4-2 Present Situation and Planing of Seed Production

4-2-1 Seed Production and its Problem

(1) Production Organization

A seed-production and distribution organization seed to the increased production and delivery into farmers' hands of improved varieties seeds developed at research organizations (Breeding experimental station). The seed production of improved variety usually follows three stages: production of breeder seeds (B.S.), production of foundation seeds (F.S.), and production of extension seeds (E.S.). In Indonesia, breeder seeds are produced at the Food Crop Research Institute. Production of foundation seeds at seed cultivation and distribution organizations responsible for nationwide distribution of breeder seeds is small. Consequently, foundation-seed quantities are increased and are distributed to extension-seed growers as stock seed (S.S.). In other words, the cycle of the seed production in Indonesia consists of four instead of three stages: production of B.S., production of F.S., production of S.S., and production of E.S.

E.S. grown by seed growers are sent to a processing center where they are selected and processed before being shipped to seed growers. Fig. 4-1 shows the organization and future aspect involved in seed production and distribution in Indonesia and especially in the three provinces covered by this project.

The most fundamental aspect of the organization is production of B.S. since, in this stage, scrupulous control must be exercised to ensure that the improved varieties donot lose their genetic characteristics. Emphasis is placed on preserving the variety characteristics instead of on increasing seed quantities. For this reason, in the stage of B.S. production, some strains of new variety received from Breeding organizations reponsible for B.S. production should be planted in the manner of one seedling to a hole according to pedigree respectively.

All off-types resulting from genetic segregation or mutation are discarded. A few individuals from improved varieties preserving the characteristics of the new strain are selected for the cultivation of the following year's B.S. The remainder is harvested, mixed, and used

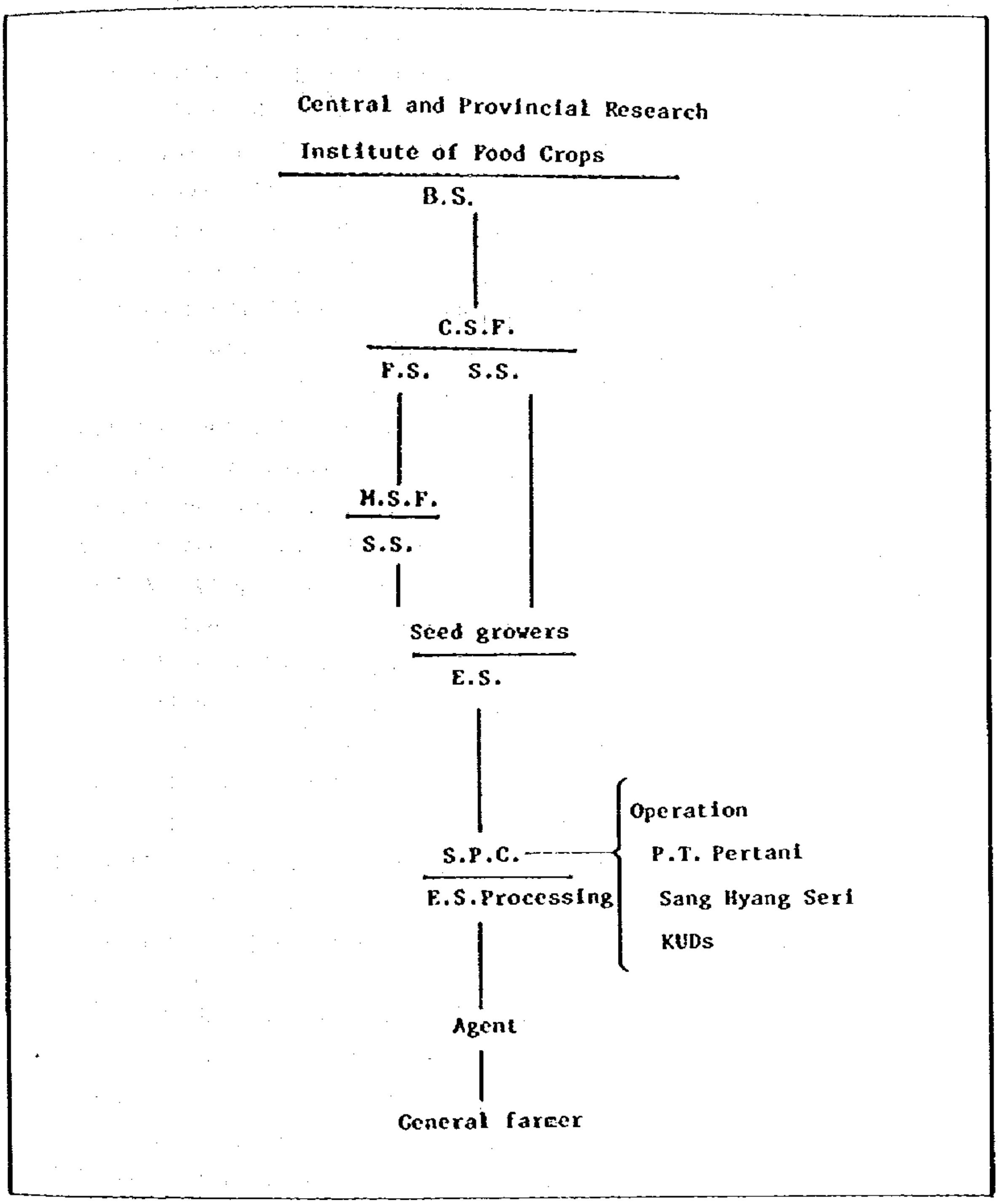


Fig. 4-1 Future aspect of rice seed production and distribution

as B.S. for the production of F.S. Cultivation of B.S., which demands a high level of knowledge, experience, and technical skill, is now being carried out in such Indonesian research organizations as CRIF and the seven Food Crop Research Institutes located throughout the country.

In some instances, strains are cultivated, not by pedigree, but in bulk culture. In such cases, when off-types are discovered, only the individual demonstrating the undesirable traits is discarded. This means that individuals preserving recessive-hetero off-type traits persist. And this, in turn, means that off-types are preserved in generations after that of F.S. To prevent this, it is essential that pedigree culture be carried out and that all individuals of a strain demonstrating off-type characteristics be eliminated.

In Japan, all the prefectural station for seed production raise B.S. Seeds for the cultivation of F.S. are therefore plentiful as are crops of foundation seeds themselves. Therefore, F.S. can be distributed directly to growers of E.S. At present in Indonesia, on the other hand, personnel skilled at cultivating B.S. are in small supply. And for some time it will be necessary to rely for their production on Food Crop Research Institutes, where people with the required high level of skill are stationed. In the case of improved strains, it is desirable to minimize the number of generations between the breeder-seed stage and the time seed grains are supplied to farmers since this reduces chances for the emergence of undesirable recessives.

F.S. are grown by sowing breeder seeds. Their purpose is to increase the amount of healthy B.S. in pure improved strains for distribution to cultivators (general farmers). Consequently, preserving their genetic purity is vitally important. They must be raised plant by plant so that off-types may be easily spotted. Further, to ensure good quality, they must be well fertilized and protected from insect damage. Off-types must be weeded out upon discover. The greatest care must be taken to prevent pollution with other seeds at harvest, threshing, and processing stages. The danger of such pollution is especially great in the case of F.S., since their large crops require mechanical assistance in threshing and processing. Once again, in the cultivation and harvesting of F.S., a high level of knowledge and skill is essential. At present in the H.S.F. of the three provinces of Sumatera covered by this project, sufficiently trained personnel are unavailable and must be trained and sent there in the future.

S.S. are the next generation after F.S., the increase of whose quantity is the sole reason for their cultivation. The limited quantities of B.S. production means that there are insufficient F.S. for direct distribution to growers. Consequently, this extra generation has been added. S.S. are distributed to E.S. growers. They are grown three or four plants to a clump and fertilized in the standard fashion. Nonetheless, since, at this stage also, genetic purity is important, it is preferable to plant them singly to facilitate removal of off-types. E.S. growers receive S.S., which they sow and cultivate in the ordinary fashion. The resulting seeds of improved strains are then distributed to farmers.

To provide general farmers with high-quality seed, seed growers, must be good at their work. Since it is desirable that seeds be pure in strain and be strong in germination capacity, strict checks must be made of both the product and the fields while crops are standing unharvested. At present in Indonesia, production of high-yielding seeds for the sake of elevating the level of agricultural production does not always meet the need. Nonetheless, though production of seeds for dissemination proceeds at a leisurely pace, it is expected that productivity will be higher than their own seeds harvested by farmers which were contaminated during the decades when the system was imperfect.

(2) Current seed production

Fig. 4-1 shows the overall plan of seed production and distribution in Indonesia. B.S. are raised in the CRIFs or in the seven branches of Food Crop Research Institutes and are sent to C.S.Fs in various regions for the production of F.S. seeds.

At Perum Sang Hyang Seri (National Seed Corporation=NSC) in Sukamandi B.S. obtained from the Bogar Institute of Food Crops (BORIF) and the Sukanami Institute of Food Crops (SURIF in Sukamandi) are used to produce F.S., S.S. and E.S. as well. (At present, F.S. are temporarily being produced at SURIF and distributed to Perum Sang Hyang Seri (National Seed Corporation=NSC). Beginning in the dry season of 1982, Aceh obtained B.S. from SURIF (Sukarami in Padang) Lampung and South Sumatera are scheduled to obtain them from BORIF. Furthermore, CSFs that are now been put in working order are to produce F.S. and S.S., though at present production is about zero. Keumala, in Aceh, is still in the stage of producing stock seeds, whereas Upang in South Sumatera and Way Jepara in Lampung produce extension and S.S.

