient soybean producing area.

Table 3.23 Production Cost of Soybean Per Hectare

Unit: Rp/ha

	1981	1982	1983	1984	1985
Java island	66,548	74,852	96,872	94,071	104,360
East Java	64,571			90,376	99,595
Outer territories	65,419	61,276	79,470	55,417	8,865
Bali, Nusa Tenggara	51,404	49,437	76,118	39,053	71,762
Sumatra	64,624	73,335	81,198	67,284	86,155
Kalimantan	32,194	13,380	46,508	24,028	85,523
Sulawesi		69,658	79,648	56,416	74,491
Indonesia	66,356	71,914	92,747	83,560	96,173

Source: Cost structure of farms paddy and palawija 1981 - 1985.

Table 3.24 Production Cost of Soybean Per kg

Unit: Rp/ha

	1981	1982	1983	1984	1985
Java island	74.9	85.8	115.3	102.9	102.4
East Java	67.7			93.3	94.0
Outer territories	81.2	75.0	95.2	65.0	94.4
Bali, Nusa Tenggara	57.8	57.4	96.6	44.3	82.0
Sumatra	85.6	94.0	96.2	79.3	103.4
Kalimantan	49.6	20.2	59.4	30.0	108.9
Sulawesi		86.2	87.8	68.5	79.3
Indonesia	75.9	83.6	110.5	93.2	100.0

Source: Cost structure of farms paddy and palawija 1981 - 1985.

Table 3.25 Production Cost of Soybean in Indonesia (1985)

	Production Cost Per Hectar(Rp/ha)							Yield per hectar (kg/ha)	Cost per kg (Rp/kg)
	Seed	Fertilizer	Pesticide	Labor	Transportation	Others	Total		
Java island	23,241	11,701	4,613	51,296	2,554	10,954	104,370	1,019	102.4
East Java	22,727	10,280	5,186	44,646	2,654	14,102	99,595	1,060	94.0
Outer territories	14,008	6,339	3,320	37,905	2,890	16,409	80,865	857	94.4
Bali, Nusa Tenggora	20,487	792	1,195	32,345	1,342	15,601	71,762	875	82.0
Sumatra	11,614	9,438	3,191	42,210	2,963	16,739	86,155	833	103.4
Kalimantan	21,175	8,926	226	25,977	3,669	25,550	85,523	785	108.9
Sulawesi	10,648	3,037	5,053	32,167	5,377	18,109	74,491	939	79.3
Indonesia	20,023	9,833	4,163	46,631	2,671	12,852	96,173	963	99.9

Source: Cost structure of farms paddy and palawija 1985.

Table 3.26 Production Cost of Soybean in Five Provinces (Result of Field Study)

	Plating condition	Production cost per hectar (Rp/ha)						hectar (kg/ha)	Yield per Cost per kg (Rp/kg)
		Seed	Fertilizer	Pesticide	Labor	Others	Total		
East Java	Off-season crop in paddy field (plowing)	27,500	28,250	12,000	175,067	8,000	250,817	1,517	165.3
East Java	do (non-plowing)	26,250	25,000	13,600	185,000	14,500	264,350	1,200	220.3
East Java	do (broadcasting)	27.667	11,458	18,000	156,000	1,000	248,458	1,310	189.7
Bali	do (broadcasting)	53,375	8,453	10,125	110,500	12,500	192,453	1,213	158.7
Jambi	do (plowing)	29,226	30,208	9,167	163,167	3,667	175,475	1,567	112.0
Jambi	Immibration area	23,667	20,833	8,300	220,000	3,000	275,833	1,033	267.0
South Sumatra	Off-season in paddy field (culturation)	19,083	25,000	11,000	151,667	1,000	207,750	1,300	159.8
South Sumatra	Immigration area	12,000	24,875	10,000	155,400	1,000	203,275	1,250	162.6
North Sulawesi	The second crop in paddy field (culturation)	24,400	10,000	12,000	79,400	10,160	136,560	1,160	117.7

3.3.7 Marketing and Processing of Soybean

(1) Supply and demand

In the past Indonesia had been an exporter of soybean but after 1975 when her status changed to net importer. Soybean import has begun to tend to increase. In recent years despite general rise in domestic production, annual import volume of soybean has been kept at a high level over 300,000 tons because growth rate of domestic consumption is higher. The largest supplier of soybean to Indonesia is the United States.

About 70 - 80% of total soybean production is produced in Java island. Java island is the largest producing area and at the same time it is the largest consuming area. Although there are annual variations, per-capita consumption volume of soybean has been increasing and the level of consumption is above 6.0 - 7.0 kg. Soybean is an important source of protein favored by Indonesian people and the income elasticity against consumption is high. This fact means future demand for it will continue to increase from both aspects of population increase and increase of per capita consumption.

Table 3.27 Balance Sheet of Soybean

	Domestic Production (1000 ton)	Export (1000 ton)	Import (1000 ton)	Change of stock in BULOG (1000 ton)	Domestic consumption (1000 ton)	Population (million persons)	Pen capita consumption (kg/person)
1969	389	1			388	114	3.42
1970	498	4			494	116	4.25
1971	516	1			515	119	4.34
1972	518	3			515	122	4.24
1973	541	36			505	125	4.05
1974	589	4			585	128	4.59
1975	590		18		608	131	4.65
1976	522	1	172		693	134	5.18
1977	523		89	14	598	137	4.37
1978	617		130	△ 14	761	140	5.44
1979	680		177	11	846	143	5.91
1980	652		194	5	841	146	5.75
1981	704		361	13	1,052	150	7.02
1982	521		361	△ 2	884	153	5.77
1983	554		391	△10	955	157	6.09
1984	769		400	31	1,139	160	7.10
1985	817		330	29	1,118	164	6.82
1986	1.196		343	9	1,530	168	9.11

Source: BULOG.

(2) Price

In recent years large rise in domestic demand has kept the market price of soybean at a high level, therefore total production of soybean increased at a high pace. Domestic production of soybean being impossible to fulfil the national demand, Indonesia has been forced to import increasing amount of it. BULOG has a monopoly of soybean importation and has a power to control the domestic selling price and volume of soybean import. In other words, domestic price of soybean is separated from the international price and domestic prices are kept high intentionally. Accordingly future possibility of increasing domestic production of soybean highly depends on BULOG's policy of soybean importation.

BULOG has responsibility of purchasing soybean from farmers through KUD in case market price of soybean drops under the floor price which was set for protecting farmers. But because the market price of soybean has been higher than the floor price, BULOG stopped procuring soybean in the domestic market after 1983/1984.

Table 3.28 Farmgate Price of Soybean

Unit: Rp/kg

	East Java	Central Java	Lampung	South Sulawesi	North Sulawesi	Nusa Tenggara
1980	311	308	303	274	251	316
1981	355	335	342	292	257	353
1982	355	349	377	333	309	351
1983	489	489	471	416	381	503
1984	407	451	430	330	324	403
1985	495	516	485	439	323	466
1986	586	612	551	556	-	535

Source: Directorat bina produksi Tanaman pangan.

Table 3.29 Domestic Market Price of Soybean

Unit: Rp/kg

	Surabaya	Denpasar	Manado	Palembang	Jambi
1980	319.3	325.0	278.1	382.4	323.9
1981	381.2	370.7	299.6	368.7	384.4
1982	399.0	394.2	329.4	389.7	428.4
1983	436.9	487.7	347.3	443.4	484.2
1984	506.0	490.0	411.6	503.0	599.1
1985	562.2	520.0	396.9	511.8	595.0
1986	635.0	650.0	550.0	600.0	650.0

Source: BULOG

Table 3.30 Floor Price of Soybean by BULOG

Unit: Rp/kg

	From farmers to KUD	From KUD to BULOG
1979/80	210	217
1980/81	240	251
1981/82	270	283
1982/83	280	293
1983/84	280	293
1984/85	300	313
1985/86	300	313
1986/87	300	313

Source: BULOG

Table 3.31 BULOG's Operation for Soybean

Unit: Ton

	1980/81	1981/82	1982/83	1983/84	1984/85
Procurement	79,188	311,729	461,868	340,187	350,608
Domestic	5,457	3,751	1,619	--	--
Import	73,731	307,978	460,249	340,187	350,608
Release	83,365	303,348	441,208	364,326	353,210
End stock	10,850	36,737	57,397	29,957	25,152

Source: BULOG

(3) Marketing

Farmers can choose one channel from several channels to sell their soybean. Normally they sell their grain to traders who can give them a good price. Most transactions are done in the market (more than 50%) and in the village (25 - 30%). Farmers who have a large stock grain sell their product to local wholesalers and farmers who have a small stock of grain sell their product to village traders at their farmgates. Village traders receive some advance payment from local wholesalers, buy soybean from house to house and regularly carry the soybean to the local wholesaler. Most of the local wholesalers run family enterprises. At the time of soybean transaction traders usually grade the beans considering moisture content, size and impurities. Domestically produced soybean in the market is of low quality because of improper post-harvest handling by farmers. It seems traders do not have incentive to re-process grain to upgrade its quality or to store it.

Indonesia is importing large amount of soybean because she can not satisfy the growing domestic demand for soybean with domestic production. BULOG has a monopoly of soybean imporatation and soybean cake. BULOG has assigned P.T. Berdikari to import soybean. Since 1983 general soybean wholesalers were excluded from the transaction of imported soybean, and the wholesale business of imported soybean is done through two channels of Cooperatives and P.T. Watraco (a subsidiary of P.T. Berdikari). Much of imported soybean is used

for processing into Tempe and Tofu, and KOPTI (Indonesian Tempe/Tofu Processors' Cooperative) procures and distributes imported soybean to its members through the channel of cooperatives. BULOG sells 60% of imported soybean cake directly to large feed mills and sells remaining 40% of imported soybean cake to ASBIMTI (Association of Wholesalers of Imported Raw Materials for Feed).

(4) Processing

In Indonesia soybean is used for human consumption, animal feed and seed. About 90% of the soybean is used for food. Soybean for consumption is used in many processed forms such as Tempe, Tofu, Kecap, beansprouts and Yuba. A smaller but increasing amount of soybean is used for animal feed, especially for the burgeoning poultry industry. Usually only imported soybean cake is used for feed, since it is considered the cheapest. Soybean has been an important source of protein and fat for hundreds of years. Many varieties of foods which have been developed from soybean can be classified into two groups, i.e fermented and non-fermented foods. The main fermented soybean products in indonesia is Tempe and Kecap. Non-fermented soybean foods include Tofu, soybean sprouts, soybean milk, fried beans, boiled beans and soup ingredients.

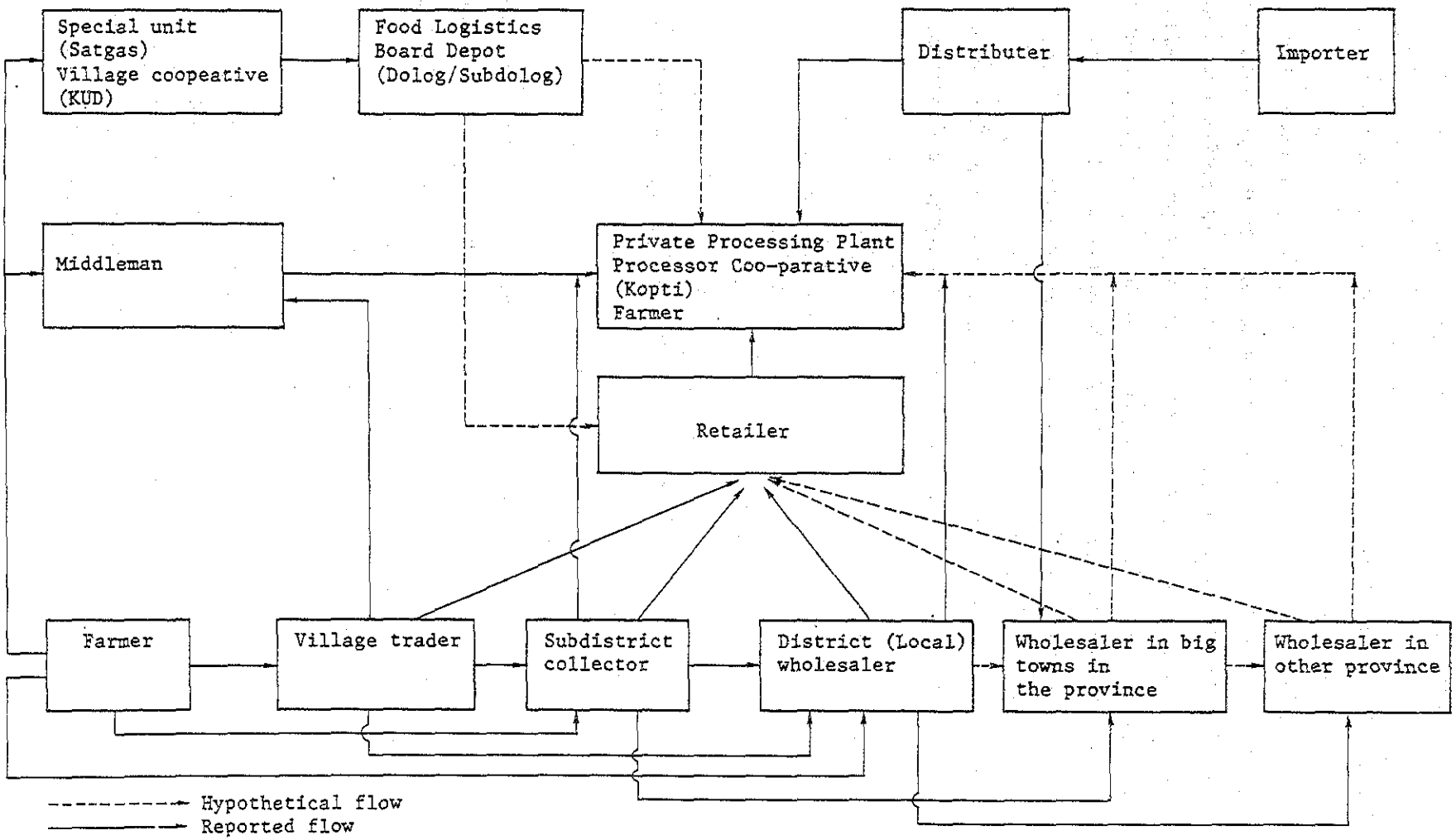


Figure 3.10 Marketing Channels of Soybean in Indonesia

3.4 Multiplication and Distribution of Seeds and Its Problems

3.4.1 Seed Multiplication

(1) Classification of seeds

The Indonesian Government has strongly promoted the rapid growth of seed industry by providing guidance and assistance in the fields of breeding, seed multiplication, seed processing and distribution, and control of seed quality since 1971. The Government has taken a great interest also in private sectors of seed industry in order to make the best use of their power in the muliplication as well as distribution programmes.

The following four classes of seeds are to be used for release and multiplication of new varieties by the National Seed Board.

1) Breeder seed (BS)
2) Foundation seed (FS)
3) Stock seed (SS)
4) Extension seed (ES)

The general status of each class of seeds are explained briefly as follows.

1) Breeder seed (BS)
Breeder seeds are the core of the varieties which were bred at the Breeding Centre of Food Crop Research Institute and registered into improved varieties. The Breeding Centre has preserved, selected and multiplied these BS and distributed them to Central Seed Farm (BBI) of each province.

2) Foundation seed (FS)
Foundation seeds are multiplied from the first progeny of breeder seeds and it is the source for stock seed production. This class of seed has been produced at the Central Seed Farms (BBI) of the provinces under strict guidance and supervision in order to keep genetic purity. Sometimes, the production of

this seed is left to seed growers of such ability. Foundation seeds are distributed to seed farms of each region for multiplication of stock seed, after it is multiplied.

3) Stock seed (SS)

Stock seeds are the multiplied from the first progeny of foundation seeds and it is produced as well as processed so as to conform to the fixed standards of seeds. The multiplication of pure stock seeds from foundation seeds has been carried out by BBI, seed farms of each province (BBU, BBP), seed growers and so on under the responsibility and technical supervision of DGFCA.

Production cost of stock seeds is covered mainly by the national budget, but a portion of provincial budget is also alloted to that in some provinces. The stock seeds are distributed to private seed traders or seed growers as a source for extension seeds.

4) Extension seed (ES)

The extension seeds are multiplied from the first progeny of stock seeds and they are produced as well as processed according to the previously fixed production standards. Recently, a method to further multiply ES from selected ES (Poly-Generation System) has been also adopted instead of a method to produce ES from SS, in order to overcome the shortage problem of SS. Extension seeds are multiplied, by Seed Corporation, BBU, BBP, KUD, seed growers and so on. The extension seeds are sold directly to farmers or through dealers..

A portion of the seeds are used to multiply pink-tag seeds. The pink-tag seed is considered as the certified seed one rank below ES according the generous inspection standards to compensate unsatisfactory production of ES.

(2) Condition of multiplication and distribution

1) Multiplication and distribution of BS.

Table 3.32 shows the relation between demand and supply of breeder seed.

Table 3.32 Demand and Supply of Breeder Seed

Year	Demand (kg)	Supply (kg)	%
1982	600	232	39
1983	1,080	1,584	147
1984	3,400	2,495	73
1985	5,320	1,873	25
1986	5,400	4,965	92

Source: Directorate of Food Crop Production Development, Ministry of Agriculture Indonesia

Table 3.33 Distribution of Breeder Seed

Province	1983	1984	1985	1986
	(kg)	(kg)	(kg)	(kg)
Jambi	180	85	185	85
South Sumatra	-	125	80	95
East Java	140	220	220	565
Bali	-	80	100	10
North Sulawesi	-	120	40	260
Whole Indonesia	1,584	2,495	1,873	4,965

Source: Directorate of Food Crop Production Development, Ministry of Agriculture Indonesia

The supply of BS has been constantly below the demand since 1984. That of 1986 was really on a line with the demand, but, the amount produced at Food Crop Research Institute, among them, was only 1,285 kg out of the total quantity of 4,965 kg. The others are the seeds which were produced at BBI Plumbon in West Java and at Pilot Seed Farm of Muarango in Jambi.

2) Multiplication and distribution FS, SS, & ES

Table 3.34 shows the situations of multiplication of seeds (FS, SS, ES) in the objective five provinces for the study.

Table 3.34 Production of Seeds (FS, SS, ES) in 1986/87

Province	FS(BBI)		SS(BBI/BBU)		ES (Seed Growers)			
	Area (Ha)	Production (kg)	Area (Ha)	Production (Kg)	Area (Ha)	Production (Ton)	Certified Seeds (Ton)	Label-Seeds (Ton)
Jambi	2	300	5	2,963	560	276	4.4	245.7
South Sumatra	7	1,298	8	366	724	350	17.2	28.7
East Java	15	4,417	25	5,348	9,849	4,881	-	47.4
Bali	3	670	11	4,576	305	148	78.2	29.7
North Sulawesi	9	3,080	26	5,928	871	202	6.1	-
Whole Indonesia	135	38,737	288.5	80,348	27,636	13,731	217.5	721.7

Source: Directorate of Food Crop Production Development, Ministry of Agriculture, Indonesia

Table 3.35 Production of Certified Seeds of Soybeans, and Requirement in 1986

(ton)

Item \ Class of seeds	FS	SS	ES (Certified Seeds + Label Seeds)
Required Amount (A)	29.4	587.6	11,751.7
Produced Amount (B)	38.7	80.3	939.2
(B)/(A) (%)	131.6	13.7	8.0

Source: Directorate of Food Crop Production Development, Ministry of Agriculture, Indonesia

Notes: 1) Planted area = Harvested Area ÷ 0.95 (1,116,415 Ha ÷ 0.95)
2) Required seed amount: 50kg/Ha
3) Yield per unit: 1 t/Ha
4) Renewal rate of seeds: Once in five cropping

Table 3.36 Comparison of ES Production with Estimated Requirement in 1986 in The Provinces where the Study was Carried Out

Province	Planted Area (Ha) (Harvested)	Production (ton) (A)	Requirement (ton) (B)	(A)/(B) (%)
1. Jambi	2,754 (2,616)	276 * 250.1	27.5	1,003.6 * 909.5
2. South Sumatra	16,268 (15,455)	350 * 45.9	162.7	215.1 * 28.2
3. East Java	467,322 (443,956)	4,881 * 47.4	4,673.2	104.4 * 1.0
4. Bali	20,802 (19,762)	148 * 107.9	208.0	71.2 * 51.9
5. North Sulawesi	21,053 (20,000)	202 * 6.1	210.5	96.0 * 2.9
6. Whole Indonesia	1,175,174 (1,116,415)	13,731 * 939.2	11,751.7	116.8 * 8.0

Source: Directorate of Food Crop Production Development, Ministry of Agriculture, Indonesia

Notes: 1) Planted Area = Harvested Area ÷ 0.95
2) Required seed amount: 50 kg/Ha
3) Renewal rate of seeds: Once in five croppings
4) * indicates the total of certified seeds and lavel seeds

Table 3.35 shows a trial estimate on how much of the required amounts of soybean seeds (FS, SS, & ES) were fulfilled by the production achievement. The figures were calculated based on an estimated total planted area 1,174,174 ha, in Indonesia on the premise that a farm household renews their seeds once every 5 croppings. According to this Table, the required seed amount is as follows, i.e. FS: 29.4 tons, SS: 587.6 tons and ES: 11,751.7 tons. The Table indicates that the produced amount of SS and ES are far below the required amount, while that of FS is produced more than the required amount. This proves that the system of multiplication and distribution of seeds for soybean has not satisfactorily functioned at the production stage of SS and ES.

Table 3.36 shows the comparison of total production of ES

with supplied amount for each province, by the method of tentative calculations in the way already described before. According to this table, trial calculations predict a large surplus would occur in production of seeds and supply of certified and labeled seeds in Jambi. This is because seed quantity of soybean produced at Soybean Pilot Farm at Muara Bungo in the province is comparatively large, whereas planted area in the province is small. South Sumatra and East Java also have a surplus production but they are considerably short of certified seeds including label seeds. The production in the remaining two provinces is below the required amount. The comparison of the total production of ES in the whole country with the required amount shows that the production was 116.8% of the required amount. Still, the certified seeds including label seeds among them accounts for only 8.0%. The Government increased the number of seed growers in order to rapidly raise production of soybean seeds. The quality seeds to the standards, however, have not been produced as were planned at the beginning since the production plan has not been backed by techniques. Table 3.37 shows the actual situation of supply and demand of soybean ES in 1985 in East Java. Break-down shows that approximately only 2% of the total was supplied through formal routes from seed farms, seed growers etc., while nearly 98% were exchanged individually among farmers and so that they have not used regular certified seeds. Here seems to lie a basic problem of multiplication and distribution of soybean seeds.