F.S. are being grown on land recommended for a C.S.F. in Belitang in South Sumatera and on land recommended for use as an M.S.F. in Tani Mulyo, but observations reveal that the cultivation methods employed are much more careless than they formerly were.

Since the seed-harvesting system in Indonesia is far from complete, in all districts, farm lands assigned for use as seed fields and those attached to research and training centers play an important role in the production of S.S. and E.S. and are referred to locally as supplementary seed farms. ANNEX Table 4-6 provides information related to these farms, though exact information on quantities of S.S. and E.S. produced by them was unobtainable.

The following comments should be made about seed-production conditions in the provinces covered by this project. In 1981, land recommended for a C.S.F. in Keumala, Aceh Province, produced 10 tons of S.S., which were distributed over 420 hectares. At present, varieties PB 50, 52, 54 and 26 are raised on a total of 4 hectares. Though S.S. were raised on one hectare in Tangan Tangan, but seed production was zero by drought injury. At the Pulo-ie training center (BBP), IR36, Semeru E.S., were grown on 8 hectares of land. At the Belitang C.S.F. in South Sumatera, in 1981, Semeru, Cimardin, PB42 S.S. were raised on 8 hectares; and GH147H, B1050 and B1043 F.S. were raised on 2.7 hectares. But, owing to the depredations of birds and field mice, the total crop of all 3 varieties amounted to only a little over 200 kilograms of S.S. At the Tanimulyo M.S.F., where full irrigation facilities are available, stable crops of PB36 S.S. and F.S. were produced. At the Tanjung Tebat supplementary seed farm, 11 hectares of PB36 were planted. At Delta Upang, 2 hectares of E.S. of PB 42 were cultivated. During the rainy season at the Wayjepara C.S.F., in Lampung, 3.75 hectares of Cisadane, 1.25 hectares of Semeru, and 3.0 hectares of IR 36 were planted. At the Metro M.S.F., 8 hectares of E.S. of IR36, IR50 and IR54 were planted in the dry season and 8 more in the rainy season for a total of 16 hectares. At the Srimenanti suplementary seed farm, 7 hectares of IR36 were planted. All of these undertakings are for the purpose of alleviating the absolute shortage of improved varieties now being experimented in local regions by producing S.S. and E.S.

S.S. produced at seed-growing farms are sold to farmers. Oral report has it that part of the E.S. raised by the farmers is transported to seed-growing farms, while the rest is distributed directly to general farmers.

(3) Problems related to seed production

From the standpoint of cultivational methods there is little difference between what are locally termed F.S. and S.S. As has already been stated, in the production of F.S., preservation of genetic strain characteristics is paramount, whereas, in the production of S.S., both purity and quantity are stressed. Consequently, cultivation methods must suit these aims. The gist of the local seed-production method are explained in terms of guidance for Perum Sang Hyang Seri and D.I. Aceh (Refer to ANNEX Table 4-7 & 4-8). There seems to be no major error in this method, as set forth in various explanations. But some points in actual cultivation deserve attention. For instance, remarkable quantities of chemical fertilizers are employed. Furthermore, plants are densely set. Finally, the growers need to be fully aware of the great importance of using improved seed.

Cultivation methods of S.S. must take into consideration the individual traits of varieties, and S.S. need to produce for quantity production. However, the amounts of chemical fertilizers used should be smaller than ordinary cultivation. Furthermore, interplant spacing should be great enough to facilitate elimination of off-types during the growing period, weeding, and protection from disease and insect damage.

Since it is seed-cultivation, the production of E.S. differs from ordinary rice growing. As is true in the case of cultivation of S.S., fertilizing must be held at a level lower than that of ordinary rice growing since too much chemical fertilizer can cause the strain to vanish. At present in Indonesia, overfertilizing and dense planting frequently result in overgrowth. As a consequence of the same two factors, in Aceh damage from several sorts of rice borer is great; and in Lampung, Rice leaf sheath blight (Rhizoctonia SPP.) damage is a serious problem. Heavy fertilizing in the upland rice districts of South Sumatera is causing an increase in damage from Black rice bugs (Scotinophara Jermicutata).

In Indonesia, upland rice seeds are produced in upland field. Because of limited amounts of dry field, in stock seed farms where upland rice is raised on such land, overcropping can cause damage and is therefore a problem. Furthermore, especially on sloping land, heavy rain or showers beat down ground and wash away seeds and seedlings of upland rice, thus reducing the planting/output ratio (establishment of seedling). Rains of this kind do not sink into the ground but run off ground surface. Added to this, the light intensity of sun in Sumatera is 50%, because of dehydration even in rainy season is very high. Therefore, when the unstable rainfall of the rainy season is relied on, consideration must be made of possible early drought. Upland rice requires great amounts of water from the panicle shooting time to the ripening phase. Shortages of rain during this period are major causes of the occurence of abortive grains in panicle and result in damage from rice leaf blast (Piricularia orizal cavara) as well. For this reason, it is better to cultivate upland-rice stock seeds in wet fields wherever possible. And, if growing them in dry fields is unavoidable, adequate irrigation must be provided. In addition to these problems, it is essential to raise the technical-skill level of all Indonesia seed growers, especially in connection with the following points.

1) Selection of seed. Germination rate and especially viability of the seed are important. When seed selection is poor, a great amount of seeds must be sown. This results in great competition which is not conducive to the raising of strong and sound seedlings. It is far

better to select carefully, sow sparsely, and in this way raise good seedlings.

2) When a variety is sown in a field where another strain was previously cultivated, it is of the utmost importance to remove meticulously all fallen grain and plant hills after harvesting of pre-crops variety to prevent contamination. Furthermore, seedling beds must be kept out of danger of contamination from other varieties.

3) If possible plants for both S.S. and E.S. should be planted with the method of one seedling in a hole, and not in dense clumps. Furthermore, parallel rows or some improvement of that layout should be used since they facilitate such processes as elimination of off-types during the growth period. In addition, parallel rows improve the growing environment by allowing good ventilation.

4) Research has determined the amounts of fertilizer optimum for each region; but in general too much is used, and overgrowth is prevalent. Since seed raising differs from ordinary cultivation, fertilizer should be moderated, administered evenly, and repeatedly and thoroughly raked.

5) Because of insufficient infrastructures, in tropical areas where several plantings are possible a year, crops tend to concentrate in certain periods. For this reason, crops grown at some time other than the optimum period tend to suffer heavily from birds, rodents. and pests. Although the kinds of pests and insects damage on rice differ from region to region, preventing their ravages is a major problem. It is possible to equalize damage caused by birds, beasts, and pest by spreading out and staggering crop times. In addition, however, it is necessary to burn off grasses on the boundary level in rice field and to exterminate rodents as a preventative measure. In Aceh, heavy fertilization and dense planting result in serious damage from Rice stem borer, Rice leaf blast (Piricularia orizae cavara), and Rice bacterial leaf blight (Xanthomonas orizae). Heavy fertilization in Lampung,

where the soil is lean, causes severe attacks of Rice leaf sheath Blight (Rhizactonia SPP.) To increase productivity, it is desirable to improve the quality of the soil and provide better water drainage system. Furthermore, in Indonesia, seeds contamination occurs most frequently because of lack of adequate control after the crop has been harvested. This also must be corrected.

4-2-2 Central and Main Seed Farms

(1) General

The Indonesian Government is establishing central and main seed farms in the Provinces of Aceh, South Sumatera and Lampung in order to implement the Rice Seed Production and Distribution Project.

C.S.F. will produce F.S. and S.S. and M.S.F. will produce only S.S., which will be distributed to seed growers in the area.

Facilities of the C.S.F. will include a laboratory, training center and a cold storage for the F.S. and S.S. produced.

Shown in the following table are the location and over-all field conditions of each seed farm to be established under the Project and the area in hectares required for seed production.