Table 3.37 Supply and Demand of Soybean Seeds (ES) in East Java in 1985

Demand	Production & Supply of ES in Each Organization					
	Central Seed Farm (BBI)	Seed Corporation(SHS)	Seed Farm (BBU/BBP)	P.T.Patra Tani	Seed Producing Farmer	Farmer's self seed
13,826 (ton)	77	28	176	41	114	13,390
100 (%)	0.6	0.2	1.3	0.3	0.8	97.8

Source: Agricultural Annual Report, 1985, East Java Province

3.4.2 Techniques of Seed Production

(1) Guidelines on techniques of soybean seed production in Indonesia

In relation to the techniques of seed production, Directorate of Food Crop Production under Directorate General of Food Crops Agriculture of the Central Government has had charge of coordinations issuing guidelines.

The authorities concerned of the province set forth the technical guidance to Extension Centres (PPL) and seed inspection, etc. to Seed Inspection and Certification Offices (BPSB) according to the standards and thus it has taken part in the coordination as well as administrative and technical guidances on production and distribution for seed farms and seed producing farmers.

The Table 3.38 shows the summary of the production standards for soybean seeds which were set by DGFCA of the Central Government.

Table 3.38 Production Standards for Soybean Seed

Item	Details
I. Preface	
1. Importance of Soybean	1) Important as nutritive resources for the nation. (Protein, fat, etc.) 2) Important also as resources to promote trade and industry, also valuable as green manure. 3) The combination with soybean cropping brings about higher income than single cropping of paddy. Farmers know this through their experience. 4) The life of soybean is short. The rate of germination of soybean seeds at markets is about 45 - 65%. 5) It is required to constantly produce the seeds of germination viability of at least 80%.
2. Items to be considered for varieties	1) Grain color. They are classified into the grains of pale yellow, black, green, mixed color and so on. 2) Growing period. Early varieties 75 - 85 days Medium varieties 85 - 90 days Late varieties 90 - 100 days
3. Use of seeds	1) Cropping time and pattern i) October - January ii) February - May iii) June - September 2) Use of seeds. Grown seeds in the previous crop are used for the following crop.

Item	Details
II. Selection of Farms and Foundation Seed	
1. Farm conditions	1) At the altitude of 0 - 500 m.
	2) Easy access and good facilities in water supply.
	3) Well drainage.
	4) Places where other varieties are not grown in a farm.
2. Implementation of isolated culture	1) Attention to be paid to a possibility of natural crossing of 1% soybean in spite of soybean being a self-fertilization crop.
	2) To isolate at least 8 m. Desirable to construct roads on drains, or to lay fields in fallow for this purpose.
3. Conditions of foundation Seeds	1) Pure stock seed to be used should be one rank above the seed to be produced.
	2) ES production on the basis of FS and SS.
	3) Endowment of ES with the purity special to the variety. (To observe the harvest grown at the farm and grasp the characteristics.)
	4) No mix-up of other varieties, weed seeds or sand.
	5) Sound seeds.
	6) Germination rate more than 80%.

Item	Details
III. Cultivating method	
1. Plowing and land preparation of farms	1) Fields should be plowed fine, exposed to the air and thus dried. This brings about the effects of dried soil. 2) To plow with hoes or spades and make ground by eliminating weeds or cut stems. 3) To make ridges of a wide width of 3 - 4 meters after ground-making. The length is not an important matter. The side drains of ridges should be 20 - 25 cm in width and 25 - 30 cm in depth.
2. Cultivating pattern	1) Amount of grown seeds, Small grains 40 kg/Ha Large grains 50 kg/Ha. 2) At the fields where soybean was introduced for the first time, the mixed seeding of 50 kg of seeds/Ha with the soil of already introduced fields will help the growth of nodule bacteria. 3) Seeding method is drill seeding method. The depth of the hole: ± 3 cm. To put two grains in a hole. Row spacing: 30 x 30 cm, 25 x 30 cm. In the case of varieties of many branches: 32 x 20 cm, 25 x 25 cm.
3. Cultivating practice a) Weeding	Twice: First : 3 weeks after seed Second: 6 - 12 weeks (Before the flowering time.)
b) Irrigation	1) To take care to prevent plants from over drying at germination, flowering and grain thicknening period. 2) To sprinkle water on them for 2 - 3 hours in the morning or evening when they are too dried.
4. Manuring	1) Non-fertilization in fertile soil. 2) To apply Uren(N) 50 kg/ha, TSP (P_2O_2) 100 kg/ha and Kcl (K_2O) 50 kg/ha to sterile soil. 3) To put fertilizer into holes before seeding and cover with earth. (at the depth of 7.5 cm)
5. Pest Control	In the some way as is implemented in 3 cultivating practice.

Item	Details
6. At-Farm selection	
a) At-Farm selection	1) Tests and elimination of other varieties at farms: 3 times. First: after sprouting, Second: Early flowering period, Third: Maturing period.
	2) Investigation items: navel color, flower color, number of branches and its color, color of stem & leaf, hair color of stem leaf, number of branched pods, germination type, ending of flowering period, uniformity of maturity.
b) Seeds	3) Items: color, shape & size of grains
IV. Harvest	1) The quality of seeds depends on the harvesting time. When they are harvested too late, pods will be broken and beans dropped down, while when they are harvested too early, they may sprout too early, or they may wrinkle or mold. Thus, the quality will be deteriorated.
	2) When the color of stem leaves and pods turn into yellow, leaves fall and then color of pods changes into chocolate color, it is the optimum time for harvest.
	3) When grains have fully matured and they become bustrous and hard.
	4) To reap with sickles on fine days after soybeans are dried.
V. Drying and threshing	1) To dry while paying attention not to mix other varieties.
	2) As for threshing, to enclose with a boundary in order to avoid mixing of other varieties.
	3) To fully sieve and winnow after threshing to eliminate foreign substances and dry until moisture content reduces to 10%.
	4) After seeds' moisture content reduces to the fixed rate, to sort grains, take samples and send them to laboratories of the nearest seed inspection office for inspection and certification.
	5) To sell passed seeds with a certificate attached thereto.

Source: Directorate of Food Crop Production Development, Ministry of Agriculture, Indonesia.

The guidelines are thus described in detail. Especially, as for the variety identification method by observing, main emphasis has been placed on the color and the shape of the crop. Special attention has also been paid to drying and cleaning.

(2) Seed production techniques of seed producing farmers.

Farming practices are shown in the three examples in Table 3.39 in order to exemplify to which extent the above-mentioned standards for guidance have been utilized by the farmers. There is not a big difference in their cultivating pattern from the general one. In detail, other varieties are eliminated twice only (standard: three times) in early flowering time and in early maturing time. Planting density and the number of sown seeds were followed to the fixed standards. It was also seen that they paid careful attention to drying after harvest, cleaning and prevention of mixing of other varieties while threshing. As far as these three households are concerned, it was learned that the standards have been kept except for the elimination of other varieties.

Table 3.39 Cultivating Techniques for Soybean for Seed Growers

Operation \ Province	Jambi	East Java	North Sulawesi
Village	Sarako	Nuganjuku	Mopuya Utara
1. Farm condition	Secondary crop of rice, cropped area 2.5 Ha (2 crops)	Secondary crop, cropped area 3.5 Ha (2 crops)	Secondary crop, cropped area 1.25 Ha (2 crops)
2. Plowing, land-preparation			
o Method	Use of tractor in group	Human power	Human power
o Required labour	3 man • day/ha	25 man • day/ha	9 man•day/ha
3. Manuring			
o Method	Between rows	Between rows	Non
o Amount (kg/ha)			
1) Urea	10 (N: 22.5)	75 (N: 33.8)	
2) TSP	100 (P_2O_5: 45.0)	150 (P_2O_5: 67.5)	
3) KCL	75 (K_2O: 60.0)	50 (K_2O: 30.0)	
o Topdressing/basal dressing	N 1/2	N 1/2	
o Frequency of topdressing	1	1	
o Required labour	3 man • day/ha	3 man • day/ha	
4. Seeding	Amount: 40 kg/ha	Amount: 40 kg/ha	
o Method	Drill seeding after plowing (20x20 cm, 2-3 grains/hole)	Drill seeding without plowing (20x20 cm, 2-3 grains/hole)	Without plowing
o Required labour	20 man • day/ha	28 man • day/ha	5 man • day/ha
5. Pest-control			
o Method	Control in groups	Human power (Hand sprayer)	Human power (Hand sprayer)
o Frequency	3 times	8 times	5 times
o Required labour	6 man • day/ha	18 man • day/ha	10 man • day/ha
6. Weeding frequency	Twice	Once	Twice
7. Removal frequency of other varieties	2 times (Flowering, Maturing times)	2 times (Flowering, Maturing times)	2 times (Flowering, Maturing times)
o Required labour	62 man • day/ha	18 man • day/ha	30 man • day/ha

Operation \ Province	Jambi	East Java	North Sulawesi
Village	Sarako	Nuganjuku	Mopuya Utara
8. Reaping, drying			
o Method	With sickles Dry under the shine for 3 days	With sickles Dry under the shine for 4 days	With sickles Dry under the shine for 10 days
o Required labour	35 man • day/ha	32 man • day/ha	10 man • day/ha
9. Threshing, cleaning			
o Method	Beating against stands Cleaning after threshing.	Beating with clubs Cleaning after threshing.	Beating with clubs Cleaning after threshing.
o Required labour	12 man • day/ha	28 man • day/ha	14 man • day/ha
10. Yield per unit area (kg/ha)	1,400	1,200	2,000
11. Total required labour (man • day/ha)	141	152	78

Note: Interviewing, the Study Team.

(3) Production scale of seed growers

Table 3.40 shows the production scales of the seed producers in East Java. The area of 233.64 ha has been cropped by 32 units which is the number of individuals added to that of groups. The output is 205 tons, and the circulated amount out of that is 125.8 tons (61.4%). Therefore, the average cropped area per 1 unit is calculated to be 7.3 ha. But this figure is rather high, because groups and individuals are mixed in this. Generally, the cropped area for one individual around 1.0 - 5.0 ha, while that for one group is 10.0 - 50.0 ha.

Table 3.40 Produced Amount of ES by Seed Growers in East Java (1985/1986)

Prefecture	Variety	Number of Growers	Area (ha)	Production (ton)	Marketing Amount (ha)
1. Jombang	Wilis	3	58.5	58.5	58.5
2. Bujonegoro	Wilis	10	29.0	14.5	-
3. Magelan	Wilis	5	21.0	20.6	-
4. Ponorogo	Wilis	3	25.0	14.5	14.5
5. Nuganjuk	Wilis	1	1.14	1.5	-
6. Tronggalek	Wilis	5	37.0	30.8	30.8
7. Pasuruan	Wilis, No.29	2	18.0	22.0	22.0
8. Jamber	Lokon, No.1340	2	42.0	41.6	-
9. Sampeng	Si nyonya	1	2.0	1.0	-
Total		32	233.64	205.0 (100)	125.8 (61.4%)

Source: Annual Report 1985/1986, published by DINAS, East Java Province

(4) Analysis of soybean samples

Seed samples of soybean were collected from the five provinces and analyzed on moisture content, weight of 100 grains, germination and quality. The samples were collected from BBI, BBU, BPSB and farmers totaling 72 samples.

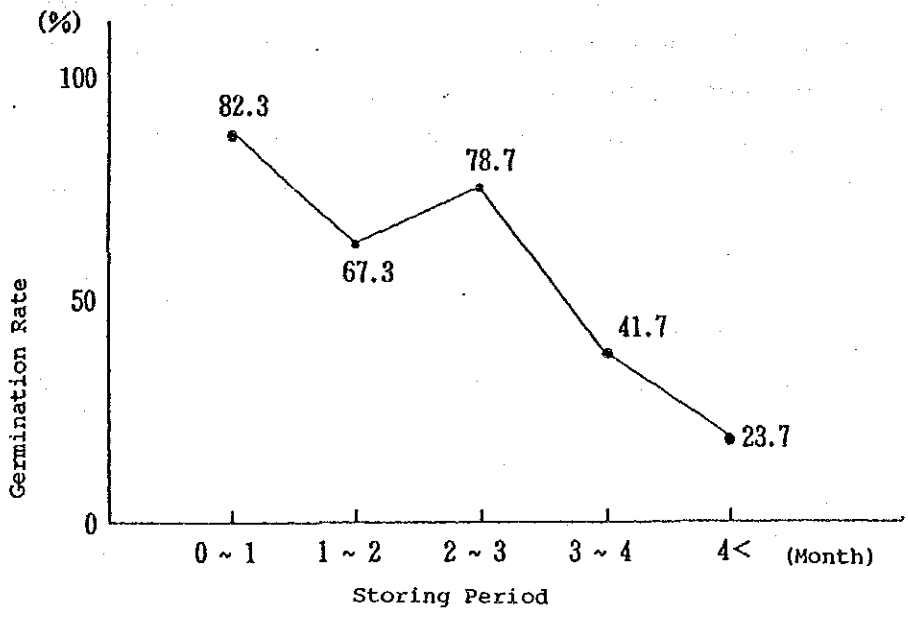


Figure 3.11 Germination Rate of Soybean Seeds Broken Down by Each Storing Period

The Figure 3.11 shows the comparison of the average rate of germination of 64 samples of clear derivation broken down into each storing period.

This figure indicates that the germination rate tends to incline rapidly after three months of storing period. The average germination rate of the samples which were kept for six months in a cool storage (Temperature 20 - 21°C, Humidity 60 - 75%) equipped with a home-cooling device of P.T. Patra Tani of South Sumatra Province was 73.5%. Therefore, it is very effective in order to keep soybean seeds for a longer period.

The average germination rate of the certified seeds (BS, FS, SS) of a storing period of less than three months and that of the seeds grown by farmers were 72.4% and 76.5%, representing; no significant BPSB standards, the effective period of BS, FS, and SS is less than three months after harvest and the germination rate is supposed to be over 80%. Taking into consideration these instances, it is necessary to raise the germination rate of certified seeds a little more.

The average moisture content of the samples collected from among certified seeds and that of the samples collected from farmers were 10.6% and 12.5% respectively. The study was carried out in dry season, still, seeds were well dried.

The following table shows the comparison on the weight of 100 grains and quality of seeds between certified seeds and farmers' seeds. The variety Wilis was adopted here among collected samples, since it was comparatively larger in the number.

Table 3.41 Quality of Seeds (Variety: Wilis)

Seeds	Item	Whole grain (%)	Damaged grain (%)		Immature grain (%)	Cracked grain (%)	Foreign matter (%)	Weight of 100 grains (g)
			By insect	By disease				
Certified seeds		85.8	1.8	6.4	1.6	4.3	0.1	9.69
Farmer's self-seeds		84.7	2.8	5.1	2.7	4.3	0.4	8.99

There were not significant differences between two, except the item of the weight of 100 grains. According to the BPSB standards, the content rate of pure seeds is prescribed to be 98% in the case of FS and SS and 97% in that of ES. Even though whole grains, damaged grains and immature grains may be included in pure seeds, still, a great deal of seeds are below the standards at present. Besides, the content rate of damaged grains as well as premature grains is too high to be used as seeds.

It is said that the size of seeds has a great influence on yield in the case of soybean, and according to certain experimental results in Japan, it was reported that 1% increase in the weight of 100 grains lead to yield increase of 0.4%. The fact that the weight of 100 grains of certified seeds is heavier than that of seeds grown by farmers may be attributed to the great efforts of the people involved in seed producing programmes, but there is not much difference in other items. And so, it is further required to make efforts to improve the quality.

In order to promote seed distribution programmes, it is an important point to give a better understanding of the effect of quality seeds (certified seeds) to farmers, users of seeds, and to raise demand for certified seeds. And to begin with,it is an urgent task to improve the quality of certified seeds.

3.4.3 System and Organization for Multiplication and Distribution of Seeds

The present system and organization for multiplication and distribution of soybean seeds in Indonesia are shown in Figure 3.13. Outline of major related organizations is as follows.

(1) Directorate of Food Crop Production Development

This is one of the eight directorates to the Directorate General of Food Crops Agriculture of Ministry of Agriculture, and it has been conducting administrative services concerning production of paddy and secondary food crops (Palawija) in the central government level.

The Directorate of Food Crop Production Development consists of six subdirectorates, and the Subdirectorate of Seed Production Development has had charge of deciding on production and distribution programmes for seeds of paddy and secondary food crops, promoting seed producers development, budgeting for seed production and so on.

The organization chart of the Directorate is shown in Fig. 3.12.

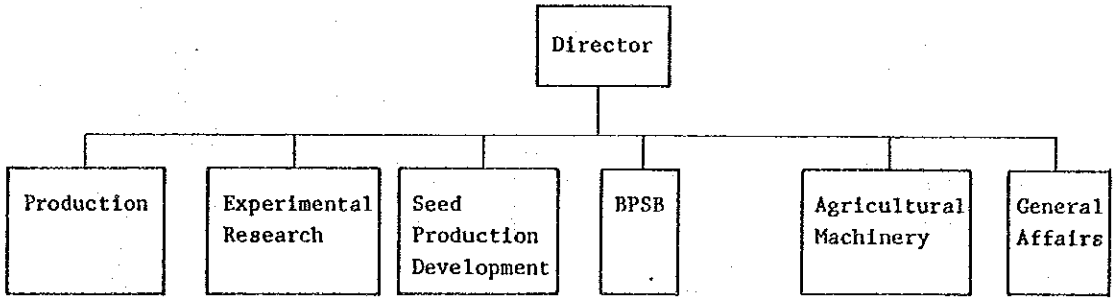


Figure 3.12 Organization Chart of Directorate of Food Crop Production Development

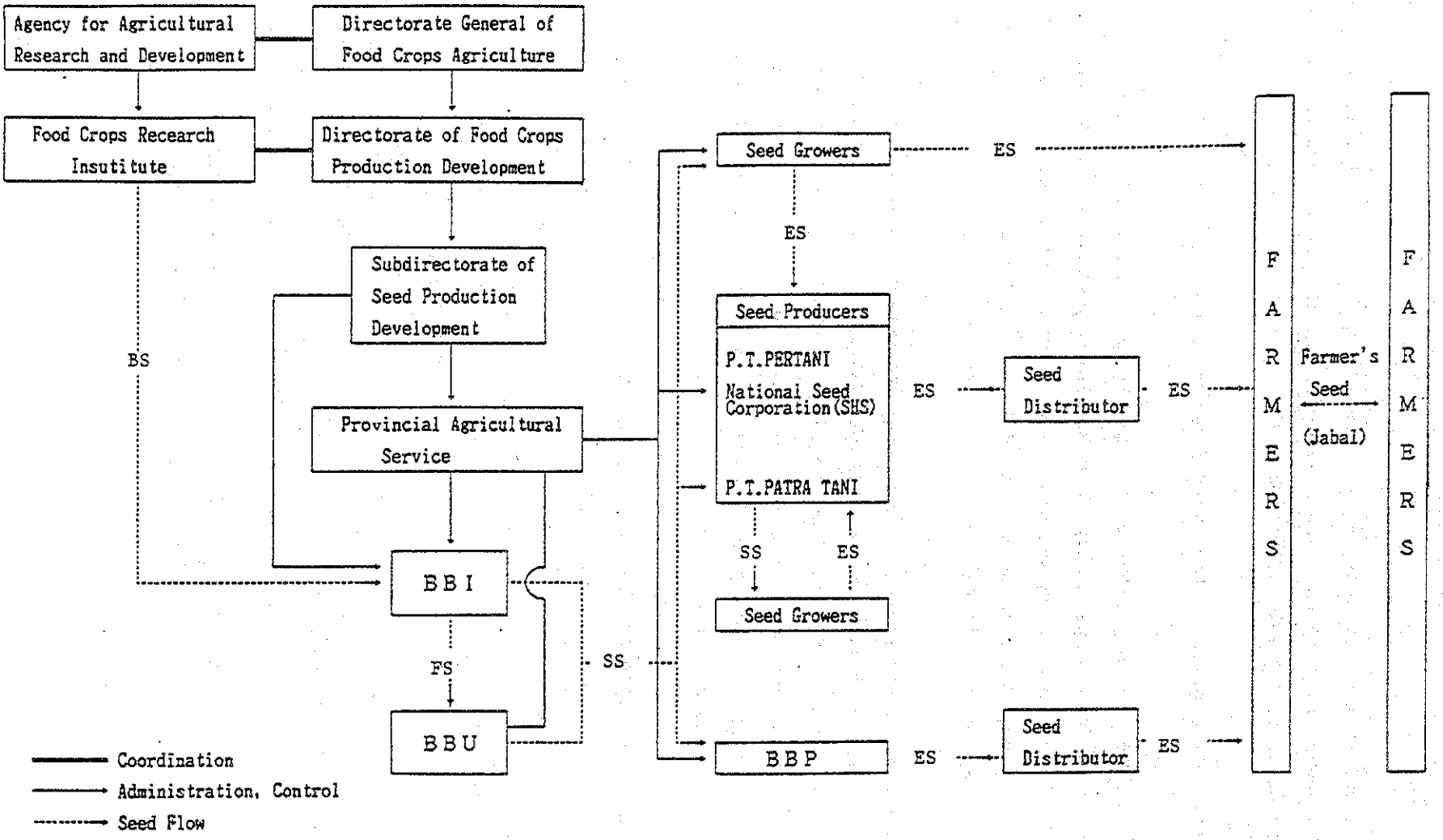


Figure 3.13 Organization Structure for Soybean Seed Multiplication and Distribution

(2) Food Crop Research Institutes

There are six research institutes for food crops at present in Indonesia, and the Central Research Institute for Food Crops (CRIFC) has carried out general control over them.

The following are the names of the places where each institute is located.