Table 4-9 Present Situation and Required Area for Seed Farms

PROVINCE	NO.	TYPE OF SEED FARM	LOCATION		FIELD CONDITION		FARM SITE (ha)					ACREAGE REQUIRED FOR SEED PLANT (ha)	REMARKS
			NAME	DISTRICT	TYPE	CROPPING	ARABLE	YARD	WASTE	ARABLE	TOTAL		
ACEH	2	C.S.F.	Keumala	Pidie	Lowland	Double	6.9	2.9	15.2	-	25.0	*19.0	L.=10.43, U.=8.55 (S.S.=17.8, F.S.=1.18)
		M.S.F.	Tangan-Tangan	A.Selatan	Lowland	Single	9.6	1.9	-	-	11.5	8.3	L.S.S.=3.2 U.S.S.=5.1
SOUTH SUMATERA	5	C.S.F.	Upang	Muba	Tidal	Single	20.7	1.7	-	-	22.4	4.7	S.S.=4.6 F.S.=0.14
		C.S.F.	Belitang	O.K.U.	Lowland	Single	11.4	4.2	-	0.1	15.7	7.9	L.=5.31, U.=2.6 (S.S.=5.1, F.S.=2.81)
		M.S.F.	Betung	Muba	Upland	Single	28.9	2.1	-	-	31.0	21.0	U.S.S.=21.0
		M.S.F.	ADC Lahat	Lahat	Upland	Single	20.0	4.0	1.0	-	25.0	18.0	U.S.S.=18.0
		M.S.F.	Tugumulyo	Mura	Lowland	Single	8.4	1.1	-	-	9.5	3.3	L.S.S.=3.3
LAMPUNG	3	C.S.F.	Way Jepara	L.Tengah	Lowland	Double	8.1	2.0	-	-	10.1	*16.0	L.S.S.=3.7 U.S.S.=9.7 U.+L.F.S.=2.61
		M.S.F.	Metro	L.Tengah	Lowland	Double	11.5	2.5	-	-	14.0	*22.3	U.S.S.=14.3 L.S.S.=8.0
		M.S.F.	Tanjungiman	L.Tengah	Upland	Single	11.1	0.4	-	0.6	12.1	11.0	U.S.S.=11.0

C.S.F. = Central Seed Farm

M.S.F. = Main Seed Farm

* = Extended Cultivation Acreage
L. = Lowland
U. = Upland
S.S. = Stock Seed
F.S. = Foundation Seed

(2) Natural Conditions

1) Aceh Province

a) Keumala C.S.F.

The farm is located on the side of Malacca strait in Aceh Province

Keumala Village experiences a marine tropical climate with an average maximum temperature of 32° C and an average minimum temperature of 21° C. Since the temperature change between months is quite small, the difference between the annual mean temperature and the monthly mean temperature is 1° C at the maximum. Annual rainfall is 1,300 mm which is the least amount in Aceh Province. The humidity varies from 74% to 80%.

The soil developed from alluvial soil and is abundant in peat where drainage is poor.

At present the seed farm is operating on a total area of 9.8 ha of which 6.9 ha is arable land and 2.9 ha is occupied by buildings, etc. The absolute total amount of land required for seed production under the Project, however, is 9.5 ha (double cropped) resulting in the requirement of an additional 2.6 ha. Therefore, it is necessary to open unreclamated land at the site as farm land to supplement the required land.

Natural conditions are very favorable, the topography is flat and supply of irrigation water is from a nearby stream. The water is abundant in volume.

The existing farm is gravity irrigated and as such is effected by both flooding and shortage of water. Headworks construction and improvement of the main channel from the intake to the field will be necessary. Also, planning of farm roads and drainage and irrigation channels within the farm area will be fundamental.

b) Tangan Tangan H.S.F.

Tangan Tangan H.S.F. is located at Tangan Tangan Village, South Aceh District, along the south coast of Aceh Province.

The climate is marine tropical with an average maximum temperature of 32° C, an average minimum temperature of 21° C and an average mean temperature of 27° C. Rainfall in the area is a considerably high 2,800 mm per annum. Humidity fluctuates between 76% and 82%.

The soil developed from alluvial soil and in the field there is much sandy clay soil.

At present the farm covers a total area of 9.6 ha including rice fields, cultivated land and uncultivated land which is more than sufficient to meet the required area of 8.3 ha necessary for future seed production.

Natural conditions are quite good, there is a natural stream nearby which can supply irrigation water needs and the topography is flat which makes it suitable for a rice seed production farm. However, planning of drainage and irrigation channels and farm roads inside the farm area will be indispensable. The survey of irrigation water showed that although, enough water is available during the rainy season, the amount of water available during the dry season is insufficient, therefore, only single cropping is practical.

2) South Sumatera Province

a) Upang C.S.F.

The farm is located 65 km from Palembang City, Muba District between the Musi River and the Upang River. The entire region is affected by tidal changes and transportation is by means of 10-20 ton boats navigating along rivers or canals.

The climate is marine tropical and the annual mean temperature is 26.4° C and the difference between the annual mean temperature and the monthly mean temperature is about 1.5° C. The annual rainfall is 2,300 mm and the range in humidity is from 83% to 87% which is rather high.

The soil developed from alluvial soil with an abundance of heavy clay soil which results in poor drainage.

At present the farm operations consist of 13.5 ha of rice fields, 7.2 ha of coconut and 1.7 ha for buildings giving a total of 22.4 ha. This is more than sufficient for the 4.7 ha required for future rice seed production.

Since the field is located in a tidal region irrigation is carried out at high tide using gravity irrigation. In other words, during the rainy season when stream water is abundant the influence of the tide causes the water level of the stream to rise above the level of the field allowing water to flow into the field. However, in the dry se son when the quantity of stream water is scant, water stops flowing into the field and as sea water comes inland, damage from salt water also occurs. Consequently, in tidal regions single cropping will be carried out in the rainy season only and crops which are highly resistant to the effects of salt will be planted in the dry season.

Although the field is flat, drainage is very poor and planning of drainage and irrigation channels and farm roads will be required.

b) Belitang C.S.F.

The farm is located at Gumawang Village, O.K.U. District in southern South Sumatera Province which is a rice field region included in the Belitang Extension Area Agricultural Development Project.

The climate is marine tropical with an average maximum temperature of 32° C and an average minimum temperature of 22° C giving an average mean temperature of 27° C. There is no change in monthly temperatures so the difference between average annual mean temperature and the monthly mean temperature is 1° C. The annual rainfall is within 2,600 mm and humidity ranges from 70% to 85%.

The soil developed from alluvial soil and there is much sandy clay soil.

At present, the seed farm operates on a total of 15.7 ha including 11.4 ha of rice fields and 4.3 ha occupied by infrastructures. This is more than sufficient for the 7.9 ha required for future seed production.

As the farm is located within the Project the natural conditions are very good, irrigation water is supplied directly from the Ministry of Public Works number one canal making double cropping achievable. However, in one section of the farm levelling is insufficient resulting in poor drainage. Planning of drainage and irrigation channels and farm roads will be essential for the complete improvement of the farm.

c) Betung H.S.F.

The farm is located 125 km by road to the Northwest of Palembang City in a hilly region near Betung Village, Muba District.

The climate is marine tropical and the average maximum temperature is 32.4° C, the average minimum temperature is 22.6° C giving an mean temperature of 26.8° C. Since there is no variation in monthly temperatures, the difference between the annual mean temperature and monthly mean temperature is less than 1° C. The amount of precipitation per annum is quite high at approximately 3,000 mm.

In the dry season from May to August rainfall is within 600 mm and in the remaining months it is from 200 mm to 400 mm per month. Humidity is also rather high ranging from 81% to 86%.

The soil which is red-yellow podosolic, is easily eroded and lacking in organic matter and plant nutrients. In general, the soil exhibits a reddish brown color and in heavy clay.

At present, the seed farm consists of 2.2 ha of upland rice, 26.7 ha of pasture land and 2.1 ha of building space making a total of 31 ha under operation ensuring that the 21 ha area required for seed production is available.

In consideration of the fact that the farm is located in a hilly region there is considerable undulation and places where the gradient exceeds 10% extend over a 10 ha area. Also, as soil erosion occurs in the farming area improvements and countermeasures will be necessary for erosion control.

d) ADC Lahat M.S.F.

The farm is located halfway up the Babisan Mountain Range at Tanjungtebat Village, Lahat District which is in the southwestern part of South Sumatera Province. In view of the fact that the elevation is approximately 420 m, coffee, tea, etc. are being cultivated.

The climate is marine tropical with an average maximum temperature of 30.7° C, an average minimum temperature of 20° C and an average mean temperature of 24.6° C which indicates lower temperatures at higher elevations. Inasmuch as the monthly temperature shows little change, the difference between annual mean temperature and the monthly mean temperature is only 0.5° C. Annual precipitation is within 2,400 mm and rainfall in the dry season is 135 mm per month and in the rainy season it is 240 mm per month. Humidity ranges from 78% to 85%.

The soil is andosolic formed from volcanic matter and is applicable to field cultivation.

The area which is intended for the seed farm is long and narrow, approximately 80 meters at its widest point, and lies alongside a road in a north-south direction. There have been eight buildings constructed up to the present. The farm is scheduled to be constructed on 8.5 ha of land which was a comparatively gentle slope that at present is covered with woods. In order to obtain the 18 ha required for future seed production, the coffee field on the opposite side of the road will have to be included.

Natural conditions are favorable. As the soil is fertile the land should function well as a seed farm after consolidation of the gentle slope.

e) Tugumulyo M.S.F.

The farm is located in a rice growing region at Tugumulyo Village, Mura District in west South Sumatera Province.

The climate is marine tropical with an average maximum temperature of 30.6° C, an average minimum temperature of 22.7° C and an average mean temperature of 26° C. The area receives a rather large amount of precipitation which is within 3,400 mm per year. Humidity is a rather high 81% - 95%.

The soil is sandy clay originating from alluvium.

At present the proposed site is called Tugumulyo Seed Farm (Balai Benih Tani Mulyo) and operates on a total of 9.5 ha of which 8.4 ha are for cultivation of wet-land rice and 1.1 ha are for building space. This covers more than the 3.3 ha necessary for future rice seed production.

Natural conditions are good, irrigation water will be supplied from the Ministry of Public Works number one canal making double cropping practical. However, as drainage canals and farm roads are insufficient it will be necessary to improve and supplement them.

3) Lampung Province

a) Way Jepara C.S.F.

The farm is located in a rice growing region on the western side of Lampung Tengah District, Lampung Province.