1. Bogor, West Java (BORIF)
2. Sukamandi, West Java (SURIF)
3. Malang, East Java (MARIF)
4. Sukarami, West Sumatra (SARIF)
5. Banjarbaru, South Kalimantan (BARIF)
6. Maros, South Sulawesi (MORIF)

These above-mentioned institutes have been playing a part in supplying BS of registered varieties which were to the central seed farms (BBI) of each Province. BS for soybean seeds have been supplied mainly by BORIF.

BORIF is composed of four Departments of Research, General Affairs, Information and Researching Facilities.

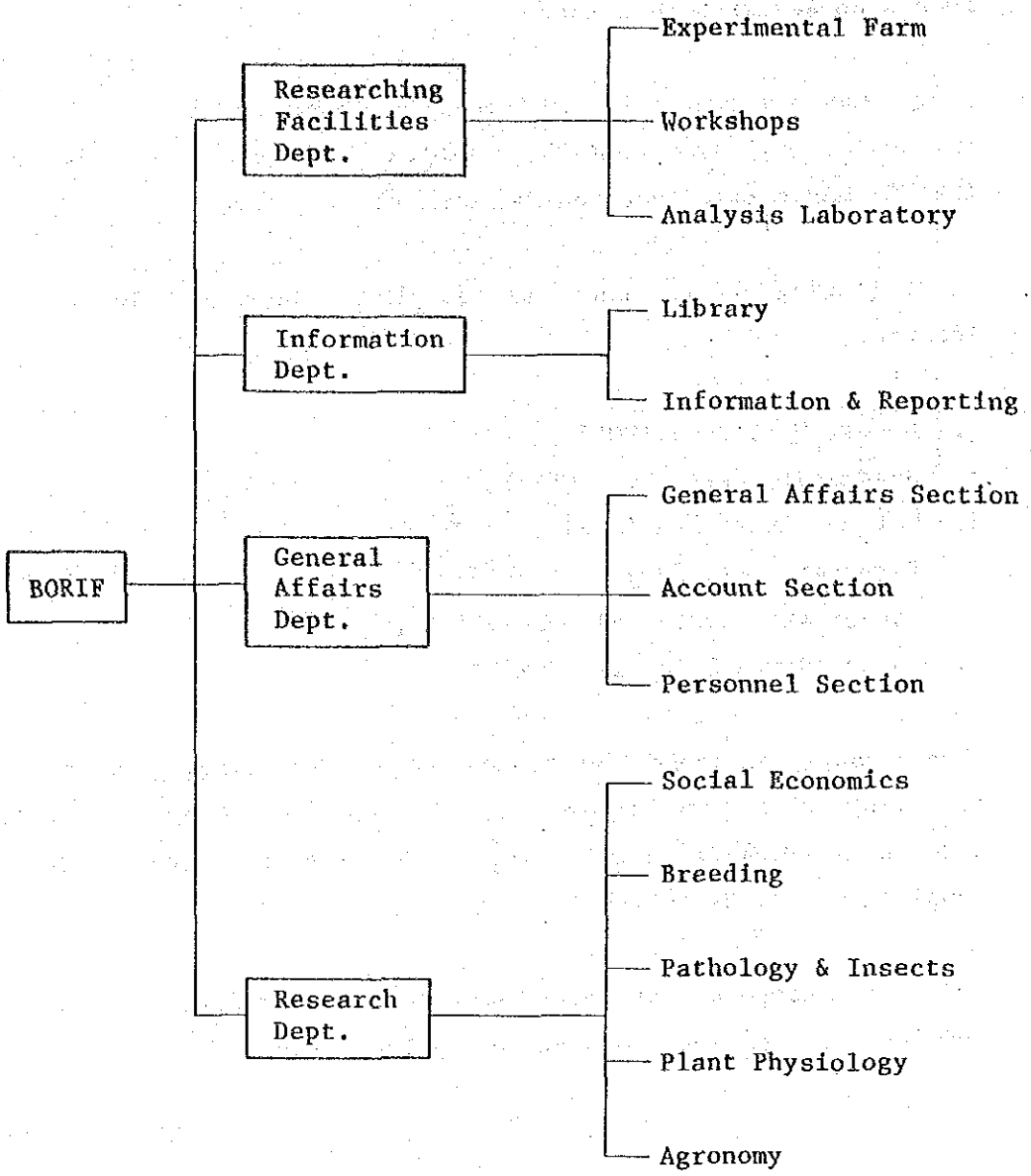


Figure 3.14 Organization Chart of BORIF

(3) BBI/BBU/BBP (Seed farms)

There are Central Seed Farms (BBI) for paddy, Palawija and horticultural crops established in each province and each province has several main seed farms (BBU) (Refer to Appendix C-1 and C-2). Besides, in several provinces, BBP (Supplementary Seed Farms) have been also established.

The major role of these seed farms is to multiply standard FS as well as SS, and to contribute to the production of standard seeds. But, this role is basically divided into three types of farms; that is, BBI is supposed to multiply FS from BS and SS from FS, BBU-SS from FS and BBP-ES from SS. In addition, these farms are supposed to provide technical guidances to seed growers in cooperation with the agricultural office of the province under the supervision of Subdirectorate of Seed Production Development of the Headquarters in Jakarta.

The structure of these seed farms was reorganized by the DGFCA Decision Letter I, A5.82, 6 dated February 10, 1982. BBI, BBU and BBP have been placed at present under administrative supervision of the provincial government through provincial agricultural offices. Actually, however, BBI has been entrusted with the supervision and coordination in seed production programmes by the Central Government and also the budget for seed production has been provided by the Central Government.

Table 3.42 shows the amount which the Central Government paid to BBI for the multiplication of FS and SS. According to this table, the budget for the multiplication of SS is eliminated in 1987/88. Besides, even though the cropped area for the multiplication of FS has increased, the budget has decreased as a result.

Table 3.42 Budget for Seed Production Allotted to BBI

Year	BS-FS		FS-SS	
	Cropped Area (ha)	Budget (XRp10,000)	Cropped Area (ha)	Budget (XRp10,000)
1983/84	27	7,002	150	37,545
1984/85	85	22,421	213	45,795
1985/86	133	63,745	750	246,703
1986/87	135	68,185	291	149,825
1987/88	150	48,000	-	-

Source: Directorate of Food Crops Production Development, Ministry of Agriculture, Indonesia

(4) Seed producers/distributors

The seed producers' role is to produce seeds or to process ES seeds which are produced by contract growers, to receive inspection and certification on seeds and then to sell them. The following public corporation and private companies have been producing soybean seeds in Indonesia.

1) Seed Corporation (SHS)

This was established based upon the Government Regulation No. 23 dated May 5, 1971, and is given the roles as follows.

a. Production, processing, storing, packing and distribution of certified seeds
b. Training for personnel of seed production
c. Promotion of programmes directly related to seed production

The facilities for processing of paddy seeds have been established in each province of Java and in some provinces of Sumatra at present and seeds are being produced there. Some facilities among them are also processing soybean seeds.

2) P.T.Pertani

This is a semi-governmental company under the control of Ministry of Agriculture. Its major services are distribution of fertilizer and agricultural chemicals. I has also participated in the field of seed production and distribution recently.

3) KUD

They were established as farmers' organizations at the stages of Kebupaten and Kechamatan in each province, and they have carried out services mainly such as sales of agricultural equipments or purchase and sales of

agricultural products, mainly rice, for farmers. They have also participated in the production and distribution programmes of seeds.

4) P.T. Patra Tani

This is a semi-governmental company and a subsidiary of Pertamina. It has a farm near Palembang in South Sumatra and mainly taken part in the production and distribution of soybean seeds.

5) Muara Bungo Soybean Pilot Farm in Jambi Province

This is a governmental farm which was developed under the cooperation of EEC. The role of this farm is to produce BS and FS soybean seeds throughout a year and so, this has been expected as a model for the quality seed production programmes in Indonesia.

(5) Seed growers

This category refers to farmers organizations and companies who produce seeds. All of them should be registered in the agricultural offices of the province through Kabupaten agricultural offices.

To take East Java for example, the number of soybean seed growers registered in 1985/86 was 32, and the certified seeds of 205 tons were produced in the area of 233 ha by them.

(6) Kiosk/Retail traders

They do their activities within a closest range to farmers and they deal in not only government-certified seeds, but also other seeds.

(7) Seeds grown by farmers themselves

Generally speaking, soybean farmers have been using seeds grown by themselves or those which they bought from other farmers, and the periodical renewal into certified seeds have hardly been carried out under the present situation. The followings are thought to be the reasons for that.

1) The shortage of certified seeds.

2) The quality of certified seeds is not always superior to that of seeds grown by farmers.

3) The price of certified seeds is high.

Under such circumstances, Jabal System has been established in East Java and Bali, a system to secure seeds of high germination viability by selling soybean seeds to each other among the farmers of the regions where cropping seasons for soybean are different from each others. The traditional water-management group "Sabak" has taken a leading role in selling and buying of seeds through the group in Bali Province, while in East Java, seeds are sold to and bought from each other among farmers.

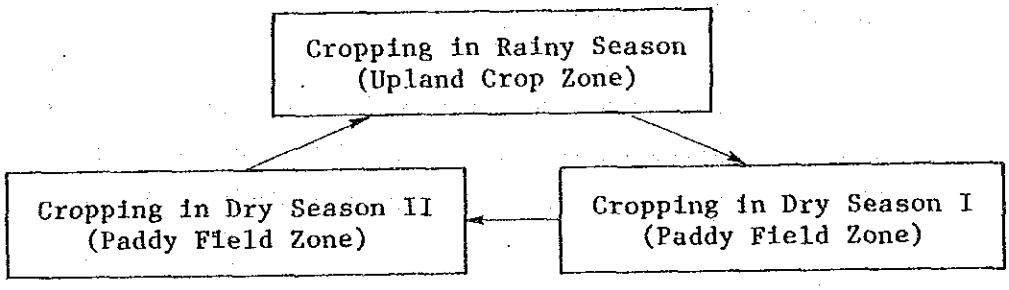


Figure 3.15 Jabal System

Though some traders have commercialized this system to merchandise soybean seeds in large scale farming areas, most of the deals in this system are done at the level of rank and file farmers. Therefore, seeds are circulating in a narrow range such as within a Kabupaten or a few neighbouring Kabupatens.

3.4.4 Seed Inspection System

(1) Seed Control and Certification Services (BPSB)

One of the most important elements for increase in agricultural production is how to secure quality seeds of good varieties. Quality seeds can be produced from genetic pure seeds only when they are multiplied under fixed conditions in advance. And, special control must be given in every phase such as cultivation, processing, storage and distribution in order to certainly maintain the genetic characters as well as physiological vigor of seeds until they reach farmers.

The present policies in relation to production, marketing and certification of seeds have been implemented under President Decree which was issued in 1971 and a series of Ministerial Decrees which followed the President Decree (Refer to Appendix D-21 and D-22), and the Seed Control and Certification Services (BPSB) was established as a part of the policies under Directorate of Food Crop Production Development, Directorate General of Food Crops Agriculture, Ministry of Agriculture.

BPSB was established at the central level in 1971 under Ministerial Decree No. 174/1971, and the following two were provided as its main functions under Ministerial Decree No. 460/1971 and its amendments (No. 67/1977 & No. 415/1979).

1) To formulate the standard and procedure of seed quality control and certification, which should be issued by Director General of Food Crops subject to approval of the National Seed Board (NSB).
2) To supervise the implementation of seed control and certification carried out by the provincial Seed Control and Certification Services (BPSB).

BPSB has 13 provincial offices up to today under Ministerial Decree No. 529/1978 and has taken over seed control and certification services which used to be carried out in Provincial Agricultural Service/Provincial Seed Centre during

1971 - 1979. Out of 13 provincial offices, 8 offices were furnished with working units under Decree of the Director General of Food Crops Agriculture I.HK.050.84.83, and thus, the system to cover the whole province was arranged. The locations of BPSB offices and their working units and their working area are shown in Appendix D-1.

The total number of BPSB staff is 1,179 persons as of 1986/87, and 931 out of them are technical staff while 248 are non-technical. (Refer to Appendix D-2) The number of the staff will be altered according to varying requirement and the ideal proportion of technical staffers to non-technical staffers is deemed as 4:1.

BPSB has made various efforts to level up their techniques as well as knowledges. For example, on-the-job training was provided by Directorate General of Food Crops Agriculture every year between 1971 and 1975, and on-the-job training of less than two weeks have been organized by the same Directorate General since 1975 while that of more than two weeks by the Agency for Agricultural Education, Training & Extension (BPLPP). In addition, the training both in the country and abroad have been implemented under IBRD the Second Seed Project. Several staff have also been dispatched abroad for long as well as short term training which are provided by other foreign organizations such as Colombo Plan and FAO.

According to the Ministerial Decree No. 460/1971 and other guidances, the following four items are fixed as the main activities of BPSB.

1) Cultivar Evaluation, 2) Seed Certification,
3) Seed Marketing Control, 4) Seed Testing

1) Cultivar evaluation

The cultivar evaluation is carried out through multi-location tests to study adaption potential and performance of promising cultivars according to the details provided by research institute. These testing results are used as the data for recommendation of varieties by the National Seed

Board. The 121 varieties of food crops have been released under the name of Agricultural Minister during the period of 1971 - 1985, and among them, 62 varieties of paddy, 14 of maize, 9 of soybean and 9 of peanuts were included (Refer to Appendix D-4).

2) Seed certification

The released varieties are declared as the Regulated Seed and the quality standard as well as marketing regulations are applied to them. Regarding seed production of Regulated Seed, the certification system of BPSB such as supervision, field inspection, testing etc. should be applied in every stage. The seed certification system aims to maintain purity and quality of improved variety seed and to constantly supply them to farmers. The certification system for paddy seeds has been put into practice since 1971, while that for maize in 1982, and that for soybean, peanut and mungbean in 1984. On the case of other crops, such as potato, tomato, sweet potato, onion, garlic, spinach and so on, even though their varieties has been included in the list of Regulated Seed, the seed inspection and certification system of BPSB has not been applied to them yet.

Appendix D-6 shows the BPSB activities for seed certification during the period of 1971/72 - 1984/85.
Seed certification is carried out on the following procedures.

a) To conduct field inspection including harvesting and processing and take seed samples.
b) To test the seed quality whether it conforms to the standard or not.
c) To control the provision of certification labels.
d) To collect related data in order to perfect seed certification method.
e) To provide certification labels.
f) To develop certification method recording and storing data.

3) Seed Marketing Control

Control services for seed marketing is basically limited only to the seeds of the varieties which have declared as Regulated Seed, and BPSB activities in this field have started in 1975.

The actual services for seed marketing control are shown below.

a) Inventory check of seed merchants
b) Receipt and judgment of registration application from seed merchants and seed growers
c) Issuance and revocation of registration cards for seed merchants and seed growers
d) Examination of label properness of the seed supplied in trade
e) Examination of cultivated seeds
f) Imposition and revocation of prohibition against circulation of premarketing seed
g) Settlement of disputes arising in seed deals

The number of seed producers/seed trader registered in BPSB, as is shown in Appendix D-7, shows a constant rise, reaching the figure of 1439 as of 1984/85. The seed lot inspection of distributed seeds started with paddy in 1976 and it was extended to maize, soybean and peanuts in 1979. The BPSB activities for seed lot inspection are shown in Appendix D-8 and D-9. The services to monitor the amount as well as the quality of seeds in the market is one of the important services for BPSB, and the service achievements are described in Appendix D-10.

4) Seed testing

Every BPSB office possesses its own inspection laboratory, and the services of seed testing has been provided to all who want it. The data about seed quality can be gained through inspections at laboratories and the people concerned such as producers, seed merchant and seed buyers need them. The achievements of seed testing in BPSB are shown in Appendix D-11.

Seed testing includes:

a) Germination test
b) Verification of moisture content and purity of seeds
c) Check on vigor of seed, genetic mutation, bio-chemical viability and seed weight
d) Improvement of inspection method and accumulation of data

BPSB has implemented the above-mentioned activities and they have been further promoted every year. Actually, however BPSP has still many problems to be solved which are described below.

a) Quality of seeds

The production of certified seeds of secondary food crops and vegetables have been promoted so far and BPSB has conducted inspections in conformity with it. But, satisfactory seeds of good quality have not been constantly produced under the present conditions, as the history of seed production is still short in the county.

b) Inspection ability

Satisfactory inspection has not been conducted in BPSB yet, since the inspection system for seeds except paddy, especially for vegetable seeds have not been fully prepared because of lack of manpower and equipment.

c) Authority

BPSB is empowered to warn the distributors or producers of seeds below standard not to sell the seeds and to take measures to eliminate them from the registration in case they do not obey the warning, but it is not legally authorized to prohibit the sales of these seeds. It goes without mentioning that severe abuse of authorities such as prohibition of sales should be avoided. Actually, however it is difficult to drive home standards since BPSB is not empowered to take any strong measures under the present situation.

d) Provincial office

There are thirteen provincial offices at present and eight offices out of them have exercised control over more than two provinces. Even though these eight offices have their own working units in each province within their work territory, interprovincial services need many administrative procedures to execute them. Thus, the services are not conducted smoothly in many cases.

(2) Inspection of soybean seeds

As is shown in the Table 3.43, the inspection standards for soybean seeds have been stated, and BPSB has conducted inspection of FS to ES (including pink-tag) for soybean seeds. In conformity with the standards, BPSB is to conduct inspection in the field at least three times (before planting, twelve days after planting, at the flowering time) and in laboratories once, for certification of soybean seeds. The manual on the certification of soybean seeds by BPSB is shown in Appendix D-19.

As were described already, the certification system for soybean seeds was put into practice in 1984, while control services on seed meeting in 1979. The Table 3.44 and 3.45 show the achievements in these services.

Table 3.43 *Inspection Standards for Soybean Seeds in BPSB*

a. Field Standards

Seed Class	Isolated	Other variety and off type (Max.)
FS	8 metre	0.1%
SS	8 metre	0.2%
ES (Blue tag)	8 metre	0.5%
ES (Green tag) ES1 ~ ES4	8 metre	0.7%
Pink tag	8 metre	1.0%

Source: BPSB

b. Laboratories Standards

(%)

Seed Class	Moisture Contents (Max)	Pure Seeds (Min)	Foreign Matter (Max)	Other Varieties (Max)	Germination (Min)
FS	11.0	98.0	2.0	0.1	80.0
SS	11.0	98.0	2.0	0.2	80.0
ES (Blue tag)	11.0	97.0	3.0	0.5	80.0
ES (Green tag) ES1 - ES4	11.0	97.0	3.0	0.7	70.0
Pink tag	11.0	97.0	3.0	1.0	70.0

Source: BPSB

Table 3.44 Activities on Inspection and Certification of Soybean Seeds

(Ton)

Year	FS	SS	ES	Pink Tag	Total
1983/84	-	-	-	237.2	237.2
1984/85	9.6	2.0	6.5	660.8	678.9

Source: BPSB

Table 3.45 Activities on Marketing Control of Soybean Seeds

Year	Quantity of Checked Seeds	Results	
		On Standard	Off Standard
1979/80	316.1	271.4(85.9%)	44.7(14.1%)
1980/81	401.6	329.1(81.9%)	72.5(18.1%)
1981/82	259.0	223.1(86.1%)	35.9(13.9%)
1982/83	671.3	233.5(34.8%)	437.8(65.2%)
1983/84	1,707.4	1,259.7(73.8%)	447.7(26.2%)
1984/85	1,009.9	662.5(65.6%)	347.4(34.4%)

Source: BPSB

According to Subdirectorate of Seed Production Department of Directorate of Food Crop Production Development, the total producing area of soybean seeds for FS, SS and ES was 28,059.5 ha, in 1986/87. According to the study by the Team,

both of BBI/BBUs and seed producers have received BPSB inspection without fail and it seems that BPSB has been conducting all of the necessary inspection on soybean seeds at production farms and on the quality of produced seeds.

There are 931 technical staff in BPSB at present and when the above-mentioned area is supposed to be covered with this number, it means that one staff has to take charge of 30 ha, in average. Taking into consideration the fact that BPSB has conducted inspection on paddy, maize, peanut and green bean, besides soybean, the area to be covered by one staff member should be considerably large, and there is the apprehension of falling of inspection quality.

According to the results of analysis on soybean seeds samples which was conducted by the Team, it was found that the seeds which were inspected and certified by BPSB were not always of good quality in comparison with those grown by general farmers and the seeds off standards were produced in a large quantity.

The followings are thought to be the reasons.

a) Taking into consideration the technical level of BBI/BBUs as well as seed producers, it will rather hinder the production of seeds to apply strict standards and, therefore, BPSB has mitigated strictness of application of the standards more or less.
b) There are amounts of service works in inspection which exceed inspectors' ability and, so, satisfactory inspection has not been conducted.
c) Since the history of soybean seeds inspection is still short, inspectors' ability has not fully developed yet.

There are complaints about low quality of certified seeds and too much time required for inspection of BPSB among the officers concerned in the investigation sites. Therefore, it is urgently required to level up the inspection ability of BPSB for soybean seeds. It is certain that inspection services of BPSB will definitely increase as the government promotes the multiplica-

tion plan for quality seeds in future. So, it is required for BPSB to heighten the level of inspection practices in quality as well as to quicken inspection works.

Since the Government is faced with budgetary deficit, it is difficult to largely increase the number of staff or to fulfill requirements for inspection equipments under the present conditions. So, it can be a major condition to heighten the inspectors' ability in order to reinforce the capacity of BPSB.

In addition, in order to rationalize inspection services and reduce inspectors' burden, it is the most economical and effective way to produce such a condition under which self-inspection has been completed by seed producers in prior to the inspection by BPSB, by fostering able seed producers and by helping them in appropriate farm management. Thus, it is necessary to foster seed growers and improve their skills in cooperation with agricultural extension services.

3.4.5 Equipment and Facilities for Multiplication and Distribution of Soybean Seeds

(1) Multiplication equipment and facilities for soybean seeds

The public organizations which are equipped with seed multiplication facilities for soybean are BORIF/MARIF on the national level and BBI/BBU/BBP on the provincial level. There are also seed producing farms established by East Java Province and its subsidiary to EC Project of Jambi Province which has been directly controlled by Directorate of Food Crop Production Development of the Ministry of Agriculture. On the other hand, the facilities which are possessed by private sectors including Seed Corporation are mainly seed processing centers run by firms such as P.T. Patra Tani, Perum SHS, Swasta, P.T. Pertani, and Kamar. P.T. Patra Tani possesses a multiplication farm for soybean seeds, while others secure seed material by means of by-contract system at farmers' fields. The most of the seed processing centers are basically meant for paddy seeds, while only P.T. Patra Tani has established the exclusive facility for soybean near Palembang.