The climate is marine tropical with an average mean temperature of 26.5° C, rainfall from 2,000 to 2,500 mm and a high range in humidity between 82% to 87%.

The soil originated from alluvium and where drainage is poor there is an abundance of peat.

At present the seed farm is operating on a total of 10.1 ha which includes 8.1 ha of rice fields and 2 ha for buildings. Seed production in future will require an area of 16 ha which can be satisfied by double cropping.

The natural conditions are favorable. With the supply of irrigation water coming from the Ministry of Civil Works' Way Jepara Irrigation Project's number two canal, double cropping can be achieved. Considering that the place from where water will be taken is located in the lower stream of the number one canal, there is the danger that during the dry season a large amount of water will be taken from the upper stream and not enough water will reach the lower stream, therefore, the control must be carried out within the Project area.

The farm is elongated in shape and has a gentle downward slope in a southwesterly direction. At present drainage channels and farm roads are inadequate and will need to be improved.

b) Metro M.S.F.

The farm is located adjacent to Metro City, Lampung Tengah District in a rice growing region.

The climate is marine tropical, with an annual mean temperature of 27° C, total precipitation of approximately 1,500 to 2,000 mm and humidity ranging from 79% to 85%.

The soil originated from alluvium and there is a lot of sandy clay.

At present the seed farm is operating on a total of 14 ha of which 10.1 ha are for rice production, 1.4 ha for upland crops and 2.5 ha for building space. Future seed production will require an area of 22.3 ha which will be covered by converting the upland crop fields into rice fields and utilizing double cropping.

Natural conditions are good, and supply of irrigation water is from the irrigation canal constructed by F.A.O. that cuts across the farm between the fields and the farm buildings. Double cropping is already being carried out.

Maintenance of the farm is poor and comprehensive improvement will be essential including drainage and irrigation channels and farm roads.

c) Tanjungiman M.S.F.

The farm is located at Tanjungiman Village on the north side of Lampung Tengah District facing the national highway which connects Kotabumi and Tanjungkarang Villages.

The climate is marine tropical with an annual mean temperature of 26.5° C, total precipitation of approximately 2,000 to 2,500 mm and humidity in the range of 78% to 85%.

The soil is latosolic with a limited amount of plant nutrients and is easily eroded.

Although the farm consists of 11.1 ha, only 0.4 ha are being utilized for the cultivation of upland rice. The remaining 10.7 ha are covered with weeds. Therefore, with proper maintenance of the existing 11. ha of land the required area for seed production can be secured.

Natural conditions are favorable as the slope of the land is less than 1% making maintenance quite simple.

(3) Mechanical Facilities

1) Electric Power

In most cases, neither a generator nor an electric power cable is provided at the C.S.F. and M.S.F., excepting C.S.F. located at Belitang in South Sumatera where a power generator is installed for general electric use. However, at the time of our field survey, the generator was found to be out of use due to mechanical faults.

The generator which is installed at C.S.F., Belitang, and provides 200V, 30A and 10 HP in capacities, was used both for supplying power as well as light to the entire C.S.F. premises concerned. When drying of the paddy and the processing operation is not required, i.e. in the off-season, the generator can supply electricity to the local community. During the off-season, the generator can be operated for four hours per day due to the scarcity of state budget funds.

Meanwhile, the electric power supply situation in Lampung is summarized as follows:

A single phase electric cable is facilitated at Metro M.S.F. whose capacity is found to be insufficient when used for power supply. However, at present for this M.S.F. a new diesel engine (three phase) of 11 to 12 H.P. is facilitated for the operation of a circulation type tempering dryer having 3.2 tons in capacity.

No electric light is provided at the premises of C.S.F Way Jepara but two diesel engines were newly installed with a capacity of 5 H.P. (single phase: 220V, 110V). These engines are also being utilized for drying and processing purposes but not for general consumption purposes when it is so required.

In any case, for the abovementioned C.S.F. and M.S.F., minimum capacity of the electrical supply must be maintained for the existing mechanical facilities and it has been observed that there are neither sufficient spare parts nor arrangements for capable maintenence officers, so that in case of mechanical trouble the necessary repairs will not be executed.

For each C.S.F. and M.S.F., sufficient electricty should be supplied in accordance with their processing capacity. For this objective, basically two generators, each being above to generate half of the entire amount of electrical power requirement of the facility shall be installed for its rotative operation together with an adequate maintenance system. Not only these generators but also the necessary spare parts shall be supplied for adequate operation and maintenance.

This kind of pluralization of number of generators having a smaller generationg capacity is advantageous, because they will provide lower running costs for the entire processing operation in each processing facility.

2) Agricultural Field Machinery and Seed Processing Machinery

a) Agricultural Field Machinery

In our observation, the team observed that in each facility, there is neither a work shop nor spare parts available for the existing cultivator, tractor and other agricultural field machinery which are required for the rice seed production and processing activities. To make it worse, because of the lack of the spare parts, this important machinery is somehow being rather wasted or otherwise left idle.

In some facilities, there is no machinery, and even if machinery is provided, there are no spare parts.

Equipment installed in the existing facility are being manufactured by the knockdown process at present in Indonesia. (Refer to ANNEX Table 4-9) Therefore it is necessary that in future an adequate budget shall be allowed for the supply of parts required for the facility concerned (Refer to ANNEX Table 4-10).

A repair work-shop to be facilitated in each facility, and in there, a welding machine, grinder, small size boring machine and other working tools shall be installed for its adequate operation. At the same time, a control system shall be made for spare part maintenance.

A list of the agricultural field machinery now in operation at the relevant facilities is shown in ANNEX Table 4-9. Meanwhile, in ANNEX Table 4-10the newly required number of trucks, sprayer and other implements (No. of trucks, etc.) for each facility is described.

b) Seed Processing Machinery

b-1. Existing Problem

In order to find out the actual condition of the seed processing operation and of its pre and post operations, a sample of 1 kg of seed has been prepared for qualitative analysis at each jobsite.

These obtained samples have been brought to Pasar Minggu in Jakarta for the required analyses of which results are as shown in ANNEX Table 4-11-(1) & (2). Moreover, for the seed in storage, in accordance with its storage condition, relevant temperature was noted at the time of sampling.

① Seed Drying Test
(Characteristics of the test seed; Sample No. 5 and 6.)

1) The stalk of the paddy which has been harvested at a length of 50 cm to 75 cm from the panicle is shown in ANNEX Fig. 4-1 (1). These stalks of paddy are piled up in

a small shed build in the paddy field, this being the traditional way of storage and drying.

ii) As shown in ANNEX Fig. 4-2 (2), threshing paddy is done by farmers stamping on it, then the straw and bigger size admixtures are removed by hand. Paddy thus prepared, is spread over a mattress, which is made of coconut leaves, for sun drying. Thickness of the spread paddy on the mattress has been measured at nearly 10mm to 15mm.

iii) After two hours drying, winnowing is conducted twice using a winnow. (Refer to ANNEX Fig. 4-2(3).

For the above survey and test, the following testing instruments have been employed:

a. Atmospheric Temperature: Dry & Wet Buld Thermometer

b. Grain Temperature: Digital Thermister Thermometer

c. Moisture of Paddy: Resistance Type Moisture Meter

Test Results and Consideration:

In general, the harvested stalk of paddy is piled up and dried in the shade for about a week and moisture content of the paddy at the time of threshing has been observed at 16.53%.

In testing, after one hour drying, a cloudy sky was observed for about 10 minutes. After two hours of the drying operation (commence drying: 08:55 hrs and completion test: 10:55 hrs.), and with the moisture content duly measured, the team obtained 13.20% of M.C.

Both initial and final moisture contents as shown in the above are based on the average figures respectively, taken from the samples used for the test. (Refer to ANNEX Fig. 4-3)

During the two hours moisture content testing, the temperature of the paddy rose to 52.8°C. Speed of drying is found to be 1.7% hr as a result.

The above test was conducted on a mattress, but on a concrete-made drying bed, assuming that within two to four hours drying, the temperature of the paddy will definitely reach 55°C.

The fact that damage may occur to the germination of the paddy due to the high temperature is quite obvious.

In general, in sun drying, direct sunshine should be avoided.

It is also noted that, for the No. 5 testing; a sample without winnowing preparation is used, while the carefully winnowed sample is presented for the No. 6 testing.

② Results of the Structural Analysis of the Paddy

Results obtained from S.P.C., Sukamandi indicate that for the seed processing, the most important factor is a separation of immature paddy from the sound rice seeds.

This can be achieved by installing a gravity separator, which is designed to separate the impurities and immature seeds from the objective paddy upgrading the traditional seed cleaning and grading system now being employed in Indonesia.

Application of the separator will increase the ratio of clean or good paddy as a seed product.

Some photographs in ANNEX Fig. 4-4 (1) and (2) indicate procedure of the analysis made on the representative samples.

Meanwhile ANNEX Fig. 4-5 indicates the principle of the separator to be installed.

③ Results of the Germination Test of Rice Seed

In accordance with the International Testing Method the test was conducted at the laboratory of Pasar Minggu.

In Belitang, samples of various types of rice seed were collected from respective storage places. These were found to be the product of 1979.

In other places also, various types of raw paddy have been collected and dried accordingly to make samples.

The effects of the storage on the decrease of the germination rate of the seed are quite remarkable after one year storage of the seed, and then after three years storage in normal condition, the rate will be reduced to almost nil condition.

Due to the scarcity of samples, a comparative test on the differences in germination rate in relation to the different methods of preparation have not been made.

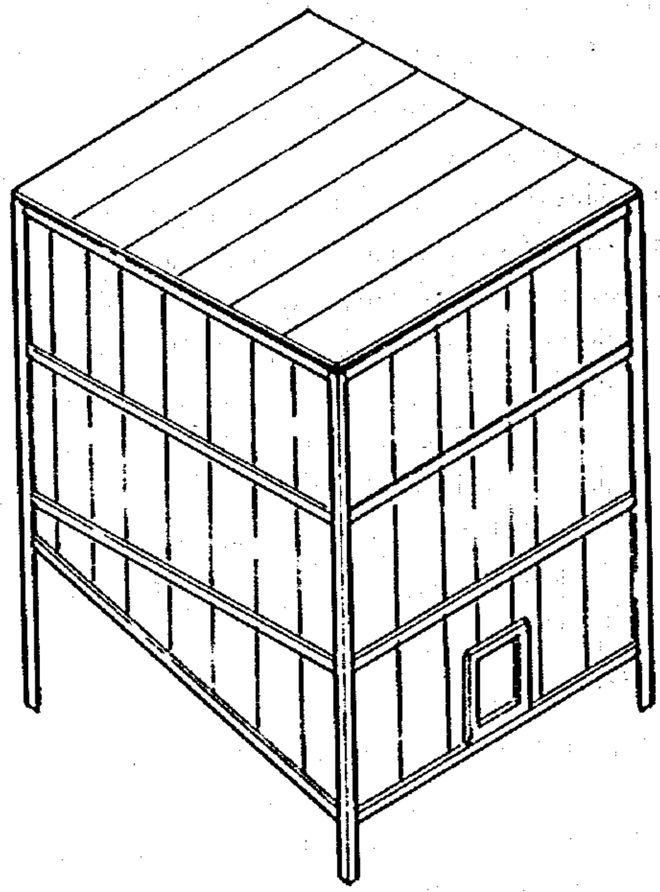
Therefore, it is recommended that in future, the government of Indonesia should conduct this kind of research work at the laboratory concerned, considering the maximum temperature, involved in the processing, the effects which may arise in mechanical threshing, especially that of impact, and the relation to the germination rate due to the revolution of the cylinders of the threshing machines. ANNEX Table 4-12 (1) & (2) shows the results of germination and other tests performed at Belitang on the samples of S.S. produced at expermient station and the samples obtained from seed dealers.

④ Storage Condition

Presently, at C.S.F. and M.S.F. timber silos having 1 to 2.5 tons capacity and gunny bags are used. (Refer to Fig. 4-2) The timer silo is usually lined with tin-plate or sheet having a 0.2mm to 0.3mm thickness. Temperature of the stored seed measured ±27°C and in the case of seed which had been in long term storage, insect damage, caused by a grain weevil, was found.

The silo storage system is suitable for the C.S.F. and M.S.F. facilities and considered to be efficient. By application of fumigation with phostoxin, weevil damage can be avoided to some extent.

Fig. 4 - 2 Typical Timber Silo



b-2. Seed processing machinery and equipment arranged for each C.S.F. and M.S.F. are as shown in ANNEX Table 4-9.

b-3. Processing for F.S. and S.S.

Regarding the facilitation of the threshing machine, a traditional pedal thresher is more highly recommended than an enginedriven threshing machine, as there are fewer risks involved in its operation.

In case, the engine drive is employed, the number of revolutions should be minimized.

There is no objection even though the tempering dryer which is installed in the existing facility be utilized for the mass production of the seed, when the varieties are duly specified. However it is necessary to operate the dryer by observing the temperature of the heated air in accordance with the operational instruction.

The results of the structural analysis of the seed show that there is contamination of the off type varieties found in the processing facilities in some C.S.F. and M;S.F. concerned. In this respect, a static type dryer should be installed in accordance with the specified varieties.

At present, there are several kind of distinctive varieties which are under process. Accordingly, for the processing of the varieties other than thé distinctive varieties as mentioned above, three to four units of the static type dryer each having 1-2 ton capacity shall be facilitated in the seed farm.

In detail, the processing line should consist of an aspirator with a 1 ton/h capacity, precleaner with scalper sieve assembled, width and length grader, and gravity separator.

In addition, the precleaner should have ample flow capacity to meet the processing capacity of the relevant dryer when the seed is fed in.

The basic design is shown in ANNEX Drawing SPU-001.

For the existing facility, provided it is available for actual processing, operation should be executed in consideration of the variety for which a designation is necessary.

As for the cold storage to be installed in each C.S.F., is should have minimum volume (Refer to Table 4-10), therefore, it is desireable that the prefabricated cold storage place equipped with a cleaning unit is installed in the premises.

The cooling capacity shall be 2,400 Kcal/hr to maintain the storage place equiped with a cleaning unit is installed in the premises.

The cooling capacity shall be 2,400 Kcal/hr to maintain the storage temperature below 15°C.

The dimension of the storage place scheduled for 4 C.S.F.s is shown in Table 4 - 10.

Table 4-10

C.S.F.	Dimension of Cold Storage
Keumala	1.8 m x 3.6 m x 2.6 m (h)
Upang	1.8 m x 3.6 m x 2.6 m (h)
Belitang	1.8 m x 4.5 m x 2.6 m (h)
Way Jepara	1.8 m x 4.5 m x 2.6 m (h)

Regarding supply of electricity, at least two (2) units of generators each having 20 KVA in capacity shall be installed to supply electricity for seed processing facility as well as livelihood use.

Namely, one generator having 20 KVA to be installed for the workshop and the seed processing facility while the other one having 15 KVA to be installed for the office and general livelihood purposes.

For analysis, research and control of F.S. and S.S. produced in each C.S.F. and M.S.F., adequate testing equipments are installed. The detail of these equipments are shown in ANNEX Table 4-29.

(4) Buildings and related facilities

1) Site for Construction

C.S.F. and M.S.F. already have their own buildings and related facilities. These buildings and facilities consist of administration office, seed store, machinery rooms, storage and staff house, etc. made of brick or concrete block.

Existing facilities are water tank, shallow well, pump, sanitary equipment, generator, light and kitchen facilities.

Detailed data are shown in ANNEX Table 4-13 (1)~(12).

2) Building plan

Seed production farm shall be divided into M.S.F. and C.S.F.

At the M.S.F., extra staff houses shall be newly constructed because of no room for the further stage is available.

And at the C.S.F., training center, guest house and seed processing unit shall be newly constructed.

The structure of these buildings can be constructed of wood, brick, concrete block, steel skeleton construction and the size of buildings in the farm are not large; width of entrance: from 6m to 10m height of ceiling: from 3m to 5m floor space: from $36m^2$ to $300m^2$. There is no difficulty in constructing these buildings.

These buildings shall be made of wood, brick or concrete block because of lower costs.

Regarding the foundation of these types of buildings, load of foundation is very small, so it is not necessary to use concrete piles, etc.

Detailed data of buildings are shown in ANNEX Table 4-13 (1) ~ (12).

3) Equipment

The Indonesia Government, Financial Bureau of the Ministry of Finance, has criteria for staff housing shown below;

Grade	Area (m^2)	Floor space (m^2)	Facilities
Senior Staff	200	70	Local toilet, water tank Electricity 110V, 10A
Middle rank Staff	120	50	Local toilet, water tank Electricity 110V, 10A
Junior Staff	100	36	Public toilet & water tank Electricity 110V, 10A

Regarding the Water Supply System, resources are 7m deep wells and water is lift up to the head tank by hand pump.

Concerning drainage systems, 2 ϕ 150m/m concrete pipe is applied to carry sewage from each house to a septic tank whose location should be far from Wells.

Electricity for common use shall be generated at the main building; Single unit 110V, Average 6ϕ m/m.

Detailed data are shown in the ANNEX Table 4-13 (1) ~ (12).

(5) Field and Water Utilization Plan

1) Rice Field

The following plan is to be carried out for rice fields:

i) complete separation of drainage and irrigation channels and their improvement
ii) improvement of established water source or development of new water source
iii) improvement of farm roads or construction of new roads
iv) land readjustment
v) other relevant matters

a. Water Management Plan

a.-1. Irrigation Water Amount

Included in net irrigation water requirement is consumption amount (evaporation dispersement amount), permeation amount, effective rainfall amount, rice field preparation amount, etc. These can be classified into three main periods, rice field preparation period, rice planting period and the normal period. Further, the peak water requirement period will usually be during the rice planting period.

In Indonesia, in order to reduce the amount of water utilized during peak periods, a water regulation system named the Gorongan System (rotation system) is generally being carried out. However, since the rice seed farms are less than 10 ha it is more efficient to prepare the rice fields over a short period of time. Should the Gorongan system be introduced, a lack of irrigation water could possibly be produced during fertilization, plant spraying, etc., therefore, it has been decided that the rice seed farms will not introduce the Gorongan system.

Normally one cropping of rice will require a total of 1,000mm-1,200mm of irrigation water and the peak irrigation water requirement is said to be approximately 1.2 to 1.4 ℓ/sec./ha. This can be divided into the peak water requirement of 1.0 to 1.4 ℓ/sec./ha. during the rice planting period, the 0.3 times as it during the rice field preparation period and the 0.7 times as it during the normal period. Water loss is included in these requirements.