The inspection facilities of Seed Control and Certification Services (BPSB) and agricultural machinery owned by soybean producing farmers are described below.

1) BORIF (Bogor Food Crop Research Institute) and MARIF (Malan Food Crop Research Institute)

Both institutes have born the function to produce BS, besides research work. The plan of the construction project of "pioneer research for Palawija Crop Production" has been going on at present in BORIF, which started as a grant aid programme provided by the Government of Japan. Under this programme, the facilities have been expanded. It is also planned under this programme to equip seed-related facilities with dryers, threshers and cold storages of seeds which are required in experimentation rooms of seed techniques and the field of seed technology. At MARIF, which is located in East Java where the crops except paddy

are important due to long dry season, applied research has been conducted especially on the techniques of seed production for Palawija crops. The facilities of MARIF have been largely improved recently with the aid of the World Bank and the Netherland and technical cooperation has been also extended by them. As for the seed-related equipments, cold storages (4°C x 1 set, -20°C x 1 set) and dryers of packaged type have been already installed.

2) BBI (Central Seed Farms) & BBU/BBP (Main Seed Farms)

a) Existing equipment and facilities

The function and the roles of provincial levelled seed farms were reorganized according to the Director's Notice of the DGFCA of the Minitry of Agriculture dated February 10, 1982. And as the result, 33 farms were established for paddy, 25 for Palawija and 26 for horticultural crops to produce FS as well as SS. The BBI facilities for Palawija have been standardized by Directorate General of Food Crops Agriculture as the common facilities all over the country. The Appendix C-3 shows the details. But, there are considerable differences in the actual facilities among BBIs. In this Table, the comparison is made with BBI Bedali in East Java as the standard facility. Even though several years have passed since this BBI was established, there still remain many items unimproved. It is especially conspicuous in insufficient equipments for extension and training in terms of seed producing technology. Furthermore, though some farms have been equipped with irrigation facilities anyhow, they have been facing the basic problem concerning water sources, which has constituted a hindrance to seed production in dry season. Thus, it is required to take radical measures to improve irrigation facilities in order to secure stable production.

b) Maintenance and operation of facilities

The equipments were continuously provided to BBI/BBU in the past under KR2 grant by the Government of Japan.

The type as well as the quantity of the provided equipments ranged far and wide as follows: machines for land preparation (4-wheel tractor, hand power tiller, attachments), instrument of pest control (hand sprayer, powered sprayer, mist-powder-granular machine), irrigation equipments (pump, sprinkler), post-harvest machines (drier, cleaner, grader, and packer) and inspection equipment (moisture meter, divider microscope, thermo-pyrostat, analytical balance etc.)
According to the observations by the Team, these equipments have not been well maintained or operated, either, at present. But, it may be rather correct to judge that these equipments have not been fully utilized due to the shortage of seed material and naturally that careful attention has not been paid to the maintenance and operation of them under these circumstances. And, there are also some machines which do not match local needs. (For example, steel-wheels for wet fields are given to the farms which have only up-land fields.)
The followings are the problems in the field of maintenance and operation of equipments.

. A large scale of reduction in working expenses
. Inefficiency in management
. Operators' skill is not enough (Necessity of training)
. Shortage of spare parts

c) Storing of seeds

Since it is difficult to keep the viability of seed of soybean for a long time under natural tropical conditions in Indonesia, BBI/BBU have sealed and kept dried seeds in containers such as petrole cans and drum cans, conducted germination tests once a month, taken them out once every three months, dried them again, and stored them in the sealed containers again. In some cases, they also put charcoal or quick lime into the containers as drying agent.

3) P.T. Patra Tani

a) Production and sale of soybean seeds

P.T. Patra Tani is a subsidiary of PERTAMINA and it was established as the estate for rice production in the suburbs of Palambang in 1978. It started the production of paddy and soybean seeds while placing emphasis on food crops to diversify management in 1982. But, it has not produced paddy seeds in their own farms (5,000 ha) but produced soybean seeds (300 ha) as well as the improved coconut seeds (400 ha) at present.

Soybean seeds are being produced only in 20 ha in 1987, out of the soybean seed farms in this dry season. This is basically due to the constraint imposed by insufficient irrigation facilities. The operations have been carried out from first to last by the method of large-scale mechanized farming, but the production cost is considerably high, judging from the output. The current prices of soybean seeds are fixed as are shown in Table 3.46.

Table 3.46 Selling Prices of P.T. Patra Tani's Soybean Seeds (1987)

Kind	Price at Farm Gate
BS	1,400 RP/kg
FS	1,200
SS	1,000
ES (blue tag)	900
(pink tag)	750

Note: The discount of 10% will be given in the transaction of more than 5 tons. Seeds (50 kg) should be wrapped double in the bags of plastic.

Source: P.T. Patra Tani, Palembang, South Sumatra

It was heard that the seeds are sold mainly to P.T. Patra in Lampong Provice (60%), followed by that in Jambi (10%), in the three Java Provinces (10%) and then

that in South Sumatra (5%). They are also sold to farmers directly (10%) and seed dealers (5%).

b) Machinery and equipment

Large-sized agricultural machines have been used in farms and for post-harvest processing at farms, and as the result, the required hours for farming operations per hectare has become 35.9 hours/ha. Table 3.47 shows the machinery and equipments which are used for production of soybean seeds.

Table 3.47 Machines and Equipments Related with Soybean Seed Production at P.T. Patra Tani, Palembang

Field preparation and management machines

4 sets	Soybean harvester, John Deere 4420 x 2, 4400 x 2, capacity about 100 ha/4 sets/month
4 sets	4-wheel tractor, John Deere 3140, Conty 1164 with disc harrow and sprayer
1 set	Boom sprayer, tractor mounted
1 set	Irrigation sprinkler, 200 Kilopascal, 9-12 m radius, 3" dia. pipes (8 m x 30 pcs)
2 sets	Buldozer, D6C-SA
1 set	Lime and fertilizer spreader, tractor mounted
1 set	Planter, John Deere
1 set	Cultivator, John Deere

Seed processing (post-harvest) machines

3 sets	Storage dryer with re-circulating system, Kongs Kilde optimum heated air temp. 40°C and takes 24 - 32 hrs. from MC21% to 10%
5 sets	Box dryer, large type (3.5 t) x 3, small type x 2, optimum heated air temp. 40°C
2 sets	Bag sewing machine, New Long
2 sets	Seed cleaner, Vac-A-Way

Low temperature storage room

2 rooms 70 ton capacity (7.0 x 8.0 x 4.0 mH)

Equipped with 2 sets of air-conditioner (4,000 btu/1 set) for each room, 19 - 20°C and RH 60% as designed in order to get the acceptable quality of seed through out a year.
These rooms were the work-shop for machinery maintenance before, and modified as the low temperature room. The attached diesel generators are supplying electric source to the air-conditioners for 24 hrs a day.

In this connection, P.T. Patra Tani has pointed out the following problems through its experience in the mechanized system.

- The germination rate of soybean seeds falls approximately by 10% by thorough mechanization in post-harvest processing operations in comparison with the traditional method of using human power.
- The germination rate of soybeans rapidly inclines when the seeds are exposed to the normal temperature after taken out from the low temperature storages.
- The life of a room-airconditioner for a temperature-controlled storage is only 6 - 12 months.
- Since the power for the room-airconditioners has been supplied by the independent electric power plant, it is comparatively high in cost and also unstable.

c) Seed programmes in other provinces

P.T. Patra Tani possesses the processing centers mainly for paddy seeds and shops in the already-mentioned Palembang, Klaten (Central Java Province) and Jember (East Java Province), and it has carried out its activities there. Tables 3.48 and 3.49 show the achievements of the firm on seed production.

Table 3.48 Soybean Seed Production by P.T. Patra Tani

Year	Area (ha)		Production (ton)			Usage of products soybeans (kg)	
	Planting	Harvest	Swakeloba (Self-supporting fields)	Swakeloba + Op-koop	Binnan Yang tidak di Op-koop	For seeds	For food
1976	-	-	-	-	-	400	-
1977	3.3	-	-	-	-	1,331	400
1978	21.4	9.2	8.3	-	-	1,000	8,595
1979	198.0	53.5	82.0	-	-	22,358	37,274
1980	217.0	171.4	87.3	-	-	2,887	51,626
1981	386.4	332.1	211.9	-	-	31,446	94,200
1982	1) 141.8	1) 140.0	1) 86.9	-	-	1) 76,470	1) 12,225
1982/83	401.2	424.8	399.8	-	-	64,350	40,850
1983/84	343.2	358.4	267.4	-	-	179,758	229,279
1984/85	326.9	243.8	307.5	256.030	91.738	147,088.5	20,086.9
1985/86	397.5	397.5	353.7	194.527	564.514	2) 307,257	2) 144,773.28

Figures shown in the above right-side column are different from those in the left-side.

1) Period from January - March
2) Till October, 1986

Source: P.T. Patra Tani, Jakarta

Table 3.49 Paddy Seed Production by P.T. Patra Tani

Year	Area (ha)		Production (ton)		Usage of produced soybeans (kg)	
	Planting	Harvest	Production (ton)	Average yield	For seeds	For foods (ton/ha)
1976	172.6	6.0	14.0	2.33	-	-
1977	201.0	368.5	638.9	1.73	23,000	302,945
1978	547.1	145.2	243.8	1.67	11,000	218,673
1979	428.9	262.8	401.1	1.53	18,000	187,500
1980	737.1	542.4	941.1	1.73	260	296,826
1981	874.3	362.8	1,347.9	1.56	236,200	731,766
1982	1) 460.1	1) 162.9	1) 468.7	1) 2.88	1) 22,325	1) 113,300
1982/83	988.6	1,054.0	1,770.3	1.68	290,725	990,910
1983/84	988.6	1,054.0	1,770.3	1.68	290,725	990,910
1984/85	433.8	283.1	571.8	2.02	121,985	310,871
1985/86	3) 0	3) 11.5	3) 189.4	3) 1.69	2) 196	2) 285,060

1) Period from January - March, 1982
2) Till January, 1986
3) Till March, 1986

Source: P.T. Patra Tani, Jakarta

4) Facility to produce soybean seeds under EC Project (Mungotebo, Kab. Muara Bungo, Jambi Province)

This facility was established by EC with US$5,150,000 in 1978. (In addition, approximately 2,600,000 Rp was provided as the local currency portion by the Government of the Republic of Indonesia.)

At first, it was planned to culture soybean by large-scale farming method but, now it has produced BS, FS, SS and ES as the farm (100 ha) to produce seeds of soybean. Therefore, there still remains unreclaimed land around that.

This farm has been controlled directly by Directorate of Food Crop Production Development of the Ministry of Agriculture at present and it has produced BS under the technical guidance of CRIFC of Bogor and maintained as well produced BS.

The farm planted soybean in the area of 108 ha (54 ha x 2 crops) in 1985, and the harvest in January/February was only 14 tons; and the estimated harvest for June/July is only 22 tons in planted area of 30 ha this year. (It is impossible to plant crop in the remaining 70 ha in dry season since it is not equipped with irrigation facilities.) Table 3.50 shows the achievements of the same project. According to this table, the production tend to gradually incline recently. The major reason was explained to be attributed to the reduction of working expense budget for the farm.

Table 3.50: Harvested Area and Output Achieved by EC Soybean Seed Multiplication Project in Muara Bungo, Jambi Province

Year	Cropping Season	Harvested Area	Production
1983	MT II	53.52 ha	30,980 kg
1984	MT I	82.89	59,021
	MTII	88.99	31,054
1985	MT I	38.22	3,952
	MT II	51.26	24,559
1986	MT I	30.93	15,610

Source: EC Project (SAPRODI), Muara Bungo

a) Machines and equipment

EC Project possesses the following machines and equipment and has brought into practice mechanized planting and harvesting.

Machines and equipment

2 sets	Medium thresher, European Type 600 kg/hr, Max. MC 20% for threshing
3 sets	Small tresher, Japanese Type 170 kg/hr
1 set	Seed-cleaner with indent cylinder for grading
1 set	Seed chemical treatment machine, no use because of the risk of mis-consumption (eating) by farmers
3 sets	Storage type dryer, with re-circulation system, Kongs-Kilde, optimum heated air temp. 40°C, 15 tons x 3 sets, drying target MC 9 - 10%
1 set	De-humidifier, no use because of too much consumption of electricity
2 sets	Moisture tester, KM 1 V
5 sets	Diesel generator, 37 kw x 2, 3 kw x 3, supplying power source to air conditioners for a low temperature room
2 sets	4 wheel tractor

Low temperature room

Equipped with air-conditioner, 10 tons of capacity, keeping 20 kg BS in a tin-can sealed with paraffin

b) As the main characteristics of this seed farm, after seeds are cleaned and graded by machines, women labourers eliminate damaged as well as discolored grains equivalent to 15% by their hands. The cost of manual sorting is 1,200 Rp., based upon the calclation of 10 kg/man/day (7 am - 4 pm). The quality of seeds has clearly risen due to this manual operation, but, the working hours (per ha) show a large figure of 170 man/day in the case of EC Project while it is only 5 man/day (7 hours) in that of P.T. Patra Tani.

5) Seed processing center

a) Background for the establishment of the Seed Processing Centers

Indonesian Government has started SEED I Project under the financial aid of the World Bank (IBRD) to reinforce seed programmes since 1971 and established seed processing center in Sukamandi and other places. In addition, East Java local government also established eight processing centers by themselves from 1976 to 1977. The Indonesian Government started "the Comprehensive Development Project for Soybean and Other Food Crops" in 1979 and decided to place the top priority on the multiplication of high quality seed of soybean in 1982. And as the reuslt, SEED II Project was newly launched with the cooperation of the World Bank in the same year and 24 seed procesing centers were planned to be constructed. (Thirteen centers out of them are scheduled to be completed in the former half 1988.) In addition, three centers were already provided by the Government of Japan.

In the same way, several multinational enterprises (PT Cargill, PT Bisi, PT Buah Pengan etc.) have participated in seed industry mainly of maize at their own seed processing centers in 1982.

The Re-Study has been conducted at present for the construction of eleven processing centers which are to be built with OECF loan.

The Appendix F-1 shows the present situations of the processing centers all over the country.

b) Capacity of seed processing centers

The processing capacity of seed processing centers all over the country is shown in Appendix F-1. Table 3.51 shows the summary of processed amount broken down by crops at the existing centers and those under construction as well as those at the planning stage in the five provinces where the study was conducted.

Table 3.51 Processing Capacity of Seed Processing Centers Classified by Crop

(ton/year)

Province	Number of Centers	Paddy	Maize	Soybean	Mungbean	Peanut	Total
Jambi	2	980	920	600	1,460	40	4,000
South Smatra	4	5,500	1,070	700	1,730	-	9,000
East Java	18	8,214	3,790	1,060	2,064	172	15,300
Bali	1	980	300	200	480	40	2,000
North Surawesi	2	1,480	450	300	730	40	3,000

Note: As for the centers where processed amounts by crops are not known, they were estimated based upon SEED II Project (Phase 2).
Source: Directorate of Food Crops Production Development

Table 3.35 shows the demand for soybean seeds (FS) in the country and Table 3.52 shows the calculated demand according to each province.

Table 3.52 Demand for Soybean Seeds (ES) Broken Down by Province (1986)

Province	Harvested Area	Planted Area	Total Demand	Demanded Seed for Renewal
	A	B=A/0.95	C=Bx50 kg	D=Cx1/5
Jambi	2,616 ha	2,754 ha	138 ton	28 ton
South Smatra	15,455	16,268	813	163
East Java	443,956	467,322	23,366	4,673
Bali	19,762	20,802	1,040	208
North Sulawesi	20,000	21,053	1,053	211

Notes: Harvested area compared with planted area: 95%
Required amount of seeds: 50 kg/ha
Renewal rate of seeds: 1/5 (Once in 5 crops)
Source: Compiled on the basis of Table 3.3.

Table 3.53 shows the relationship between the processing capacity of soybean seed processing centers (including the centers under construction and those in the planning stage) and the total demand for seeds counting in those for renewal (1986) in the provinces where the study was implemented, based on Table 3.51 and 3.52.

Table 3.53 Relationship between Total Demand for Soybean Seeds (ES) Counting in Those for Renewal and Processing Capacity of Soybean Seed Processing Centers

Province	Demand for Seeds	Capacity of Seed Processing Center	Excess and Deviciency of Processing Center	Sufficiency Rate of Processing Capacity Center
	A	B	C=B-A	D=B/A
	tons/year	tons/year	tons/year	%
Jambi	28	600	+572	2,143
South Smatra	163	700	+537	429
East Java	4,673	1,060	-3,613	23
Bali	208	200	-8	96
North Surawesi	211	300	+89	142

Source: Complied on the bases of Table 3.48 and Table 3.49.

It can be recognized from these analytical results that the soybean seed processing centers in the East Java Province are seriously needed to increase for capacity even at present. And the centers in Bali and North Sulawesi Provinces are also anticipated to be provided for further facilities in future, taking into consideration multiplication programmes for soybean and the rise in renewal rate of seeds (provided to be 1/3). The eight paddy seed processing centers which were built in 1976/77 by East Java Provincial Government, as were already mentioned, are left to Prem SHS in the management at present. According to the study results which were conducted in Tugu Rejo (Kedri) and Kepanjen (Malang), these centers still do not need a large scale

repairment. Though the equipment needs partial repairment, it can be done within normal maintenance and operation.

c) Seed processing cost

The Table 3.54 shows the processing cost for soybean seeds, which were gained during the study. Since there are big differences in the calculation method and expenses among implementation bodies or according to regions, it is difficult to adjust them systematically. According to the explanation by P.T. Patra Tani Headquarters, they want to secure 40% of the purchasing price of row material including losses in processing as the gross profit which is gained during the process from buying of raw material (uncleaned seeds) of soybean to sales of seeds. Actually, however, these seeds could not be accepted easily by farmers when their price is higher by 40% than their own produce.

Table 3.54 Post-harvest Processing Cost for Soybean Seed

(Rp/kg)

Item		PT Pretani (Jambi)	P.T. Patra Tani (Jember)	P.T. Patra Tani (HQ)	Presm SHS (Kepanijen)	Prem SHS (Tugu Rejo)	Prem SHS (Whole country)
Harvesting							9.5
Threshing							9.5
Transportation		25 (farmer-SPC/storage)					7.5
		25 (storage-buyer)					
Drying	Machine						7 - 7.5
	Sunshine			2	7.5 (soybean)	17 (Paddy)	2.4 - 10
Cleaning/ Grading	Machine	18	12	3.5	17.5 (paddy)		
	Natural wind				25 (maize)		2.45 - 12.6
	Winnowner						4
	Winnowing basket						2 - 14.58
Packing		7 (for bags)		7			
Charges for inspection and certification	Inspection	10	5	1			
	Labelling	2.5					
Storage		-				1.5	
Others	Overhead	35	10	60 - 90			
	Interest	2.5					
	Wholesale expenses			2			
	Wholesale interest			3 - 4			
	Premium			2 - 4			
Moisture content of raw material before drying		-	20 - 23%	20%	-	-	-
Yield rate after cleaning		75 - 80%	95%	87.3%	-	-	-

Source: Data collected by the Study Team

d) Processing Capacity according to each crop

The crops which are processed at each center are recorded in Appendix F-1. The total processed amount in a year at the nineteen centers which are established under SEED II Project is 27,200 tons (100∼200 t x 6 = 600∼1,200 + 1,000∼2,000 t x 13 = 13,000∼26,000), and the processed amounts classified by each crop are fixed as shown in Table 3.55. According to this table, soybean accounts for 10% of the total processed amount.

Table 3.55 Processing Capacity of Each Crop under Seed II Project

Paddy	13,000	ton	(49%)
Maize	4,000		(15%)
Soybean	3,000		(10%)
Peanuts	6,500	(unhulled)	(24%)
Mungbean	500		(2%)
	27,000	ton	(100%)

Source: IBRD SEED II Project Appraisal Report, 1981

e) Working situation of seed processing centers

No data are available which have shown the processed amount of every seed processing center. So, by studying on the two cases (annual processing capacity 1,000 - 2,000 tons, the same type of machines) which were built under SEED II Project as the working examples, it is known that the situations are remarkably different according to localities, as shown in Table 3.56.

Table 3.56 Working Examples of Seed Processing Centers

District (Province)	Year	Crop: Paddy Seed	Crop: Soybean Seed	Total	Remarks
Munggu (Bali)	'85	401	10	411	From Apr.
	'86	558	84	642	
	'87	488	12	500	Up to Jul
Klaten (Central Java)	'85	1,784	2.3	1,786.3	
	'86	3,152	70.7	3,222.7	
	'87	2,131	17.8	2,148.8	Up to Aug.

Source: Collected data by the Study Team.

Though the center which was established by East Java Provincial Government in 1976/77 needs partial repairment, it is still at work and it will possibly continue to work even from this time on. Since the building for this center was designed quite narrow, there is no space for a storage in it. This is probably because steel silos are attached to this building (60 tons x 3 silos), still, they are not used at present since it is difficult from the viewpoint of techniques as well as mangement to keep seeds in bulk in the steel silos. Or, even if this center may be studied to be equipped with soybean seed processing function, there is actually no space for that in existing building.

6) Equipments and facilities of Seed Control and Certification Services (BPSB)

BPSB has placed its central laboratory in Jakarta and local offices in thirteen places all over the country. And a laboratory is attached to each office. The personnel, building of the office and equipments at laboratoreis are all standardized; for example, the office: 400 m^2, laboratory: 240 m^2, screen house: 40 m^2, electric power: 10 KVA and it is also equipped with a water supply pump. The equipments for laboratories have been arranged to a considerable extent at each office at present. Even though the Government of Japan provided a large number of equipments to this organization in the past in order to reinforce BPSB activities, further request was made on the occasion when the Team visited the above-mentioned organization.