However, these values are extremely small and are meant for large area irrigation schemes. After consideration of the standard of farm consolidation of the rice seed farms and consultations with experts of the Ministry of Public Works Irrigation Department the following water requirements were decided upon:

Rice planting period	-	rainy season crop	135 mm/day
		dry season crop	75 mm/day
Normal period	-	25 mm/day	

Accoringly, water loss was set at 15%, total water requirements per hectare are as follows:

Rice planting period water requirement (rainy season crop)

$$q^1 = \frac{135(mm/day)}{86,400(sec.)} \times \frac{1}{0.85} \times 1 \times 10^4 = 18.4 \ \ell/sec.ha$$

Rice planting period water requirement (dry season crop)

$$q^1 = \frac{75(mm/day)}{86,400(sec.)} \times \frac{1}{0.85} \times 1 \times 10^4 = 10.2 \ \ell/sec.ha$$

Normal period water requirement

$$q^2 = \frac{25(mm/day)}{86,400} \times \frac{1}{0.85} \times 1 \times 10^4 = 3.4 \ \ell/sec.ha$$

By carrying out preparation of rice fields for planting on a daily equal area basis, the peak water requirement will fall on the last day and is shown in the equation below:

$$Q = q^1 \times \frac{A}{\eta} + q^2 \times \frac{\eta - 1}{\eta} \times A$$

where Q = peak water requirement (ℓ/sec.)

q^1 = rice planting period water requirement (ℓ/sec./ha) q^1 = 18.4 ℓ/sec./ha

q^2 = normal period water requirement (ℓ/sec./ha) q^2 = 3.4 ℓ/sec./ha

A = area (ha)

η = number of days for field preparation and rice planting (days)

The number of days for field preparation will depend on the conditions prevailing, type of machinery applied, etc., but usually will be done in three days. The following table shows the peak water requirement of each farm. The areas listed are the number of hectares required for rice seed production.

Table 4-11 Rice field peak water requirement

Farm name	Area(A) (ha)	Peak water requirement (Q) (ℓ/sec.)	Province
Keumala	9.5	79.8	Aceh
Tangan-Tangan	8.3	69.7	"
Upang	4.7	39.5	South Sumatera
Belitang	7.9	66.4	"
Tugumulyo	3.3	27.7	"
Way Jepara	8.0	67.2	Lampung
Metro	11.2	94.1	"

a.-2. Plan of Diversion Facilities

Present conditions of diversion facilities and the plan for their alternation to meet rice seed farm requirements are shown in Table 4-12

The plan calls for construction of one diversion weir, one pumping facility and improvement of five canals.

Table 4-12 Present Conditions and Plan for Diversion Facilities

Province	Type of Seed Farm	Name	Diversion Facilities		Remarks
			Present Condition	Plan	
Aceh	C. S. F.	Keumala	Gravity flow from stream to irrigation canal	Construction of diversion weir and improvement of conveyance canal	
	M. S. F.	Tangan-Tangan	Diversion weir	Improvement of conveyance canal	
South Sumatera	C. S. F.	Upang	Gravity flow at high tide	Construction of pumping facility	
	C. S. F.	Belitang	From ministry of Public Works Main Canal	Improvement of conveyance canal	
	M. S. F.	Tugumulyo	"	"	
Lampung	C. S. F.	Way Jepara	From Ministry of Public Works Number 2 Canal	Improvement of conveyance canal	
	M. S. F.	Metro	From F.A.O. Main Canal	-	Improvement of present condition unnecessary

Note: The plan for keumala C.S.F. was demanded by the provincial.

a.-3. Construction of Irrigation Canals

Taking into consideration the reduction of maintenance, water loss, etc., all irrigation canals shall be concrete lined.

The water flow capacity of the irrigation canals was calculated using the Manning Formula.

$$Q = A.V. \quad \ldots\ldots \quad (m^3/sec.)$$

$$V = \frac{1}{\eta} \cdot R^{2/3} \cdot I^{1/2} \quad \ldots\ldots \quad (m/sec.)$$

Where

Q = discharge $(m^3/sec.)$

A = cross section area (m^2)

V = velocity, (m/sec.)

η = Manning coefficient of roughness

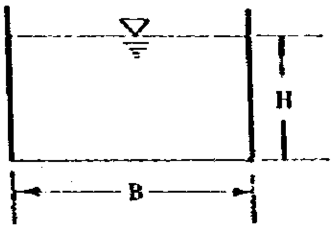
(in the case of concrete, $\eta = 0.015$)

R = hydraulic mean depth (m)

(cross section area/wetted perimeter)

I = slope of water surface (I = 0.001)

Canal cross-sections were divided into the following three types and the results of the calculations are shown in Figure 4-3.



Type a B = 0.30 m

Type b B = 0.40 m

Type c B = 0.50 m

Note: H = depth of water

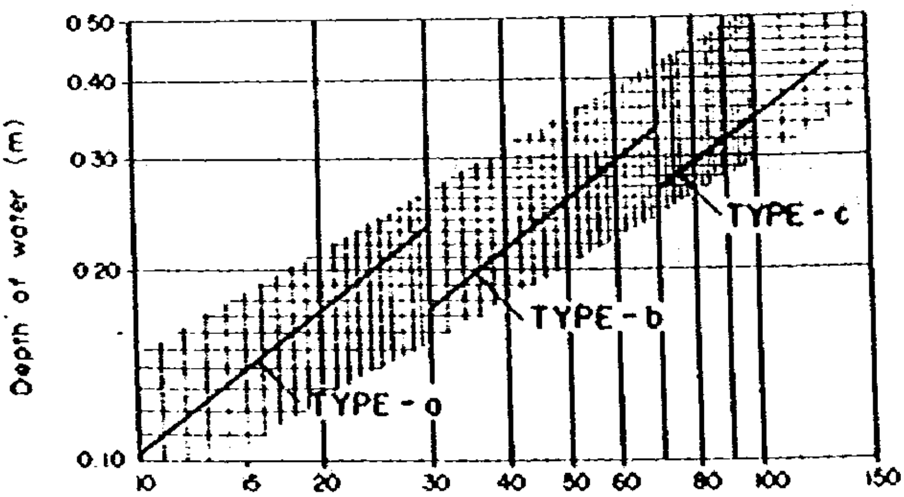


Fig. 4-3 Water discharge (ℓ/sec)

b. Drainage Plan

b.-1. Unit Area Drainage Discharge

Since the creditability of the rainfall data in each province is somewhat questionable, the general numerical value prepared by the Ministry of Public Works was used to decide the rice field unit area drainage discharge which was fixed at 6.0 ℓ/sec./ha with an allowable flooding depth of 20 cm.

b.-2. Determination of Drainage Discharge

The drainage discharge was calculated according to the following formula in order to determine the scale of the drainage facilities:

$$Q = q.A = 6.0 \cdot A \ (\ell/sec.)$$

Where

Q = drainage discharge (ℓ/sec.)
q = unit area drainage discharge (q = 6.0 ℓ/sec./ha)
A = drainage area (ha)

b.-3. Structure of Drainage Canal

As drainage canals will include subsurface drainage, all drainage canals will be unlined. The capacity of drainage canals was calculated using the Manning Formula.

$$Q = A.V. \ \ldots \ (m^3/sec.)$$

$$V = \frac{1}{\eta} \cdot R^{2/3} \cdot I^{1/2} \ \ldots \ (m/sec.)$$

Where

Q = discharge (m^3 /sec.)

A = cross sectional area (m^2)

V = velocity (m/sec.)

η = Manning coefficient of roughness

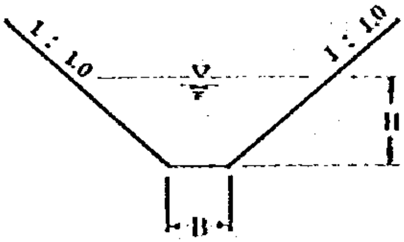
(η= 0.035 for unlined canals)

R = hydraulic mean depth

(cross sectional area/wetted depth)

I = slope of water surface (i = 0.001)

Canal cross sections were separated into three types and results of calculations are shown in Fig. 4-4.



Type A B = 0.30 M

Tupe B B = 0.40 M

Type C B = 0.50 M

Note: H = depth of water

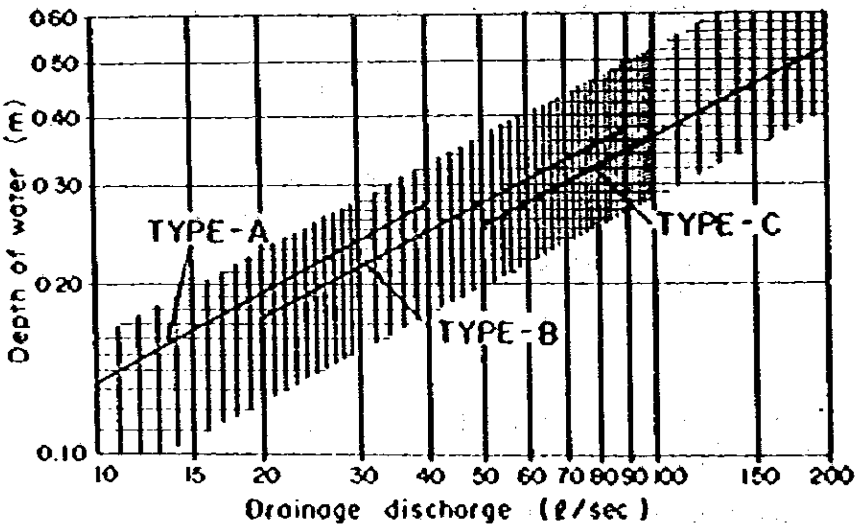


Fig. 4-4 Discharge and Water Depth of each Drainage Canal Type

C. Field Plan

Concerning the basis for deciding the shape and size of each field:

1. type of machinery, efficiency operation and other engineering conditions.

ii. topographic slope, type of soil and other physical land conditions and

iii. hydraulic conditions of drainage and irrigation operations including bearing capacity.