For Central Laboratory

Seed health tester, auto-clave, centrifugal separator, micro-scope, pippette, laminar flow cabinet, micro-meter, incubator, cork-borer, slide storage, etc.

For Provincial Laboratory

Analitical balance, small scale moisture meter, mechanical divider, grinder with mesh screen, micro-scope, camera, etc.

For Field Work

Motor-cycle, automobile

7) Machines and equipments of soybean seed producing farmers

a) Agricultural equipments and tools

The equipments for soybean seed production are naturally used in common for the production of other crops. In short, they are all used for plowing, land leveling, ridging, weeding, controlling pests and diseases and insects, harvesting and storing.

The followings are the equipments and tools which have been encouraged to be extended to soybean seed growers (Kedelai, Directorate Bina Produksi, 1986).

- Simple storage (high elevated floor, over-roof type, about 9 m^2)
- Boxed-type drier (human power pedal type)
- Threshing stand (bamboo or wooden mode)
- Winnower
- Sieve

"The Center for Development of Appropriate Agricultural Engineering Technology" which was opened this April by the Government of Japan as a technical cooperation project developed a cheap, multi-purchased and simple thresher (for paddy & soybean) and it has under practical test and investigated by the monitor system at present.

Table 3.57 shows the extension situation of agricultural equipments in Pasuruan prefecture in East Java Province which is a major producing zone of soybean. The arable area in the same prefecture was 45,048 ha for paddy and 44,276 ha for up-land crops (out of this figure, 32,775 ha for soybean) in 1986 and the number of extended agricultural machines was extremely small. It can be easily imagined from the development degree of agriculture that the rates may be further lower in other areas.

Table 3.57 Number of Extended Agricultural Machines and Equipments in Pasuruan Prefecture, East Java Province

Name of machines	Number of machines		
	Usable	Repairable	Not repairable
Tractor			
Power tiller (2 wheel)	87	1	1
Small tractor	2	-	-
Large tractor	3	-	-
Insect and desease control			
Hand sprayer	8,448	572	1,434
Mist blower	48	15	-
Power sprayer	63	10	-
Emposan	211	10	-
Post-harvest			
Thresher	58	1	2
Dryer	4	-	2
Winnower	62	2	-
Pentosoh beras	150	4	1
Small rice mill	242	4	1
Large rice mill	12	-	-
Irrigation pump	13	-	-
Maize machine			
Pemipil jagung	11	-	-
Pemberas jagung	26	-	-
Pembuat bubuk jagung	7	-	-
Cassava machine			
Pemarut ubi kayu	6	-	-
Penggilingan tapioka	2	-	-

Source: Dinas Pertanian, Kab. Pasuruan

b) Storage of seeds

Generally speaking, the seed growers seem to own no specified storage.

(2) Facilities for distribution of seeds

There seems to be no facility for seed distribution which deserves special mention. The followings are the related information.

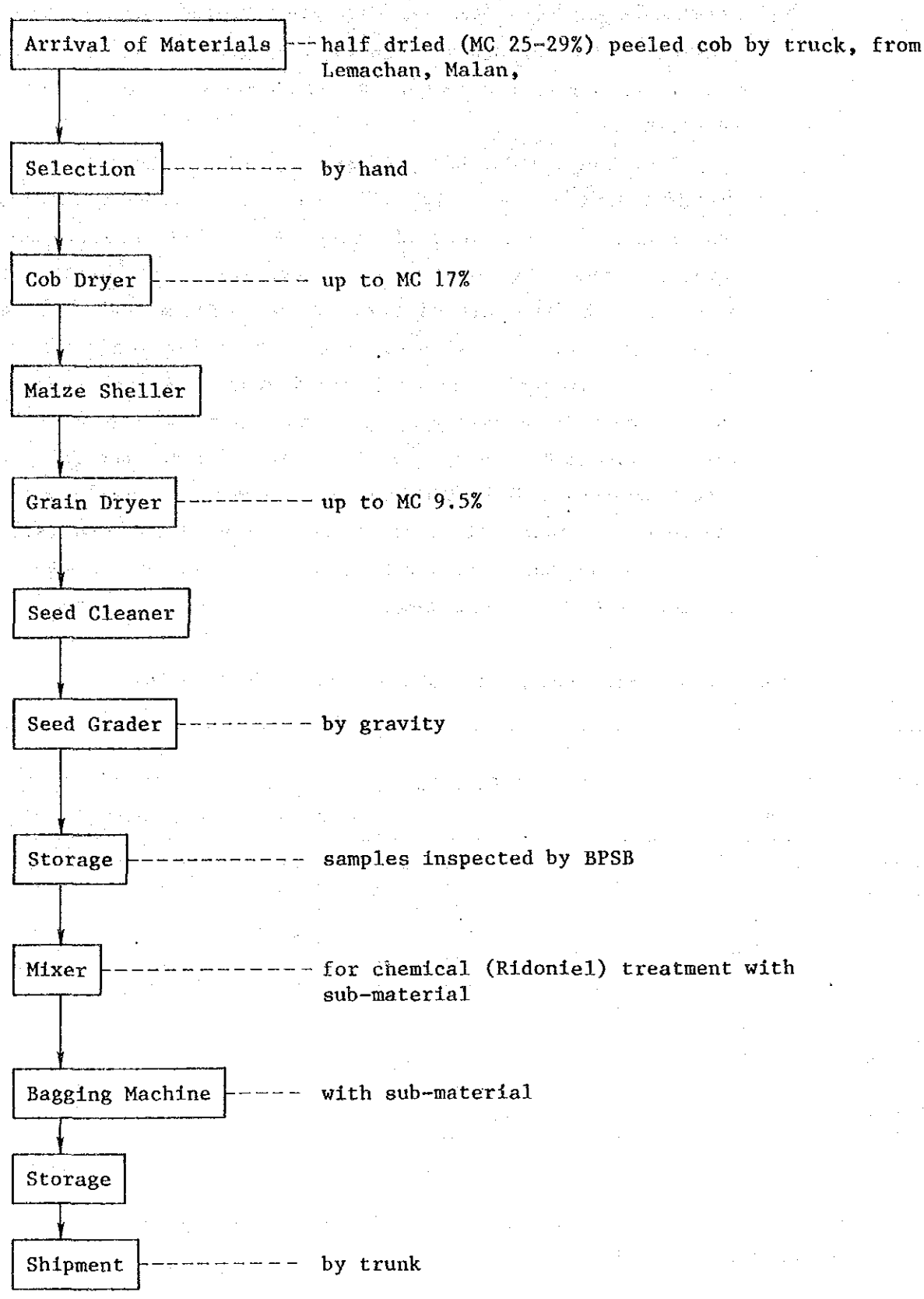
1) Cold storages were provided to five FCRIs under SEED II Project. The purposes of these storages are to preserve genetic resources and to keep BS which are to be distributed to BBI/BBU.

2) Cargill Indonesia Co. has produced the hybrid seeds of maize and distributed them. It also possesses a seed processing center and storage in Nonkojajar, Malan Prefecture, East Java, for these purposes. These facilities are located at high land of the altitude of about 1,300 m and so low temperature which is a required condition for seed storage can be gained under natural conditions. As the meteorological data of Nongkojajar were not recorded and so they were not available, here are given for reference the data of Chandi Kuning in Bali Province as are shown in Table 3.58. According to these data, it is well secured to keep seeds for 8 - 12 months under such natural conditions, as far as the temperature is concerned.

Table 3.58 Meteorological Data at Chandi Kuning, Bali

Month	1986			1987		
	Temperature		Rain fall	Temperature		Rain fall
	Min. Ave.	Max. Ave.		Min. Ave.	Max. Ave.	
January	6.50°C	22.14°C	667 mm	6.17°C	23.04°C	380 mm
Februaly	6.88	23.04	232	7.08	23.75	104
March	6.77	23.50	137	7.13	24.13	90
April	6.86	24.30	89.5	6.88	24.40	108.5
May	6.25	23.15	16	n.a.	n.a.	n.a.
June	6.40	22.62	138	6.93	25.20	33.7
July	6.17	23.39	17	6.82	25.14	14.7
August	5.87	21.15	52			
September	6.46	23.85	35			
October	6.36	22.10	73			
November	6.75	23.45	143			
December	6.75	24.09	141			
			1,740.5			

Source: Chandi Kuning Station, Bali



Source: Cargill Indonesia Co.

Figure 3.16 Flow Chart of Maize Seed Processing

The storage of Cargill Indonsia Co. which is located in Nongkojajar was once possessed by the army, and no special architectual specification was required to the building as can be seen below. The storage consists of three buildings and the floor area is approximately 700 m^2. Bag piling is separated by each field plot (production: 1-20 ton) for the purpose of better quality control.

Floor : Abt. 30 cm elevated from G.L., mortal concrete finishment
Wall : Stone brick prastered up to 1.5 m high, wood plate up to roof
Window : Opened with wire mesh at top of side wall
Roofing: Corrugated steel plate, no sky-light

Figure 3.16 shows the processing flow of maize seed by Cargill's facilities which is mentioned above.

3.4.6 Problems in Multiplication and Distribution System for Soybean Seeds and Their Countermeasures

The problems in multiplication and distribution of improved soybean seeds were analyzed according to each stage of production, processing, storage and distribution, and the outline was summarized in brief in the attached Table 3.59 "Problems in multiplication and distribution of improved soybean seeds and their countermeasures." The outline of the countermeasures to be taken is also shown in the same table.

Framework for Development

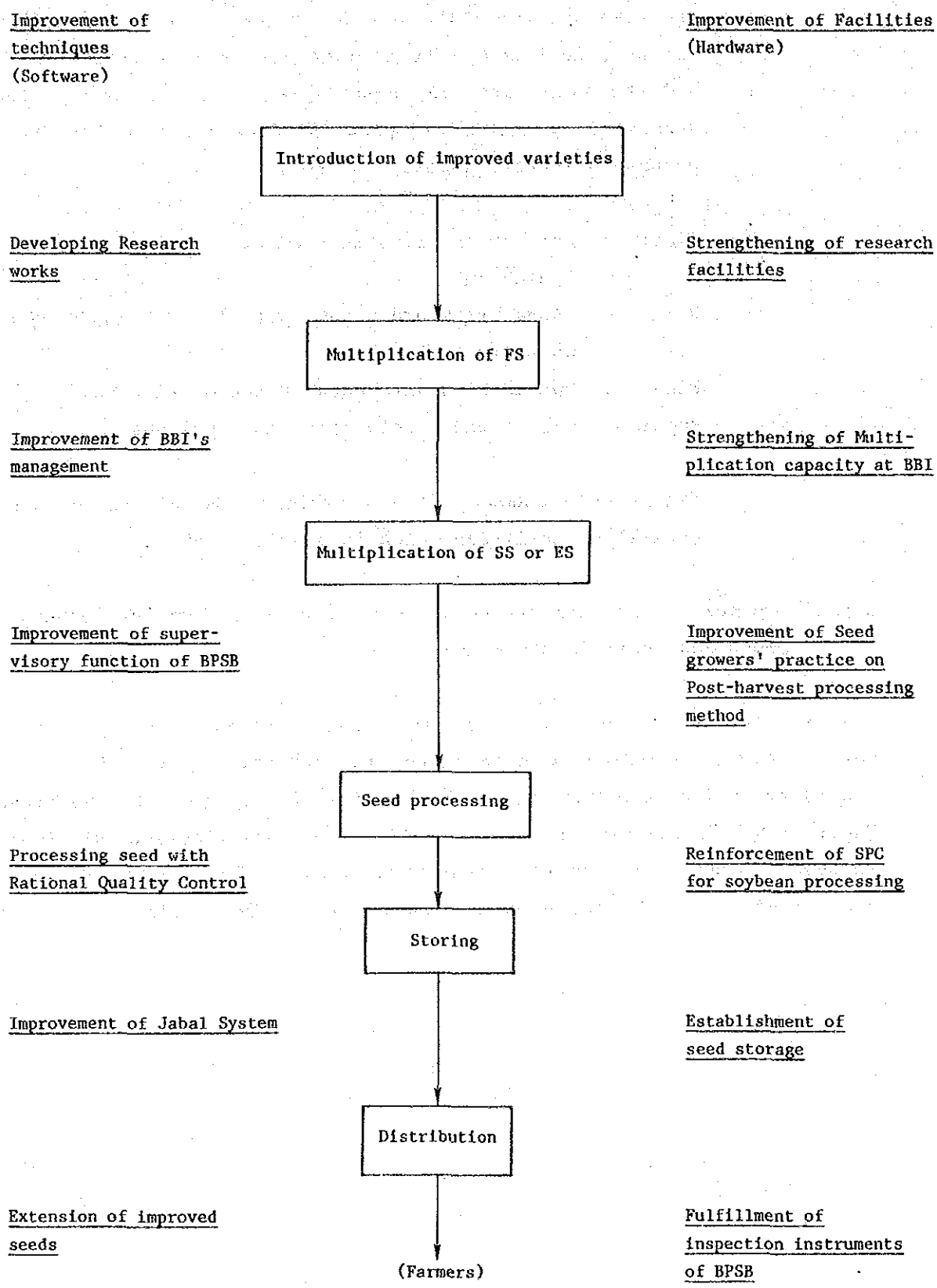


Table 3.59 Problems in Multiplication and Distribution of Soybean Seed and Countermeasures

Stage	Problems	Concrete Examples of Problems	Improvement Plans	Concrete Measures for Improvement
1. Farmers	Most of the cultivated varieties are local ones.	o Yield/ha is low. o Quality is low and, so, inferior in the value as a commodity	Introduction of improved varieties	- To introduce high-yield varieties - To select varieties which are suited to agro-ecological pattern of each area. - To introduce dry-, heat-, disease- and insect-resistant varieties. - To introduce proper varieties to be processed for protein, fat and so on.
	Seed quality is poor.	o Large proportion of Immature Grains. o The size of grain is not uniform and foreign substances are mixed in a high percentage. o Moisture content is uneven.	Improvement of seed growing and processing techniques	- To make uniform grains. - To eliminate damaged grains, foreign substances, or grains of other varieties. - To reduce moisture content as far as possibles. - To produce physiologically healthy seed.
	Viability of seed is rapidly deteriorated.	o Large seeding amount is necessary. o The number of stems per hill is uneve. o Weak in early growing period and also weak against weeds, disease	Supply of healthy seeds	- To store seeds under safe conditions - To timely deliver seeds to farmers for seeding
2. Seed growers	Farming scale is small.	o Income of seed growers is low. o Many of them convert into rival crops. o Cultivation contract is not often performed.	Promotion of seed growers to be technically high	- To promote skilled seed growers in cooperation with key farmers. - To deal with in-put material and out-put products jointly.

Stage	Problems	Concrete Examples of Problems	Improvement Plans	Concrete Measures for Improvement
	Postharvest practices are poor.	o Large losses in quality and quantity.	Improvement of post-harvest practices	- To improve primary postharvest processing at farmers' stage.
		o It is difficult to maintain genetic characteristics of a variety in field. o Seed growing standards are not enough followed. o Especially, harvesting time is uneven.	Level-up seed growers skills	- To provide on-the-job training to seed growers.
3. Seed processing center	There is no exclusive facilities for soybean.	o Paddy processing facilities are not always suitable for processing soybean.	To newly arrange exclusive facilities for soybean seed	- To newly construct exclusive facilities for soybean. - To renew outdated paddy processing facilities to make them serve for soybean processing adtionally
	Receipt schedule is not well worked out for seeds.	o Operations become unsteady. o Raw material is collected at a time during harvest season.	Well-planned purchase of raw material	- To avoid stockpiles of goods in close cooperation with seed growers' groups.
	Quality has not been controlled sufficiently.	o Check of raw material is not enough in purchasing. o It is difficult to control moisture content in rainy season. o Drying operation takes much time. o It will have a bad effect on the multipliation rate.	SPC operation with quality control	- To adopt "Bonus and Penalty System" on purchasing - To carry out operations carefully not to cause damages to raw material, especially soybeans harvested in rainy season.

Stage	Problems	Concrete Examples of Problems	Improvement Plans	Concrete Measures for Improvement
4. Storage	Seed storing facilities are not available.	o Germination viability soon deteriorates. o Poor growth in an early stage causes yield decrease.	Improvement of Jabal System Establishment of seed storages	- To supply fresh and sound seed by improving Jabal System. - To design seed storages to secure the temperature as low as possible.
	Marketing mechanism has not functioned yet.	o There are fewer seed handling shops. o It is difficult to obtain suitable varieties of proper amount at suitable time. o Packing material is poor. o There are very few services available in villages.	Establishment of convenient seed marketing system for farmers	- To deploy seed handling shops of easier access for farmers taking advantage of agriculture cooperations and kiosks. - To improve packing. - To include improved seeds to Special Intensification Programs.
5. BBI	Farms have not been fully utilized.	o Cultivation of soybean is impossible in dry season for lack of irrigation facilities.	Improvement of BBI management	- Reinforce BBI's farms including irrigation facilities. - Introduction of by-contract farming system to produce BS with private sectors to cope with financial difficulties.
	There is a heavy a budget curtailment.	o Budget has been shrply reduced.		
		o Techniques and knowledge for seed multiplication are insufficient.	Training and education of BBI staff	- To conduct training periodically.
6. BPBS	Inspection system has not fully worked.	o No transportation facility is available. o Inspection equipments for seeds have not been fulfilled. o Skills are insufficient. o Inspection and certification services take too much time.	Improvement of inspection function	- To strengthen inspection function. o To provide transportation means. o To fulfill inspection equipments. o To level up skills.

3.4.7 Demand Forecasting of Quality Soybean Seeds

During 1984 to 2000 total production will increase from 783,000 tons to 3,112,000 tons and intensification program areas from 666,000 ha to 1,987,000 ha. To attain these targets seed requirement is 33,300 tons in 1984 and it will increase to 99,350 tons in 2000. According to the long term projection the seed requirement per hectar is set at 50 kg, the volume of ES production is set at the level of one fifth of seed requirement, and multiplication rate of BS. FS and SS is set at 15 times.

Table 3.60 Long Term Demand Projection of Improved Seed Soybean in Indonesia

Year	Total Production (1000 ton)	Intensification Program					
		Areas (1000 ha)	Seed Requirement (ton)	ES Production (ton)	SS Production (ton)	FS Production (ton)	BS Production (ton)
1984	783	666	33,300	6,660	444	29.60	1.97
1985	885	869	43,450	8,640	579	38.62	2.57
1986	1,003	1,019	50,950	10,190	679	45.29	3.02
1987	1,086	1,176	58,800	11,760	784	52.27	3.48
1988	1,179	1,341	67,050	13,410	894	59.60	3.97
1989	1,567	1,387	69,350	13,870	925	61.64	4.11
1990	1,668	1,434	71,700	14,340	936	63.73	4.25
1991	1,779	1,481	74,065	14,810	967	64.49	4.30
1992	1,891	1,530	76,510	15,300	1,020	68.00	4.53
1993	2,017	1,581	79,035	15,810	1,054	70.27	4.68
1994	2,146	1,633	81,645	16,330	1,089	72.58	4.84
1995	2,283	1,690	84,500	16,900	1,127	75.11	5.02
1996	2,429	1,746	87,290	17,460	1,164	77.60	5.17
1997	2,582	1,803	91,170	18,030	1,202	80.13	5.34
1998	2,749	1,863	93,145	18,630	1,242	82.80	5.52
1999	2,925	1,924	96,220	19,240	1,285	85.51	5.70
2000	3,112	1,987	99,350	19,870	1,325	88.31	5.89

Source: Directorat Bina Produksi Tanaman Pangan

Table 3.61 Seed Requirement in Intensification Areas of 5 Provinces

Province \ Year	1984	1985	1986	1987	1988	1989	1990	1991	1992
Planted area (1000 ha)									
Jambi	2.7	17.3	25.0	35.5	40.0	42.0	44.0	46.0	48.0
South Sumatera	11.5	18.0	26.0	30.0	45.0	47.0	49.5	52.0	54.5
East Java	320.5	355.0	340.0	400.0	420.0	441.0	463.0	486.0	510.0
Bali	7.3	11.5	15.0	15.5	17.0	18.0	19.0	20.0	21.0
North Sulawesi	32.8	43.5	45.0	50.0	55.0	58.0	61.0	64.0	67.0
Seed requirement (ton)									
Jambi	135	865	1,250	1,775	2,000	2,100	2,200	2,300	2,400
South Sumatera	575	900	1,300	1,500	2,250	2,350	2,475	2,600	2,725
East Java	16,025	17,750	17,000	20,000	21,000	22,050	23,150	24,300	25,500
Bali	365	575	750	775	850	900	850	1,000	1,050
North Sulawesi	1,640	2,175	2,250	2,500	2,750	2,900	3,050	3,200	3,350
ES requirement (ton)									
Jambi	27	173	250	355	400	420	440	460	480
South Sumatera	115	180	260	300	450	470	495	520	545
East Java	3,205	3,550	3,400	4,000	4,200	4,410	4,630	4,860	5,100
Bali	73	115	150	155	170	180	190	200	210
North Sulawesi	328	435	450	500	550	580	600	640	670
SS requirement (ton)									
Jambi	1.8	11.5	16.7	23.7	26.7	28.0	29.3	30.7	32.0
South Sumatera	7.7	12.0	17.3	20.0	30.0	31.3	33.0	34.7	36.3
East Java	213.7	236.7	226.7	266.7	280.0	294.0	308.7	324.0	340.0
Bali	4.9	7.7	10.0	10.3	11.3	12.0	12.7	13.3	14.0
North Sulawesi	21.9	29.0	30.0	33.3	36.7	38.7	40.0	42.7	44.7

Table 3.61 Seed Requirement in Intensification Areas of 5 Provinces (continued)

Province \ Year	1984	1985	1986	1987	1988	1989	1990	1991	1992
FS requirement (ton)									
Jambi	0.12	0.77	1.11	1.58	1.78	1.87	1.96	2.04	2.13
South Sumatera	0.51	0.80	1.16	1.33	2.00	2.09	2.20	2.31	2.42
East Java	14.24	15.78	15.11	17.78	18.67	19.60	20.58	21.60	22.67
Bali	0.32	0.51	0.67	0.69	0.76	0.80	0.84	0.89	0.93
North Sulawesi	1.46	1.93	2.00	2.22	2.44	2.58	2.67	2.84	2.98
BS requirement (ton)									
Jambi	0.00	0.05	0.07	0.11	0.12	0.12	0.13	0.14	0.16
South Sumatera	0.03	0.05	0.08	0.09	0.13	0.14	0.15	0.15	0.16
East Java	0.96	1.05	1.01	1.19	1.24	1.30	1.37	1.44	1.51
Bali	0.02	0.03	0.04	0.05	0.05	0.05	0.06	0.06	0.06
North Sulawesi	0.10	0.13	0.13	0.15	0.16	0.17	0.18	0.19	0.20

Source: Directorat Bina Produksi Tanaman Pangan

CHAPTER 4 DEVELOPMENT PLAN FOR MULTIPLICATION AND DISTRIBUTION OF QUALITY SEEDS OF SOYBEAN

CHAPTER 4 DEVELOPMENT PLAN FOR MULTIPLICATION AND DISTRIBUTION OF QUALITY SEEDS OF SOYBEAN

4.1 Basic Concept for Development and Planning

This programme has been planned to implement a proper system of multiplication and distribution of quality seeds in order to increase the yield of soybean. The following are the basic concepts for the plan:

(1) To introduce improved varieties suitable for agro-ecological conditions of different areas in Indonesia,

(2) To make the Government seed farms properly supply qualified BS and FS

(3) To make a better arrangement for multiplication of SS and ES by private sector including seed growers,

(4) To improve postharvest technology and constantly supply sound material of quality seeds by promoting a seed grower groups technical high level,

(5) To prepare proper facilities for seed processing and storage, especially storages to prevent deterioration of the germination viability,

(6) To strengthen BPSB activities for quality control of seed,

(7) To develop a distribution system so that the farmers should be willing to use quality seeds of improved varieties, and

(8) To provide necessary training for advanced technology to the personnel concerned in the field of multiplication and distribution of quality seeds.

4.2 Areas to Be Improved

The following is the list of the areas to be improved for the fulfillment of the basic concepts for multiplication and distribution of quality seeds of soybean.

(1) Seed Requirements

- Maintenance of genetic characteristics of varieties
- Soundness in physiological viability

(2) Multiplication of seeds

- Multiplication of BS, FS
- Multiplication of SS, ES

(3) Seed processing

- Postharvest works at the stage of seed growers
- Processing at the stage of seed processing center

(4) Storage and distribution

- Storage facilities of seeds and its operations
- Seed marketing

(5) Quality control of seeds

(6) Technical training

4.3 Items to Be Improved

In connection to the above-mentioned areas, the items to be improved can be described as follows.

Improvement in the genetic characteristics of varieties

Improvement 1. Introduction of high-yield-varieties
Improvement 2. Introduction and selection of varieties suitable for ecological conditions of each producing area.
Improvement 3. Introduction of soybean varieties which grow in the tropical zone.
Improvement 4. Introduction of varieties resistant to diseases and insects.

Improvement in physiological characteristics of seed

Improvement 5. To remove immature grains, damaged grains and foreign materials.
Improvement 6. To uniform grain size.
Improvement 7. To decrease the moisture content as far as possible.
Improvement 8. To prevent a decrease in the rate and vigor of germination.

Improvement in multiplication process from BS to ES

Improvement 9. To enable farming throughout the year by providing irrigation facilities in BBI farms.
Improvement 10. To innovate management of BBI farms.
Improvement 11. To conduct prior test on BS for local conditions.
Improvement 12. To improve BBI staff's seed growing techniques.

Improvement in multiplication process from SS to ES

Improvement 13. To teach skills to seed growers.
Improvement 14. To innovate seed farming practices by organizing seed growers into cooperative units.

Improvement 15. To provide farm inputs to seed growers.

Improvement 16. To provide seed growers with credit which helps seed production increase.

Improvement in seed growers

Improvement 17. To remove foreign materials by using winnowers.

Improvement 18. To use dryers at the stage of farmers particularly in rainy season.

Improvement 19. To sift out small kennels manually.

Improvement 20. To upgrade seeds at the stage of farmer.

Improvement 21. To improve postharvest practices of seed growers.

Improvement in SPC

Improvement 22. To make proper a schedule of paddy purchasing, prevent stockpiles of raw materials, and to increase the handling quantity.

Improvement 23. In purchasing raw materials, apply "Bonus and Penalty System" so that raw material of good quality can be ensured. To pay special attention to wet ones in rainy season.

Improvement 24. To arrange exclusive facilities for soybean seed processing.

Improvement 25. To process soybean seeds at the existing rice seed processing centers by improving equipments.

Improvement 26. To train technical personnel and seed farmers.

Improvement in seed storage

Improvement 27. To improve Jabal System in order to get fresh seeds of vigorous germination.

Improvement 28. To store seeds in temperature-controlled storage houses.

Improvement 29. To arrange storages in cool environments in hilly areas (approximate altitude 1,500 m) which are also easy to access, thus planning economical management.

Improvement 30. To minimize the moisture influence by improving packing material.

Improvement in seed marketing

Improvement 31. To sell seeds at places of easier access for farmers.

Improvement 32. To establish a distribution system by utilizing farmers' cooperative organization, etc.

Improvement 33. To introduce quality seeds to farmers through government programmes for soybean production increase.

Improvement in seed inspection and certification

Improvement 34. To provide transportation for inspectors.

Improvement 35. To arrange and assort inspection equipments.

Improvement 36. To reinforce inspection staff by providing training programme.

Improvement in technical training

Improvement 37. To improve skills and techniques for multiplication and distribution of quality seeds.

4.4 Evaluation of Items to Be Improved

Out of the 37 items which are described in the previous section, important items were selected for the implementation of the programme, taking into consideration (A) the effects they have on this programme, (B) technical, economical and administrative view-points.

The results of evaluation of the items to be improved are shown in Table 4.1 "Analysis of Items to be Improved".

The following are the elements which work as bases for analysis and study.

(1) Improvement in seed multiplication

1) Maintenance of genetic purity of varieties
2) Quantitative effects in multiplication

(2) Promotion of distribution and marketing

1) Marketing promotion
2) Contribution to stabilization of seed prices
3) Cost decrease

(3) Income increase

1) Increase in the average yield
2) Expansion of arable land
3) Cost deduction

(4) Technical difficulty on multiplication

1) Operation techniques
2) Maintenance and repair

(5) Quality of technical transfer and its scale

1) Quality of techniques
2) Scale of technical transfer

(6) Relation to governmental development programmes

1) Agricultural development
2) Production yield of soybean
3) Transmigration policy

(7) Foreign aid programmes

1) Seed programme
2) Soybean-related programme

Table 4.1 Analysis of Items to be Improved

Item to be improved	Factors to Be Considered	Problems and Constraings
Improvement in characteristics of seed varieties		
Improvement 1. Introduction of of high yielding varieties	o Successful breeding will greatly contribute to the increase in yield.	o This include technical difficulty, so a lot of time will be needed to attain.
Improvement 2. Introduction and selection of varieties suitable for agro-ecological as well as cropping pattern of each area.	o Tests are needed to see whether they match the area.	o Multiplication and distribution is the main subject for this Programme.
Improvement 3. Introduction of soybean varieties which grow in the tropical zone.	o The seed of having resistant to disease and harmful insects are especially required for soybean production.	o Grant aid programme of 1987 has been implemented by the Government of Japan. "Strengthening of Pioneering Research for Palawija Crops Production"
Improvement 4. Introduction of varieties resistant to diseases and insects.		
Improvement in physiological characteristics of seed		
Improvement 5. To remove immature, damaged grains and foreign materials.	o Improvement in post-harvest operations means improvement in the quality and decrease of the losses.	o No incentive to process soybean carefully at farmers level.
Improvement 6. To uniform grain size.	o Physiological characters of seed shall be maintained.	o Poor primary processing at the stage of farmers is the main cause for this.
Improvement 7. To decrease the moisture content as much as possible.	o This will lead to the increase of income for farmers.	o There are problems especially in soybean harvested in rainy seasons.
Improvement 8. To prevent a decrease of the rate and vigor of germination.		
Improvement in multiplication process from BS to ES		
Improvement 9. To enable farming throughout a year by providing irrigation facilities in BBI farms.	o Since BBIs are the only official body for multiplication in each province, it is required to reinforce them.	o Financial support by the Government has bee decreased.
Improvement 10. To innovate management of BBI farms		o There are nearly no chances to improve skills or acquire related knowledge.
Improvement 11. To conduct prior test on BS for local conditions.	o It is suggested to introduce the contract farming system for the production of FS directly to private sectors and BBI could receive necessary amount of fund from client prior to the cultivation.	o There are almost no irrigation facilities at BBI farms.
Improvement 12. To improve BBI staff's seed growing techniques.		

Item to be improved	Factors to Be Considered	Problems and Constraings
Improvement in characters of seed varieties		
Improvement 13. To teach skills to seed growers. Improvement 14. To innovate farming seed farming practices by organizing seed growers into a cooperative units. Improvement 15. To provide farm in-puts to seed growers. Improvement 16. To provide seed growers with credit which leads to seed production increased. Improvement 17. To remove foreign materials by using winnowers. Improvement 18. To use dryers at the stage of farmers particularly in rainy season. Improvement 19. To manually sift out small kernels. Improvement 20. To upgrade seeds at the stage of farmer. Improvement 21. To improve postharvest practice of seed growers.	o This will enables the supply of sound material of seed in large quantities. o This will enable the supply of raw material of good quality. o If farmers can bear the primary works of post-harvest operations, the burden of SPC will be mitigated, and therefore, consciencious processing can be expected in SPC. o Farmer's income will be increased. o Marketing base will move from "buyers' option" of today to "sellers' option" and thus, farmers' bargaining power will be increased.	o It is necessary to organize farmers' groups in joint work. o There are many rival crops in selection. o Running scale of farmers is small, and income is low. o There are no quality oriented transactions in selling and buying. o Farmers' groups will need managing ability. o There is always a limit in the joint use of agricultural tools.
Improvement in SPC		
Improvement 22. To make proper a schedule of paddy purchasing, prevent stockpiles of raw materials, and to increase the handling quantity. Improvement 23. In purchasing raw material, apply "Bonus and Penalty System" so that raw material of good quality can be ensured. To pay special attention to wet ones in rainy season. Improvement 24. To arrange exclusive facilities for soybean seed processing. Improvement 25. To process soybean seeds at the existing paddy seed processing centres by improving equipments. Improvement 26. To train technical personnel and seed farmers.	o This will minimize new investment. o This will mitigate the burden of SPC. o Rationalization of management will extend the number of day for operation and thus, the quantities to be handled will also be increased. o This will enable the seed supply of uniform quality in large quantities.	o It is difficult to procure raw material of quality seeds. o Operation and maintenance techniques of SPC are still poor. o Business performance --- from handling of raw material to marketing of products --- is still poor. o Other SPC's cannot bear combined use.

Item to be improved	Factors to Be Considered	Problems and Constraings
Improvement in seed storage		
Improvement 27. To improve Jabal System in order to get fresh seed of vigorous germination. Improvement 28. To store seeds in temperature-controlled storage houses. Improvement 29. To arrange storages in cool environments in hilly areas (approximate altitude of 1,500 m) which are also easy to access, thus planning economical management. Improvement 30. To minimize the moisture influence by improving packing material.	o Jabal System will mitigate the storage burden. o The improvement in Jabal System will lead to the supply of high quality and stable raw material. o To build storage houses in hilly areas will lead to a cut in expenses. o The improvement in packing material will enlarge the effectiveness of storage, and at the same time, it will be easier for farmers to handle them.	o There is rivalry with private seed dealers. o To build storage houses in hilly areas will raise transportation cost. o Functional delivery of seed will be indispensable for extension of seed.
Improvement in seed marketing		
Improvement 31. To sell seeds at easier places of access for farmers. Improvement 32. To establish a distribution system by utilizing farmers' cooperative organization, etc. Improvement 33. To introduce quality seed to farmers through government programmes for soybean production increase.	o This will be beneficial to farmers who are in ready circumstances. o Merits will be beared by selling and buying in cooperation with each other. o To demonstrate the effectiveness of quality seeds by actually using them.	o Farmers possess small arable land and do not understand the effectiveness of quality seed. o Cash settlement is difficult. o Cooperative activities are still weak and poor.
Improvement in seed inspection and certification		
Improvement 34. To provide transportation for inspectors. Improvement 35. To arrange and assort inspection equipments. Improvement 36. To reinforce inspection staff by providing training programmes.	o Seed inspection will protect farmers. o This will smooth transaction. o Training will enable proper inspection.	o Inspection requires resonarable amount of fund. o It will produce a contrary effect when inspection are too severe.
Improvement of technical training		
Improvement 37. To improve skills and techniques for multiplication and distribution of quality seeds.		o Taking a long time for inspection under present system

4.5 Summing-Up of Items to be Improved.

Various items to be improved in relation to multiplication and distribution of quality seeds of soybean were studied in the previous section from technical view-points. Now, it would be more convenient to sum up these items into five groups as follows.

(1) To prepare raw material of high quality seeds

Improvements 13, 14, 15, 16, 17, 18, 19, 20

It is necessary to maintain the genetic characteristics of each variety, as well as to constantly produce seeds of good physiological characteristics. For this purpose, it is desired to have seed grower groups who have attained some technical level.

(2) To process seed properly

Improvements 5, 6, 7, 21, 22, 23, 24, 25

It is necessary to process raw material of seeds and supply fine quality seeds to farmers. For this purpose, it is desirable to process seeds in the two stages carefully avoiding quality deterioration of seeds both at farms and at seed processing centers. In this case, farmers should take care of seeds in the primary stage of postharvest works and, then Seed Processing Center could be intended to take charge of the later stages of postharvest works.

(3) To store seed economically.

Improvements 8, 27, 28, 29.

Processed seeds should be kept under as cool circumstances as possible in order to prevent deterioration of germination viability. It is also necessary to pay careful attention to avoid a further financial burden.

(4) To give farmers an incentive to use quality seeds

Improvements 30, 31, 32, 33.

It is desirable to demonstrate effects of use of quality seeds directly to farmers so as to give farmers an incentive to use quality seeds. It is, therefore, advisable to use quality seeds positively in programmes under the government initiative.

(5) To strengthen administrative functions of seed multiplication and distribution

Improvements 9, 10, 11, 12, 34, 35, 36, 37.

As for the specific fields, such as supplying of breeder's seeds, seed control and certification, and providing technical training which should be carried out by the government on its own responsibility, it is required to reinforce the funcions and activities for successful implementation of the programme.

4.6 Alternatives to Improvement Plan, and the Study

In this section, technical study will be tried on each alternative plan to the ones in the below five items, which are required to be solidified urgently, out of the summarized items already mentioned in the previous sections. Finally the focus will be placed on the most practical implementation plan for improvement.

4.6.1 Alternatives and the Study

(1) To produce raw material of quality seeds

Alternative 1-1

"To grow intensively in the optimum season, process into quality

seeds and distribute them to farmers according to their demand."

Study

- o Though germination is vigorous and soybean seeds of good quality can be produced under this plan, the storing problem should be solved first.
- o It is required that seed growers cooperate each other in production of ES.
- o It will be also necessary to establish seed processing centers on a large scale.

Alternative 1-2

"To multiply seed under the improved Jabal System. In this case, the production of ES should be done based on the by-contract farming system.

Study

- o This is the most practical method for multiplication of soybean ES in the tropical areas. It is required to implement in the most suitable area for seed growing in each season.
- o In order to ensure the productivity of soybean for a longer period, it is a precondition that the land should be irrigated, and well inter-related with other crops which are cultivated before and after soybean.
- o As for farming, it is effective to select areas of low heat-stress which may influence vigor of germination of seeds.
- o Special attention should be paid for soybean not to get wet by rain in the process of postharvest working, especially in the case of soybean which are harvested in rainy season.

(2) To collect raw material of quality seed from seed growers and process them.

"To improve the existing processing facilities for rice seed so that they can be also utilized to process soybean seed."

Study

- o It is necessary to study the actual conditions of the rice seed processing centers and pay close consideration to seasonal operations for both rice and soybean.
- o Since many parts of facilities are to be used in common for rice seed and soybean seed, it is important to confirm the commonness and interchangeability between them.

Alternative-2

"To establish exclusive processing centers for soybean seed."

Study

- o While the concrete plan-1 intends combined use with rice seeds, this plan suggests the construction of centers exclusively for soybean seed. Therefore, construction cost will naturally be more.
- o It is more economical to construct new centers to process other Palawija crops such as maize, peanuts, green bean and so on.

Alternative-3

"To establish several mini-seed-houses around seed processing centers mainly to leave available primary postharvest processing operation, such as drying, threshing, cleaning and so on.

Study

- o If primary postharvest processing can be operated at the farmers' stage, the quality and quantity losses will be reduced and it is expected to have more sound material supplied to processing center.
- o It is economical to design the mini-seed-houses so as to apply them not only to the primary postharvest processing operation of soybean, but also to that of rice, maize, peanut and so forth.
- o The quality deterioration in raw material harvested in rainy season has been considerable.

Alternative-4

"To set up movable seed-processing-wagons at seed-processing centers and move them to necessary places at harvest for primary postharvest processing such as drying, cleaning and so on."

Study

- o While the concrete plan-3 supports fixed operation, this plan is mobile, and so a larger number of wagons shall be set up.
- o since these facilities will actually be run within existing buildings, such as KUD's or private rice mills, operational coordination will be needed in advance.
- o Actually, however, the vehicles to load with equipments are naturally expected to be large and its number to be plural. Furthermore, the shifting of vehicles is sometimes dangerous. therefore, this plan may not be practical.

(3) To store seed economically

Alternative-1

"To store seeds in temperature- and humidity-controlled storage."

Study

o It is a technically possible and ideal way from the view-point of operation to keep seed in temperature- and humidity-controlled storage. However, the operation cost will be huge if the temperature has to be kept around 18°C.

Alternative-2

"To build storages in hilly areas, which are easy to access and cool throughout the year, and store seeds in such a building."

Study

o First class roads run in Java island around at the altitude of about 1,500 m.
o The temperature at the altitude of 1,500 m may be approximately 10°C lower it is at the sea level. For example, while the yearly average temperature in Jakarta is 28°C, that at the altitude of 1,500 m will be 18°C.
o Truck freight rate of goods is comparatively low, since it is 120Rp/km/ton according to BULOG rates.
o Peanuts, as well as soybean, are influenced in viability of germination by high temperature and high humidity while the seeds are kept in storage. The storage will bear multipurpose use when they are designed to keep seeds of peanuts, as well as those of soybean.

(4) To demonstrate to farmers advantages of using quality seeds.

Alternative-1

"To extend shops so that farmers can buy quality seeds by themselves to grow."

Study

o It is the best way for farmers to buy quality seeds by themselves and grow them. But, taking into consideration socio-economic aspect of soybean growers, it will not be easy to realize this plan soon.
o Even though soybean seeds may be quality ones, production increase will not be secured, as can be expected in the case of HYV of rice or hybrid seeds of maize.
o Production cost for soybean is high, because its multiplication rate is low due to high mixture of immature and other grains.

A problem will arise in relation to how farmers take the seeds, comparing with the ones they grow in their own fields or they get from their neighbouring seed growers.

Alternative-2

"To include quality seed with fertilizer and agricultural chemicals as a part of technical package."

Study

o To include quality seed in multiplication projects, such as BIMAS or INMUS, and adopt them as a part of extension programmes.

(5) To improve BBI's farms in operation and management

Alternative - 1

"To increase productivity of seed in BBI's farms"

Study

o Strengthening of BBI's capability by enforcement of irrigation facilities"is indispensable to supply a proper quantity of BS and FS to seed industry. However, it is not properly managed

presently, because their budget for multiplication of FS has been decreasing year by year.

- o In case of strengthening of productivity of BBI's farm, it is anticipated that the facilities would beg idle again because of the lack of financial backup from the Government.

Alternative - 2

"To introduce the by-contract farming system for production of FS directly to private sectors"

Study

- o It is suggested to have a contract of production of FS between BBI and private sectors directly.
- o Under the contract BBI will be reimbursed an amount equal to necessary costs for production of FS from private sector.

4.7 Priority Plan

4.7.1 Most Effective Improvement Plan

After careful study on the alternatives to each plan in 3.6.1, the following five plans are proposed as the most effective and practical plans for multiplication and distribution of quality soybean seeds.

(1) Plan to organize seed grower groups

To implement seed growing programmes under the improved Jabal system while organizing seed grower groups of a high technical level.

(2) Plan to provide soybean seed processing facilities

To renovate the existing rice seed processing facilities so as to make it serve for combined use with soybean seed.

(3) Plan to provide storage for soybean seeds

To provide storage facilities in hilly areas which are easy to access and to keep seed in a cool environment, in order to maintain germination viability.

(4) Plan to develop soybean seed distribution system

To add quality seeds, together with fertilizer and agricultural chemicals, as a part of technical packages in order to give a better understanding of the advantages of using quality seeds to farmers.

(5) Plan to reinforce the administrative functions and activities of multiplication and distribution of soybean seeds

1) Improvement of BBI farms
To improve BBI facilities including irrigation facilities and thus to steadily produce FS.

2) Strengthening of BPSB inspection activities

To strengthen BPSB activities for seed control and certification in order to maintain the genetic characteristics of the variety and to ensure the marketing of seeds with fair germinating viability.

3) Provision of technical training

To provide technical training to improve skills of the personnel concerned and to progress multiplication and development programmes for quality seeds.

Each of these improvement plans is positioned as an independent project for improvement and can be applied, in its nature, in common to each province.

Among the above-mentioned plans, those which are mutually supplemental, -- for example, the plan to reinforce seed processing facilities and the one to provide seed storages, -- should be implemented at the same time.

4.7.2 Application of Improvement Plans

The following are improvement plans for the subject provinces of the Study.

(1) Jambi province

The soybean seed project, which is a project of EEC, has already been implemented in Muara Bungo of this province since 1983. When this project promotes activities for production and marketing on a full scale, seed demand in this province will be met sufficiently. This means that the new project overlaps with this one, regarding production, processing and marketing of seeds. But, both plans to reinforce BBI farms and BPSB activities should be promoted.