Among others should be examined.

c-1. Relationship to Efficiency of Machinery Operations

The shape and size of each field will greatly influence the efficiency of tractor operations such as plowing, soil preparation, soil breaking, planting, fertilization, weeding and disease and pest protection.

Therefore, in deciding the field size and shape, important farm operations must be examined. In general, the larger the field area, and the longer the shape, the higher the efficiency of farm machinery.

Since the rice seed farms are scheduled to use 15 HP tractors, an examination of tractor operation efficiency shall be carried out. This relationship is explained in the figure below.
In general, in order to raise the operations efficiency for small and medium-sized tractors above 70%, the required cultivated area should be 0.14 ha or more.

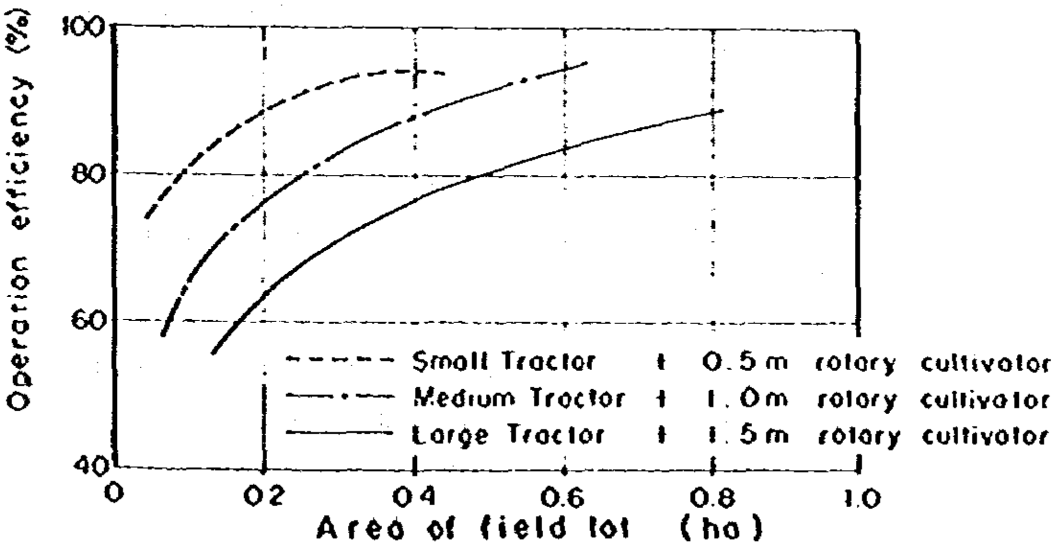


Fig. 4-5 Relation Between Area of Field lot and Operation Efficiency

c-2. Relationship to Topographical Conditions

In General, the length of the cultivated area is parallel to the contour line and the width perpendicular making the cost of land consolidation works economical.

The greater portion of the rice seed farm slopes are less than 1% so that there are no problems or restrictions on the operation of the machinery or of land consolidation works.

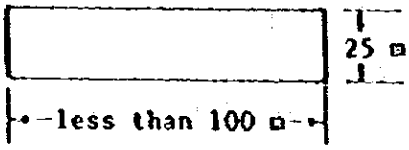
c-3. Relationship to Drainage and Irrigation Canal Operations

During the rice field preparation period, at the time of flooding and after flooding, the machinery operations time and the plowing area have a very deep relationship. These should be carried out within as short a time as possible to increase the efficiency of machinery operations and to reduce the use of precious water.

Also, in order to avoid the groundwater resulting from drainage during machinery operations, it will be necessary to wait for at least two or three days until the groundwater level falls to about 30 cm. In this case, the larger the field area the more days it will take for the groundwater to drain, therefore, it is better to reduce the size as much as possible.

c-4. Determination of Field Size

Although the size of the rice seed farm fields are determined from the number and varieties of seeds i.e. whether they are foundation seed or stock seed, etc., the basic area will be from 0.2 to 0.25 ha. The width of each field is 25 m and the length will be less than 100 m in accordance with the land consolidation standard of Indonesia.

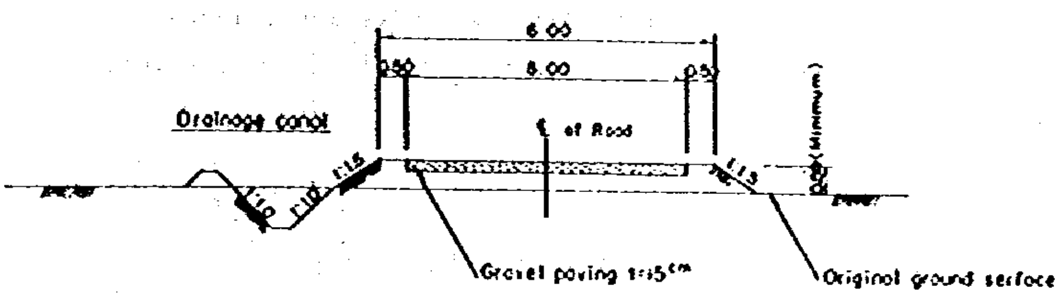


d. Road

d.-1. Truck Farm Road

This is an access road from the public road to the buildings on the farm. It is used for transportaion of materials to the farm, such as manure and agricultural chemicals, and transportation of crops from the farm. The structure of the road is shown below:

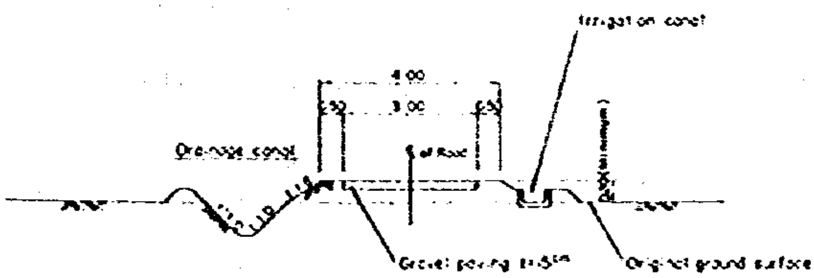
TYPICAL SECTION OF TRUNK FARM ROAD
SCALE 1:100



d.-2. Branch Farm Road

The branch farm road connects each field lot to the trunk farm road. It is used for agricultural works, such as transportation of farm implements, manure and crops.
The structure of the road is shown below:

TYPICAL SECTION OF BRANCH FARM ROAD
SCALE 1:100



d.-3. Plan for Bridges

Bridges are necessary to connect the seed farms at Tugumulyo in South Sumatera Province and Metro in Lampung Province to public roads.

Two bridges, whose spans are both 12 meters, will be constructed over the irrigation canals at Tugumulyo Seed Farm. One bridge, having a span of 13 meters, will be constructed over the irrigation canals at Metro Seed Farm.

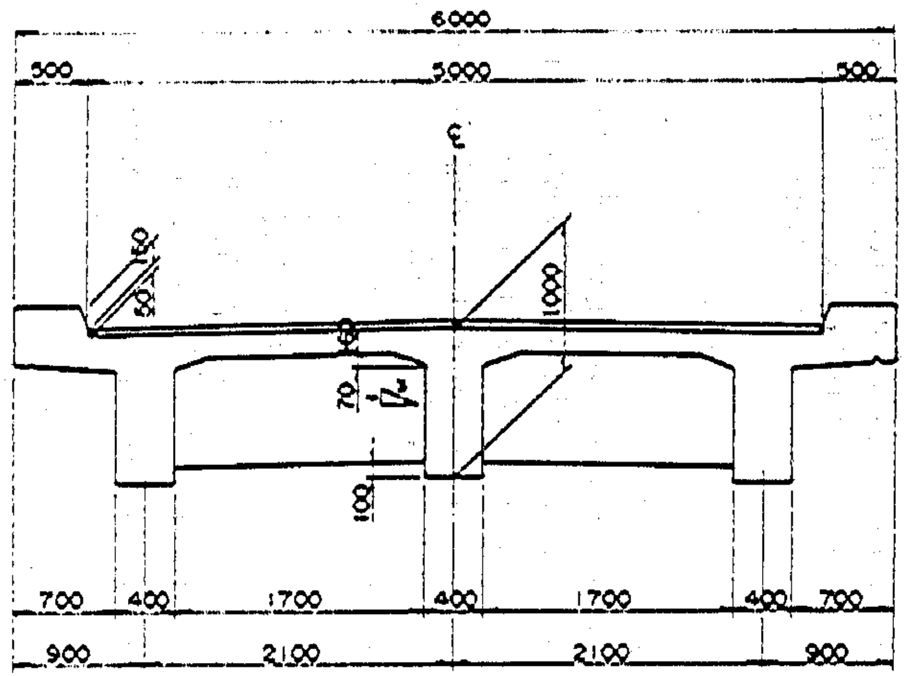
Since the spans of the bridges are quite long, T-beam bridges will be used because it is possible to construct them at the sites.