Practical plan for improvement:

a. Improvement of BBI farms
b. Strengthening of BPSB inspection activities

c. Provision of technical training

(2) South Sumatra province

As long as P.T. Patra Tani continues their activities, the supply for soybean seeds in this province will be satisfactory. Though common problems within each province, such as plans to reinforce BBI farms or to strengthen BPSB activities, should be solved, the most important problem for this province is how to distribute quality seeds timely to farmers who are scattered throughout the province.

Practical plan for improvement:

a. Development of soybean seed distribution system
b. Improvement of BBI farms
c. Strengthening of BPSB inspection activities
d. Provision of technical training

(3) North Sulawesi province

Soybean production is an important development project in this province, and so it is desired to distribute and extend soybean varieties which are suitable for each agro-ecological pattern in this province in order to increase yield. Regarding processing of soybean seed, new SPC's have been constructed under the SEED II project, and are expected to start operation at the beginning of next year. Actually, however, farmers in this province have little experience in production and distribution of seed, and are unfamiliar with related techniques. Therefore, in order to produce and distribute soybean seed smoothly under the SEED II project, it is indispensable to promote the following plans. Especially in this province where Jabal System has not yet been established, it is essential to take up the promotion of seed growers as a part of an introduction programme of the Jabal System.

Practical plan for improvement:

a. Organization of seed grower groups
b. Provision of storage soybean seed

c. Development of soybean seed distribution system
d. Improvement of BBI farms
e. Strengthening of BPSB inspection activities
f. Provision of technical training

(4) Bali province

Most soybean farming has been done fairly intensively as a secondary crop of rice farming in this province. If quality seeds can be supplied constantly, its productivity will also increase, and naturally production increase will be expected in future. But, the total production of soybeans in this province is approximately 20,000 tons, and since the demand for the quality seeds is small, it is economical to be supplied quality seeds from the neighbouring East Java province.

(5) East Java province

East Java province accounts for approximately 45% of the total soybean production in 1986, and demand for quality seeds in this province is large. All of farmers need good quality seeds, especially just before the seedtime. The traditional Jabal System has existed for this purpose for a long time, but it actually includes many problems in. Therefore, it is an economical and effective measure to improve this system in order to enable a stable supply of quality seed.

Practical plans for improvement:

a. Organization of seed grower groups
b. Provision of soybean seed processing facilities
c. Provision of storage for soybran seed
d. Development of soybean seed distribution system
e. Improvement of BBI farms
f. Strengthening of BBI inspection activities
g. Provision of technical training

The areas for implementation of the priority projects largely differs depending on the status of production of soybeans in each province. Under these circumstances, there are technical difficulties in implementing

these multiphasic projects in all the objective provinces at a time.

The practical way of project implementation is to select a core province and to efficiently carry out the priority projects in a pilot project system, and then gradually spread the effects to the other provinces.

The below 3 plans are posed as parts of the pilot project for the improvement of administrative functions and activities for soybean multiplication and distribution:

1. Plan for improvement of BBI farms,
2. Plan for strengthening of BPSB inspection activities,
3. Plan for provision of technical training

The significance of the plan is evident, but it is advisable that the projects should be implemented in accordance with the integrated approach in separate rounds at different stages, taking account of the priority of urgency of necessity, technical levels, managerial functions etc., after evaluation of the outcomes of these 3 plans in the core province.

4.7.3 Selection of the Province Where a Pilot Project Is to Be Implemented.

The Study Team selected East Java province out of the five provinces to implement priority plan which was described in 4.7. The reasons are shown in the attached comparison table, and the conspicuous reasons worthy of special mention are as follows.

(1) East Java province accounts for 45% of the total soybean production in this country. On other words, the production in this province is remarkably high and, therefore, the demand for seed is large.

(2) Since technical level for cultivation of soybean is higher than that in other provinces, it is easier to renew seed and realize the effect of new varieties.

(3) It is possible to deal in the fields of extension, agro-machinery, irrigation, postharvest processing and crop protection in addition to this seed project.

(4) It is more desirable to harvest soybeans during the dry season, to secure production of seed of high quality. The dry season last relatively long in East Java Province, allowing postharvest works to be done in better conditions.

Table 4.2 Element to Be Considered for Soybean Seed Industry Development

Items	Jambi	South Sumatra	North Sulawesi	Bali	East Java
1. Yield per Hectar	+	++	++	+++	+++
2. Soil Fertility	+	+	+++	+++	+++
3. Intensity of Soybean Crop	+	+	+++	+++	+++
4. Need of improvement of Jabal-system	+++	+++	+++	+	(V)[1]
5. Need of improvement variety seed	+	+	++	++	+++
6. Farmers' technical level	+[2)4)]	+[3)]	++[4)]	++[5)]	+++
7. Need of facilities of processing of soybean seeds	(V)	(V)	+	+	++
8. Marketing of soybean	+	+	+	+++	+++
9. Consumption of soybean products in the province	+	+	++	+++	+++
10. Cost of production	++	++	+++	+	+
11. Priority on soybean production in the provincial government	++	++	+++	++	++
12. Effects on trans-immigrants	+++	+++	+++	(V)	(V)

\+ ++ +++
Increasing intensity Suitability

1) Jabal-system is functioned
2) EEC Project at Muara Bungo
3) P.T. Patra Tani produces soybean seed at their farms
4) SPC under construction, SEED II
5) SPC operated for processing soybean

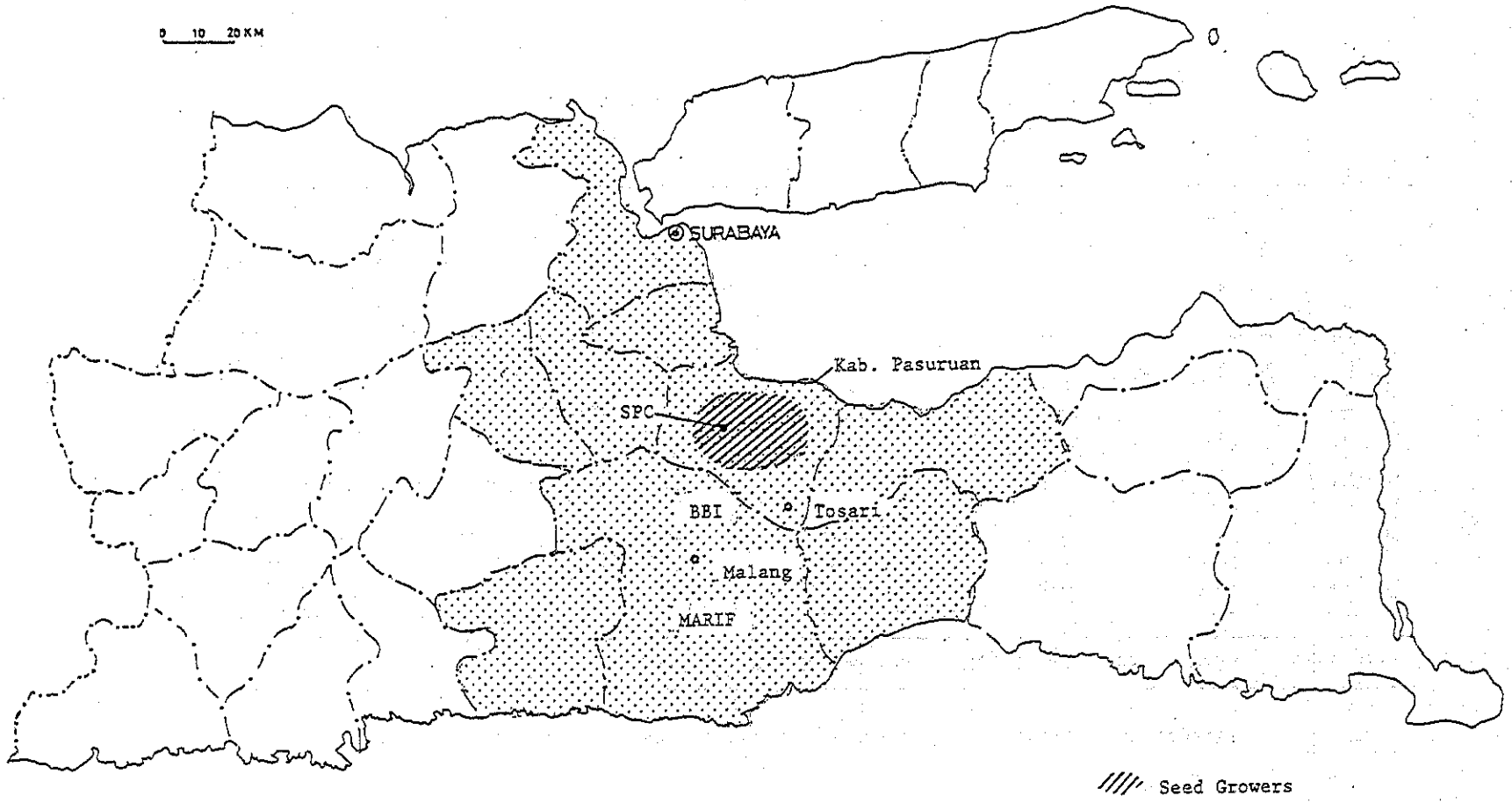


Fig 4.1 Pilot Project Area

4.8 Outlines of Pilot Projects to be Implemented in East Java Province

The basic ideas for the project formation are described in the previous section and the priority plans are proposed to be implemented in East Java Province under the system of a pilot project. The proposed six projects are supplemental to each other, and are expected to make a step forward in modernization of multiplication and distribution of a quality soybean seed industry in Indonesia.

Basic factors on project formation

(1) Soybean seed demand in East Java

The seed demand of soybean in East Java is estimated as followings.

- o Estimated soybean sowing area at the year of project attainment in East Java ..... 500,000 ha
- o Seed required for sowing ..... 40 kg/ha
- o Seed renewal ..... Once in five crops
- o Seed supply from other programmes ..... About 1,000 tons

500,000 ha (Sowing area in East Java)	x	40 kg (kg/ha)	=	20,000 tons (Potential quantity for soybean seeds)
20,000 tons (Quantity of seeds)	x	1/5 (Seed renewal)	=	4,000 tons (Seed quantity in 1/5 renewal)
4,000 tons (Seed demand)	-	1,000 tons (Supply from other programmes)	=	3,000 tons (Actual seed demand)

(2) Project area

It is advisable to have an appropriate size of project area in view of operation and management of project implementation, and proposed to conduct this project in the area of about 1/3 equivalent area of East Java for first phase of the project as followings:

1st Phase	Central area	1,000 tons
2nd phase	East area	1,000 tons
3rd phase	West area	1,000 tons
Total in 3 phases		3,000 tons

▨ ..... Applicable under this pilot plan, and others will be successively implemented as for 2nd and 3rd phase.

(3) Seed required in each season

Soybean is planted in 3 seasons through a year as follows:

Season	Sowing to harvesting	Ratio of sowing area
Rainy season	Nov. - Feb.	15%
Dry season I	Mar. - June	45%
Dry season II	July - Oct.	40%

Amount of seed required at the beginning of each season is as follows:

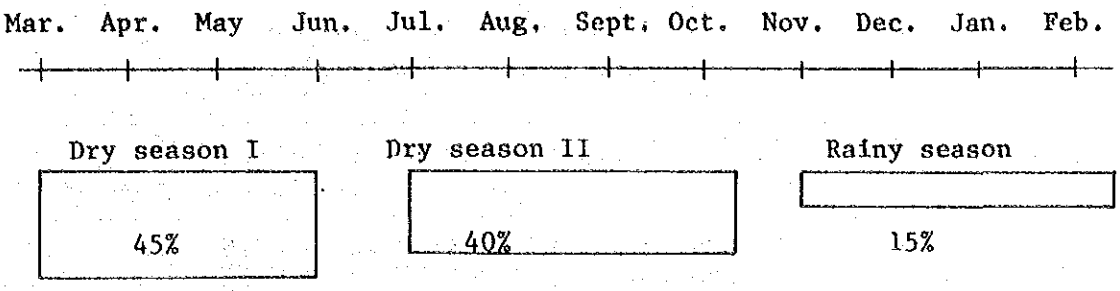


Figure 4.2 Seasonal Soybean Seed Requirement in East Java

(4) Planning of seed multiplication

1) Seasonal seed requirement

The following diagram explains the requirement of seed production in each season under the Jabal System for the total 1,000 tons of seed supply.

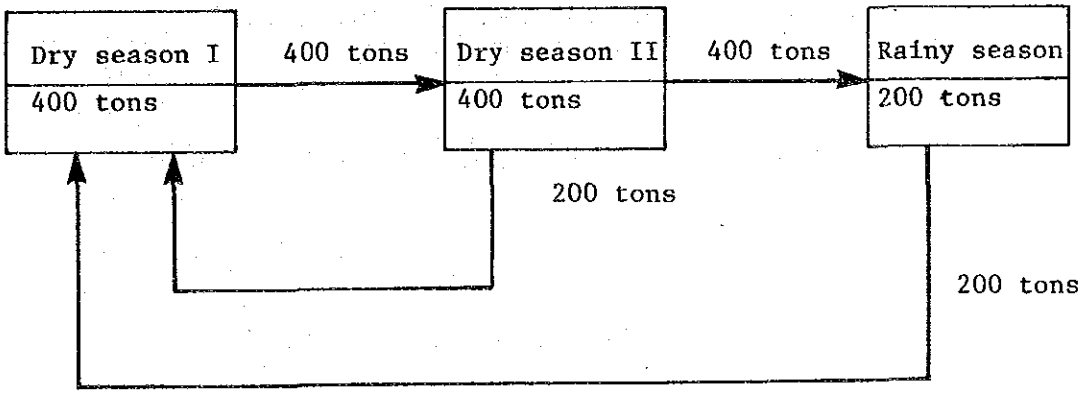


Figure 4.3 Seasonal Seed Requirement under Jabal System

Shown below are the reasons why the production of soybean seeds is merely 200 tons during the rainy season;

1. Area for cultivation of soybeans is smaller in the rainy season and it is difficult to find good seed growers.
2. Disease infection is more serious in the rainy season and infested ones are not suitable for seed.
3. Poor postharvest practices always make seed quality inferior

2) Number of seed growers groups in each season

The number of seed grower groups in each season is decided as follows:

Table 4.3 Planted Area of Soybean for Seed and Number of Seed Growers Groups

Season	Seed (before processing)	Area	Number of seed grower groups
Dry season I	400 tons (480)	400 ha	16
Dry season II	400 (480)	400	(16)
Rainy season	200 (240)	200	8
Total	1,000 (1,200)	1,000	24

Remarks:
1) Average yield of crop (1.2 tons/ha)
2) Average yield of processed seed (1.0 ton/ha)
3) One unit of seed grower group (25 ha)

3) Processing capacity of seed processing center

o Year target

1,000 tons Rainy season .... 200 tons
Dry season I .... 400 tons
Dry season II .... 400 tons

o Working day

30 day for one season

o Processing capacity per hour

$$\left[\frac{400 \text{ tons/season}}{30 \text{ day/season} \times 16 \text{ hrs}} \fallingdotseq 1.0 \text{ ton/hr.} \right]$$

4) Seed storage

200 tons of seed harvested in rainy seed is required to be stored for 4 - 5 months mentioned before. Adding to this seasonal stock, about 100 tons of seed is necessary to be stored for a precaution against malcropping of soybean. According to the table, the maximum amount of storage during the year is 400 tons, which makes the capacity of the storage 400 tons. The longest run of storage is 6 months, which is the case when seeds are stored from October to April.

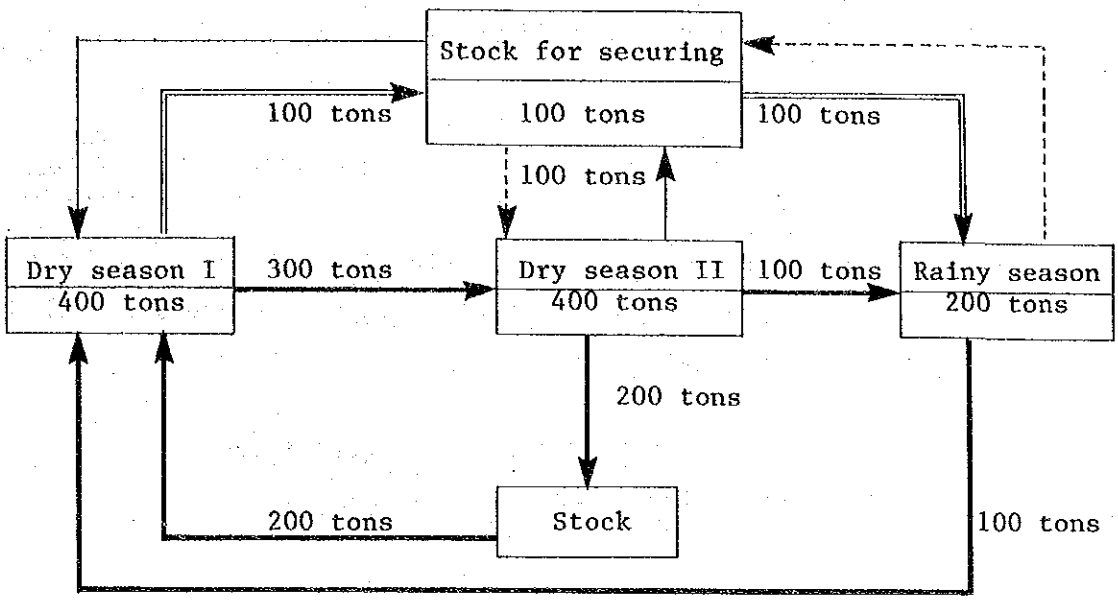


Figure 4.4 Flow of Seed Stock

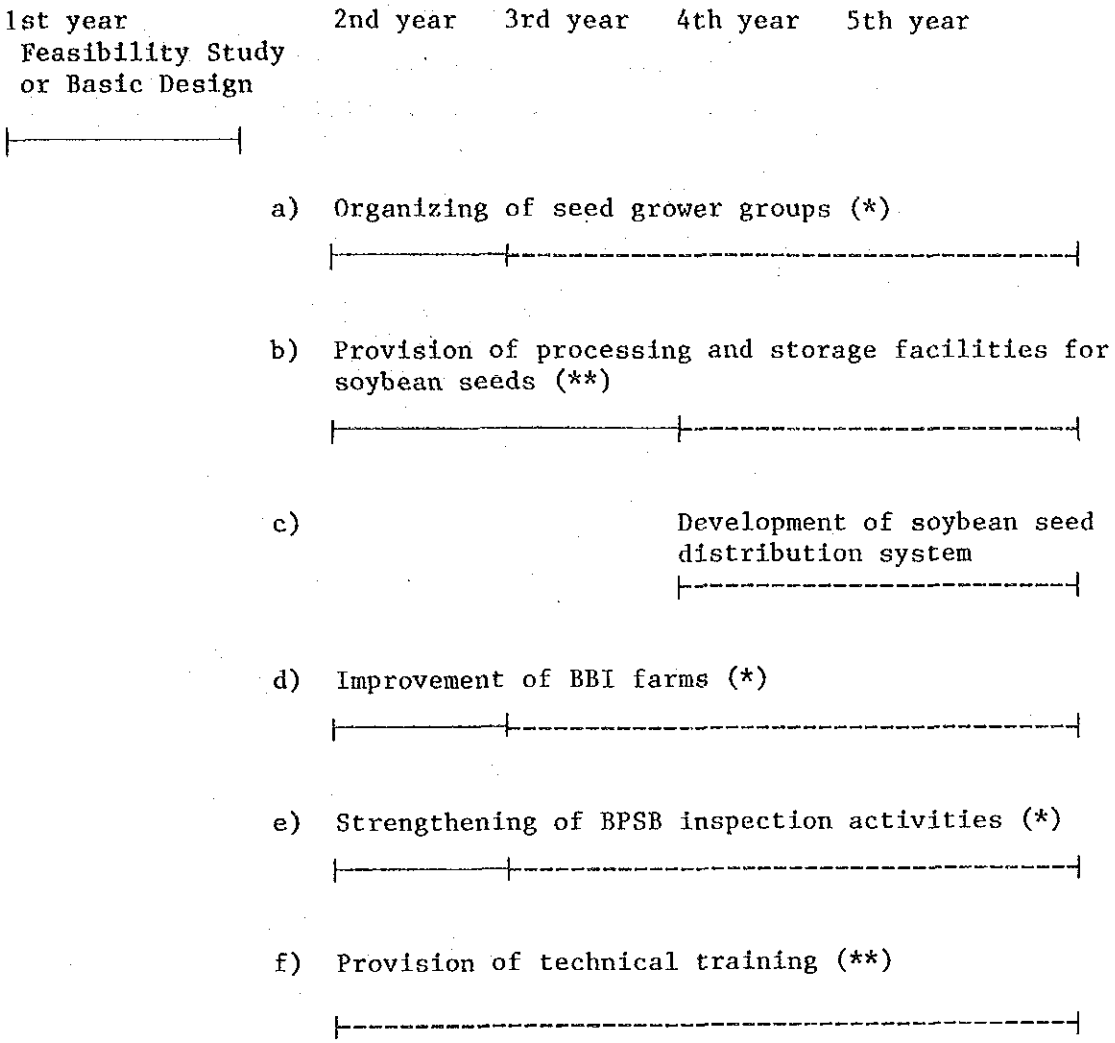
Table 4.4 Seed Inventory

Month	Seasonal stock			Stock for securing against malcropping				Total stock
	Arrival	Shipment	Stock at end of month	Opening stock	Arrival	Shipment	Stock at end of month	
Oct.	200		200	100	100		200	400
Nov.			200			100	100	300
Dec.			200				100	300
Jan.			200				100	300
Feb.			200				100	300
Mar.			0		100		200	400
Apr.		200	0				100	100
May			0				100	100
June			0		100		200	200
July			0			100	100	100
Aug.			0				100	100
Sept.			0				100	100
Year	200	200		100 (for the beginning year)	300	300		

(5) Proposed projects to be implemented

1) Organizing of seed grower groups.
2) Provision of processing and storage facilities for soybean seeds
3) Development of soybean seed distribution system
4) Reinforcement of the administrative functions and activities of soybean seed multiplication and distribution
   a) Improvement of BBI farms
   b) Strengthening of BPSB inspection activities
   c) Provision of technical training

(6) Project schedule



(7) Technical cooperation required for project implementation

Long-term

- o Project programming/ planning/organization/management ..... (1)
- o Seed multiplication ..... (1)
- o Soybean farming ..... (1)

o Processing/operation of SPC ..... (1)

Short-term

o Storage of soybean ..... (1)

o Pathologist/quarantine ..... (1)

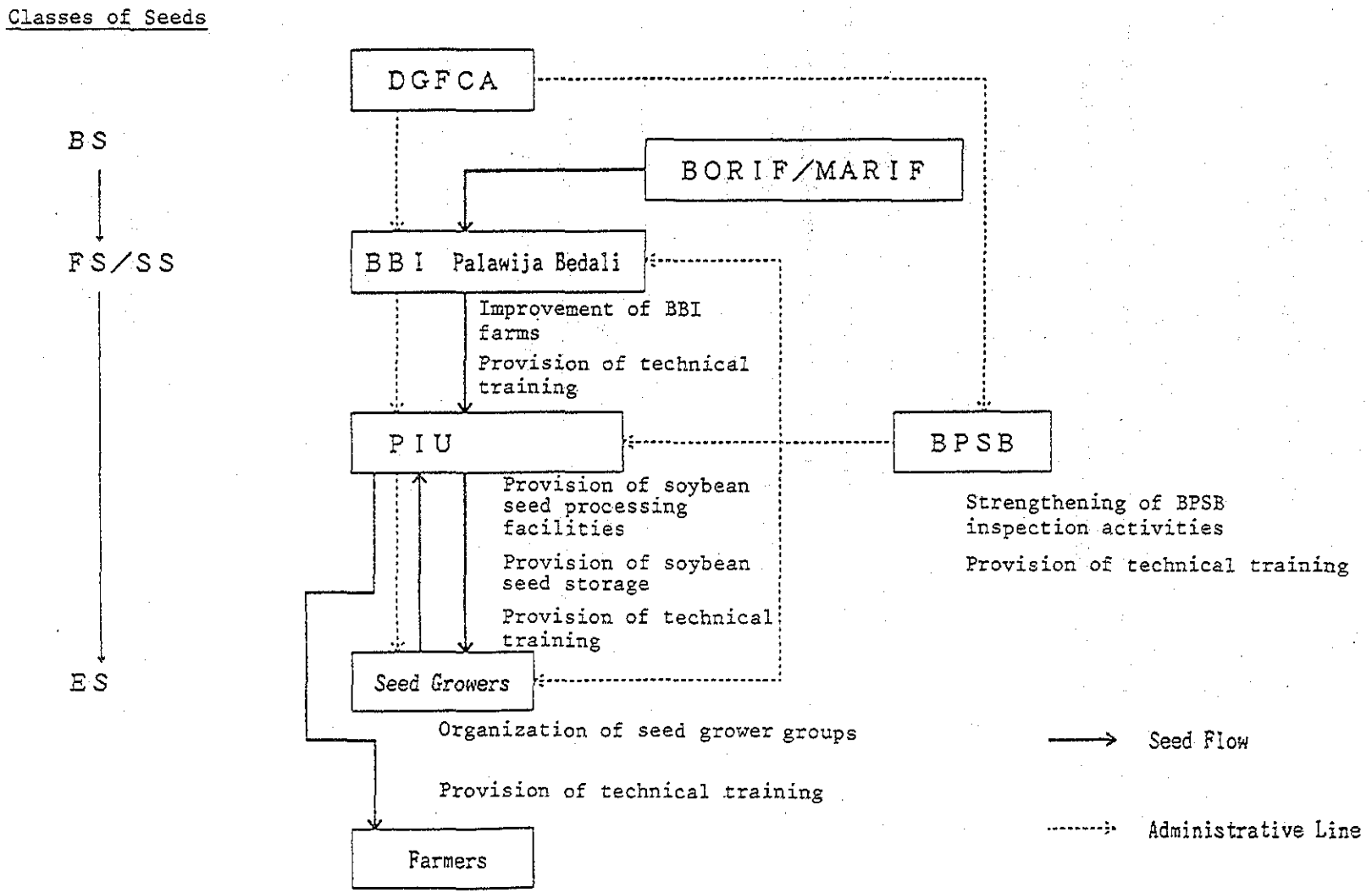


Figure 4.5 Diagram of Project Structure

4.8.1 Plan to Organize Soybean Seed Grower Groups

(1) Objective

To organize seed grower groups of a high technical level in order to prepare raw material of ES of high quality.

(2) Executing agencies

A government organization or public corporation which is related to the production and distribution of soybean seeds in East Java Province.

(3) Activities

To promote operations in groups by organizing seed growers' groups with a production unit of approximately 25 ha. in the project area of Kab. Pusaruan, to carry out post-harvest primary works, to avoid quality deterioration of seed and to reduce the losses.

1) To organize 24 groups of seed growers, each of which has a about 25 ha of soybean farming area.
2) To have a farming contract between executing agency and seed growers to produce and sell their product at a certain price.
3) To produce about 1,000 tons of soybean seed per year by applying improved Jabal system.
4) To give a credit to farmers for purchasing of necessary tools and equipment for pre and postharvest working like winnowner, thresher and sprayer of agricultural chemicals.

(4) Concept of design of machines and tools and facilities

1) The facilities should be used cooperatively or individually by seed growers in order to produce the raw material of quality seed.

2) Farmers are supposed to have a charge of primary processing after harvesting to avoid the deterioration in quality for the future and to raise the value of the products, thus the bringing about an increase in their own income.

3) They should be also utilized to improve the post-harvest processing practices for other crops (paddy, mung beans, etc.) besides soybeans.

4) It is necessary to design such facilities that can be managed and run autonomously by farmers. It other words, they are to be economically designed to save expenditures for facilities and for their maintenance. In this sense, domestic products should be used as much as possible.

(5) Scale of equipment and facilities and agricultural

The unit for soybean seed grower groups is to be approx. 25 ha (the number of household 70 - 100), yield per hectare 1.2 t/ha, the number of workdays for post-harvest processing for soybeans 30 days/crop. For rice, the yield of paddy per hectare is to be 4 tons/ha and the number of workdays for processing 30 days/crop.

Irrigation pumps are assumed to be for the boring well with coverage of 3 - 5 ha/pc, and sprayers are to be of the knapsack type with a capacity 0.5 ha/pc/day.

(6) Agricultural equipment (for one group of 25 ha)

Post-harvest processing

Power thresher (axial flow throwing-in type with engine)	5
Manpower winnower, shieves (manual or sloped wire net)	25
Grain-moisture meter	5
Small-sized dryer (box type)	5
Platform scale (weighing capacity 300 kg)	5

Operation at farming fields

Irrigation pump (boring well)	10
Hard sprayer (semi-automatic knap sack type)	10
Power sprayer	5

(7) Cost estimation

1) Investment amount for each group of seed growers (25 ha)
¥6,400,000

2) Total amount of investment for Seed Growers in project area in the central area of East Java

¥6,400,000 x 24 groups = ¥153,600,000

4.8.2 Plan to Provide Seed Processing and Storage Facilities for Soybean Seeds

(1) Objectives

1) To provide soybean seed processing facilities with the processing capacity of 1,200 tons annually in Kab. Pusaruan, East Java.

2) To provide storage facilities for soybean seed with a capacity of about 400 tons at Tosari, Kab, Pasuruan, East Java.

(2) Executing agency

Government organization or public corporation which is related to production or distribution of soybean seed in East Java Province.

(3) Actual activities

<1> Provision of Seed Processing Facilities

1) Concept for basic design

a) To receive the raw material of seeds which finished the primary processing by the soybean seed growers' groups.

b) The function of the facilities is to be limited to finishing drying (MC from 16% to less than 10%), cleaning, grading, sterilization of seeds, packing and temporary storage.

c) Provision of these facilities can be dealt with by utilization or expansion of the existing facilitis. This will help diminish investment and faciliate in turn sound operation of the corporation. Renewal of the faiclities will lead to difficulties in management of the corporation. More definitely, basic designs shall be made for the ones which have been chosen as most convenient due to positional proximity.

d) To put the existing facilities in a common use with rice and other palawija crops necessitates more complicated maintenance and control for some of the machineries, besides it amplify the possibilities of ingression of seed of other varieties. For this reason this method is not practical. Regarding this aspect, a practicable way should be designed on the basis of opinious of working staff and should not be designed simply because it is technically possible (for example, replacement of wirenets).

e) As for the establishment of processing facilities, it is required to utilize the existing facilities or increase them at the same presmises in order to promote sound management of this project.
New establishment of main facilities will lead to economical difficult situation of this project. Therefore, it is desirable to select the nearest existing facilities and implement basic design there.

f) As for the utilization of existing equipment, it is sometimes complicated for maintenance and management of some machines to utilize them in combination with rice and other palawija crops. Also there may be mixed alien seeds in them, so, it is not practical.

g) Processing systems is required to be simplified and minimized in order to avoid affecting seed price.

2) Plan of equipment

a) Finishing drying will be based on sun-drying. Mechanical dryers of boxed-type will be installed to supplement.

b) Cleaning of foreign material will be based on winnowing, sieve, rolling and gravity. The application of a color sorter is effective for sorting of discolored grains, such as violet dotted grains (violet dot disease), leaf spotted grains (dwarf virus), radiated dotted grains (mozaic disease). It is farther needed to study on the actual conditions of these damaged grains.

However, there is possibility that normal colour grains are already infested with virus brought from damaged grains. Functions of color sorter can't be expected so much in case of seed sorting.

c) As for classification, there is no standard for soybean seed at present, but it is not needed. Cleaning operation to thoroughly remove impurities and damaged grains will satisfy the present conditions.

d) As for seed treaters, some people offer opposition to their use, because the seeds may be eaten by mistake. But, it is a necessary piece of equipment fundamentally, and to pay fully attention in order to avoid such accidents.

e) As for packing, there are wide varieties of means (drying materials, CO_2, oxygens absorber vacuum polyethylene - zeolight aluminium - laminated film, etc.) such as packing material or mixed material. But, the emphasis should be placed on thorough drying before packing and using completely sealed packing and also cutting off the penetration of humidity. Since the films (plastic, polyester, polyethylene) which have been used at present have many problems in bag manufacturing and in sealing, and produce a lot of broken bags, this should be improved.

   Net weight of one bag is properly to be 10 kg, judging by the farming size and quantity of sowing amount.

f) Though BPSB is to have charge of inspection and certification of seeds which are processed. However the project is necessary to possess the minimum equipment for self-inspection (for example, moisture-meter of soybeans, 100 grains scale, germination tester, micrometer etc.)

g) For handling of packed soybean seed, palette or box system should be adopted in order to avoid damage, and forklifts should be used for cargo handling.

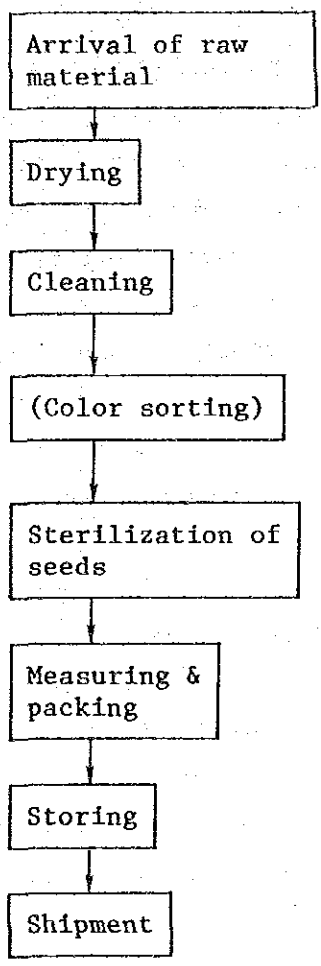
h) Two lines system should be considered by taking into consideration to ensure of economical operation to cope with seed collection amount, and in case out of order.

3) Renewal of the existing facilities

The improvement to add soybean seed processing functions for eight spc of paddy seed established by East Java provincial Government, presently lented to prem SMS, may be difficult due to narrow space of these building as far as the smaller equipment will be planed.

4) Flow-chart

The following shows the basic flow of the operation except attached facilities. Figure 4.6 also gives the flow example of soybean seed processing facilities.



Raw material completed in primary processing (drying, cleaning) by seed growers. Packed into bags of jute or chemical fiber

Sun-drying & box dryer

By means of wind, sieve, rolling, gravity and the sizes of grains

Only for a portion of raw material. As a result of the study, 5 - 6% of discoloured grains counted

Damp-proof bag . net weight 10 kg

Temporary storage

To transport in palettes or in boxes to storing houses which are located in cool areas of high altitude, or to soybean seed growers' group

<2> Provision of Seed Storage

1) Basic concept for design

a) Soybean seeds are apt to lose the rate and vigor of

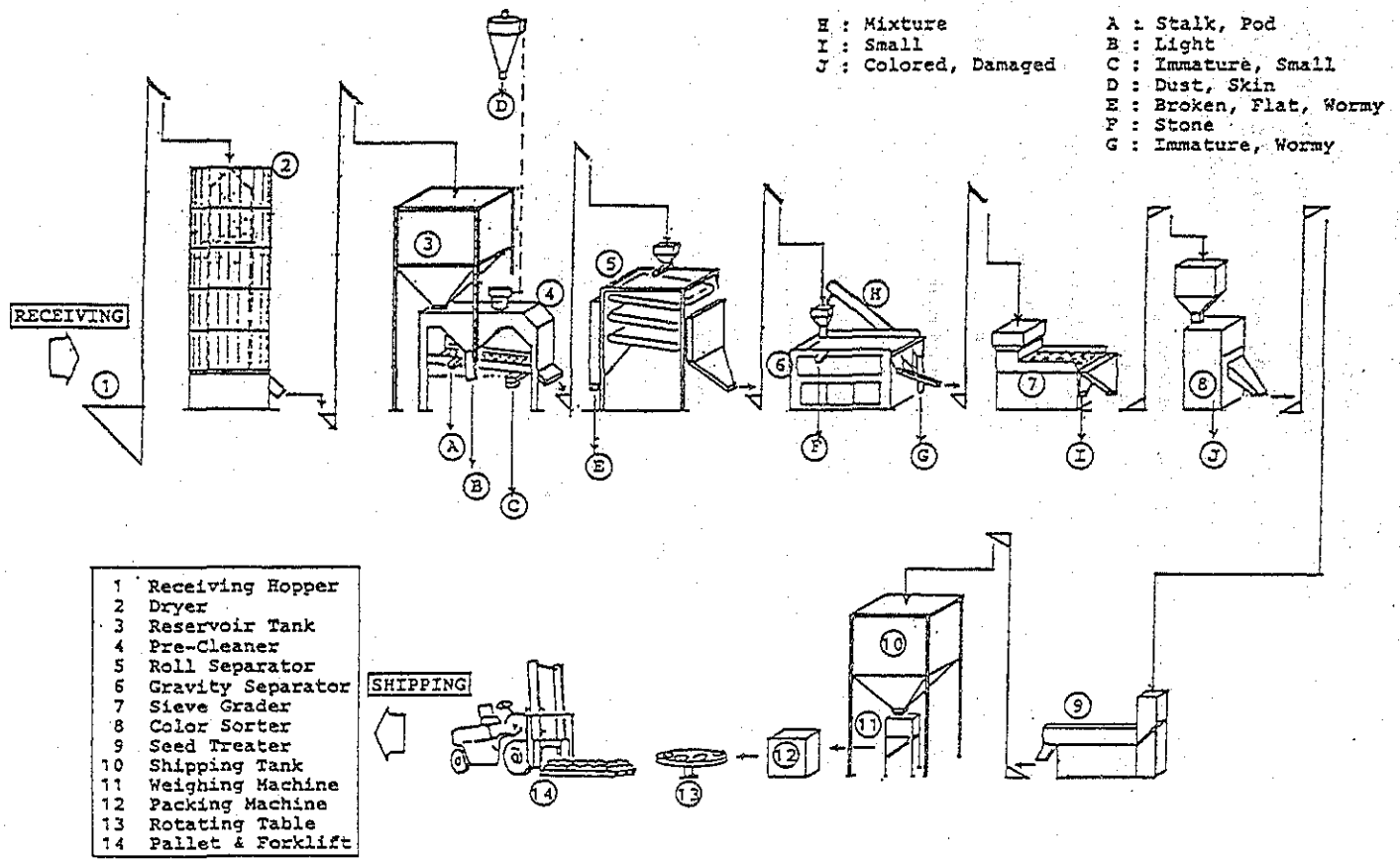


Figure 4.6 Flow Chart of Soybean Seed Processing Plant

germination rapidly around three months after harvest under normal conditions (of tropic weather).

b) The traditional Jabal system (interfarm seed exchange system) has been carried out to cope with the above-mentioned problem. It is effective to some extent under the present conditions.

c) Actually, there are some problems under the present Jabal system, such as, seeds are difficult to be produced during the optimum period, seeds are maldistributed, farmers are not able to recognize the seeds of quality characteristics, and so on. Therefore, it is required to cope with these problems while utilizing the merits of the existing Jabal system.

d) The best way to cope with the above-mentioned problems is to secure storage of required amount of seed and rapidly and appropriately distribute seed. The production of quality seed will be attained through levelling up of seed producing techniques at seed growers, BBI/BBU.

e) Appropriate amount of seed is necessary to be reserved in stock for mal-crop due to natural conditions.

f) Taking into consideration the above-mentioned description, it is necessary to design soybean seed storing facilities.

2) Characteristics of soybeans from a storing view points

a) Since soybeans contain more fat and protein, they are easy to change in quality while being kept in storages, in comparison with rice, at normal conditions.

b) Crops of high protein and oil seed, such as soybean, are highly generative, and so the temperature of the grains is hard to fall.

c) They easily suffer damage from insects and gather molds.

3) Results of tests on soybean storing houses in cool places of high altitude

Since soybean seeds are apt to rapidly lose the rate of germination after harvest in tropical zone, it has become a

serious problem for cultivation of soybeans. CRIFC conducted a test by the following methods on the influence of temperature and humidity on germination of soybean seed during storing period, in order to establish a practical and economical way to store seed in tropical zone. They have reached the conclusion that it is possible to maintain the rate of germination for a long time by keeping seed in cool areas of high altitude.

a) CRIFC sowed and grew seeds at three places for ten days after five month strong in a refrigerator, at Pacet Experimental Station (altitude 1,100 m/maximum & minimum temperature of storage 27 - 19°C) and at CRIFC of Bogor (260 m, 32 - 26°C).

b) The influence of temperature on germination rate of seeds was clearly recognized and the germination rate of seeds which were kept at Pact Experimental Station was almost the same as that of seeds kept in a refrigerator, while the seeds of Bogor showed a conspicuous deterioration in germination vigor.

c) CRIFC also conducted a test on germination of the seed which were kept for five months by changing the humidity inside the vessel and found that the germination rate can be well maintained under low humidity, the quality of seed can be also maintained and, furthermore, a decrease in germination rate of small sized grain of variety No. 29 was not recognized.

d) CRIFC also carried out germination tests once every two months on the possibility of long term storage of seeds by keeping seeds at three experimental sites of different altitudes. They were conducted at CRIFC of Bogor, Kuniggan (altitude 500 m, room temperature 29 - 23°C) and Pacet. The limit for the storing period was four months in Bogor and six months in Kuniggan. In Pacet, that for large and medium-sized grains (Orva, No. 945) was eight months, while that for small-sized grains (No. 29) was more than ten months.

This means that germination rate differed clearly in sites for storing, and varieties. Test result is

mentioned in details in Appendix ??.
It may be impossible under the present condition in Indonesia to keep soybean seeds in a large quantity in cold storages. So the second best way, proved from the above-mentioned tests, is that it is possible to keep the vigor of seed for a long time by storing them in cooler places of high altitude.

4) Type of storing facilities

a) Long-term storing of soybean seeds which meet certain conditions of moisture content and cleaning can be attained by keeping following the conditions of temperature (18 - 20°C) and humidity (RH 60% approximately).

b) As for the acquisition of low temperature in a tropical zone, there are methods of lowering the temperature of the storage using machines (cold storage) and of locating the site of low temperature under natural conditions.

c) As for cold storage, it is necessary to operate the machine throughout the year. In this case, the operation and maintenance costs for the machines will go against the seed price. On the other hand, the low temperature under natural conditions is available only at the sites of more than 1,500 m of altitude and the transportation cost will be increased. Therefore, further study will be required on the economical comparison between the two. However, in the former case, it will be practically difficult in the future to keep and maintain refrigerators.
Appendix ?? shows the economical comparison data betwen two, the storage at high altitude clearly takes advantages.

d) Since many high-land places of around 1,500 m of altitude have worked as important points for traffic in Indonesia for topographical reasons, the low temperature under natural conditions is available by selecting these places. Attention should be paid in the case where the temperature difference in a day is large and the

atmosphere becomes low temperature and high humid at night by radiated cooling.

e) Inuring to the big change of atomospheric temperature just after taking out from storage room may be advantaged to avoid d damage due to sweating to soyban grains.

5) Outline of soybean seed storage

Type	Reinforced concrete block or bricks (Insulating materials to be used, ex. rice husks) Closed type (lightening from side windows) may be recommended due to high humidity at the site. Ventilation of hot air under roof (night fan or solar cell fan to be studied) Compartment room system to be studied to avoid mixing of varieties and change of room temperature in a room
Scale	400 tons (packed with plastic, containing 10 kg)
Site	At Tosari, Kab. Pasuruan, East Java Province 1,777 m above sea level
Temperature	6 - 25°C (Refer to Table ?) RH 50 - 90%
Power supply	Available
Equipment	Palette or box container, forklift, medium truck, platform scale, small-sized scale, plastic bag sealer, fumigation material (sheets, insecticide)

Means of handling	To move palettes and boxes as they are by forklifts and trucks to avoid the damage of goods and to increase the transportation efficiency
Attached facilities	Independent power plant, residence

(4) Cost estimation

Land (clearing)	¥ 12,500,000
Buildings (Seed processing center, seed storage)	76,480,000
Machineries and equipment	254,300,000
Total	¥343,280,000

(For project area in the central area, East Java)

Remarks:

1) Charge for land is not included because the facilities will be located at existing SPC of paddy.
2) Operational cost can be analysis, referred to the section of economic.