Design Conditions

1.	Classification	:	Road bridge
2.	Type	:	T-beam bridge
3.	Effective Width	:	5.00 m
4.	Curb	:	0.50 x 2
5.	Active Load	:	TL-14 (2nd class bridge)
6.	Pavement	:	50 mm bitumen or concrete
7.	Cross Fall	:	2%
8.	Skew Angle	:	90° (right bridge)
9.	Span	:	12.00 m
10.	Beam Length	:	12.60 m
11.	Bridge Length	:	12.65 m (Ex-Joint 0.025 x 2)
12.	Allowable Stress of Materials	:	1) Compressive Strength of Concrete ck = 240 kg/cm^2 2) Allowable Bending Stress of Concrete ca = 80 kg/cm^2 3) Reinforcing Bar (SR 24) sa = 2,400 kg/cm^2

CASE - 1

Span 12.00 m



SECTION OF T-BEAM BRIDGE

1) Cross beams must be arranged at the center of the main beam and at the fulcrums.
   Thickness of cross beam - 20 cm.

2) Common standards state that the height of the main beam should be one twelfth of the span.
   Therefore, ℓ = 12.00 m   h = 1.00 m, ℓ = 13.00 m   h = 1.10 m

(2) Upland

The following works are planned for upland fields:

- Reclamation
- Countermeasure for erosion control
- Improvement and establishment of farm roads
- Establishment of pump irrigation system and wells for the dry season
- Establishment of drainage canals and intercepting drain
- Establishment of fences around the farms
- Other works

a. Irrigation

2.-1. Necessity of Irrigation

Upland rice is commonly cultivated in September and October at the beginning of the rainy season and also in November. Upland rice, in the case of local varieties, matures in 4 - 5 months, and the harvest starts from February for the fast growing type, and finishes by May. Precipitation during this duration is shown in Fig. 4-6-(1)-Fig. 4-6-(6).

Precipitation is around 150 mm at sowing time, and is more than 200 mm from December to March. However, a special feature of the rainfall is that it rains a lot but only for a few days.
The mean rainy days per month from September to April are as follows:

Betung	16 days
ADC Lahat	17 days
Tegineneng	13 days (near to Tanjungiman)

Upland rice needs a steady water supply especially around the time of budding, which will stabilize as well as increase the amount of harvest, therefore, irrigation systems are planned accordingly.

a.-2. Determination of Irrigation Method

The land slope of the upland is generally 1% to 6%, so that a spray irrigation which is not affected by the land slope should be better. There is some concern that spray irrigation may be affected by the wind. However, the wind is negligible at this site and therefore, causes no problem.

Consequently, a sprinkler method of irrigation should be adopted.

a.-3. Irrigation

i. Consumptive Use

The consumptive use of upland rice is generally considered to be 5~8 mm/day. A figure of 6 mm/day has been selected for this study.

ii. Quantity of Water per Irrigation and Interval of Irrigation Application

The quantity of water per irrigation and the interval of irrigation application are determined by the following procedure:

1) Determination of the effective root zone
2) Determination of the moisture extraction pattern
3) Calculation of the available moisture in each soil layer within the effective root zone
4) Calculation of the total readily available moisture (TRAM)

5) Determination of the quantity of water per irrigation and the interval of irrigation application

Followings are explanation of the above procedure.

1) Depth of Effective Root Zone

The depth of the effective root zone was based on the field survey and data collected on root zones, and was determined as 40 cm.

2) Moisture Extraction Pattern

Consumptive use caused by evapotranspiration varies depending on the depth of the soil. This consumptive rate of soil moisture is the so-called "moisture extraction pattern" which was determined based upon the results of the field investigation.

Due to the lack of such data, the following pattern was applied:

Percentage of Root Depth (%)	Ratio of Moisture Extraction (%)
0 - 25	40
25 - 50	30
50 - 75	20
75 -100	10

3) Available Moisture in Each soil Layer within the Effective Root Zone

Available moisture (A.M.) is obtained from the following equation:

$$A.M. = \frac{(Fc - Wp)\ H}{100}$$

Where:

FC : Water holding capacity (%)

Wp : Moisture ratio at first wilting point (%)

H : Depth of soil layer (mm)

4) Total Readily Available Moisture (TRAM)

Consumptive use based on water consumption of each soil layer (mm) concerned

$$= \frac{\text{Available Moisture (mm)}}{\text{Ratio of Moisture Extraction (\%)}} \times 100$$

After obtaining the consumptive use based on the water consumption of each soil layer according to the above equation, the layer which presents the minimum value is determined as the restricting layer of moisture. This value becomes the total readily available moisture (TRAM) which is the net amount of water to be replaced.

Table 4-13 Computation of Available Moisture

Root Zone	Depth of Zone (cm)	Field Capacity (F.C.)	Wilting Point (W.P.)	Available Moisture (A.M.) (Weight %)	Apparent Specific Gravity	Available Moisture (A.M.) (Volume %)
layer 1st	0 - 10	24.0	12.0	12.0	1.14	13.7
2nd	10 - 20	30.0	14.0	16.0	1.25	20.0
3rd	20 - 30	27.0	13.0	14.0	1.31	18.3
4th	30 - 40	29.0	14.0	15.0	1.28	19.2

Note: Data are adopted from standard soil values.

Table 4-14 Computation of Total Readily Available Moisture (T.R.A.M.)

Root Zone	Depth of Layer (cm)	Plants Water Absorption Ratio (%)	A.M. (mm)	Consumptive Use which depends on Standard of Each Layer (mm)	Restricting Layer	T.R.A.M. (mm)	Water Consumption of Each Layer after Irrigation (mm)
(layer)							
1st	0 - 10	40	13.7	(13.7/40)x100=34.3	1st	34.3	34.3x(40/100)=13.7
2nd	10 - 20	30	20.0	(20.0/30)x100=66.7			34.3x(30/100)=10.3
3rd	20 - 30	20	18.3	(18.3/20)x100=91.5			34.3x(20/100)=6.9
4th	30 - 40	10	19.2	(19.2/10)x100=192.0			34.3x(10/100)=3.4
Total		100	71.2				34.3

From the results of computation, the net water quantity per irrigation is 34.3 ≒ 34mm and the irrigation interval is 5 days.

$$\text{Irrigation Interval} = \frac{\text{Net water quantity per irrigation (mm)}}{\text{Consumptive use (mm/day)}}$$

$$= \frac{34}{6} = 5.6 \doteqdot 5 \text{ days}$$

Therefore, the net water quantity can be obtained as follows:

Net water quantity per irrigation

= Irrigation Interval x Consumptive use per day

= 5 x 6

= 30 mm

The gross irrigation water is the net water quantity per application divided by the rate of water-application efficiency or in other words the actual amount of water supplied to the field.

The gross quantity of water per irrigation can be obtained from the following formula.

Gross water quantity per irrigation

$$= \frac{\text{Net water quantity per irrigation (mm)}}{\text{Water-application efficiency}}$$

Water-application efficiency is decided by the quantity of field water loss and is obtained from the ratio between net water quantity per irrigation and gross water quantity per irrigation.

The water-application efficiency is set for sprinkler irrigation at the standard value of 85 percent.
Where,

$$\text{Gross water quantity per irrigation} = \frac{30\text{mm}}{0.85} = 35.3\text{mm}$$

iii. Water Requirement Plan

1) Unit Water Requirement

Unit water requirement is obtained as follows:

$$\text{Unit water requirement} = \frac{\text{Consumptive use (mm/day)}}{\text{Irrigation efficiency}}$$

and irrigation efficiency can be obtained as follows:

Irrigation efficiency = Water-application efficiency
x water conveyance efficiency
x water management efficiency

The value of each type of water efficiency is as follows:

Water-application efficiency - 85%
Water-conveyance efficiency - 95%
Water management efficiency - 100%

for the sprinkler irrigation method.

Therefore,

$$\text{Unit water requirement} = \frac{6.0}{(0.85 \times 0.95 \times 1.00)} = 7.5\text{mm/day}$$

(2) Net Water Discharge

The net water discharge which is decided by the scale of the pump facilities and canal facilities is obtained by the formula below:

$$Q = \frac{E}{8.64} \cdot \frac{24}{T} \cdot A$$

where

Q : Water discharge for designing irrigation facilities (ℓ/sec.)

E : Unit water requirement (mm/day) = 7.5mm/day

T : Irrigation hours (hr.) = 12 hrs.

A : Irrigation area

Therefore,

$$Q = \frac{7.5}{8.64} \times \frac{24}{12} \times A$$

$$= 1.736 \cdot A \quad (\ell/sec.)$$

Table 4-15 Water Demand of Each Farm

Seed Farm	Area (h)	Net Water Discharge (ℓ/sec.)	Remarks
Betung	21	36.5	
ADC Lahat	18	31.2	
Tanjungiman	11	19.1	

a.-4. Water Resource Plan

1) Betung M.S.F.

This seed farm shall be irrigated by digging a well near the river situated on the farm's east side and pumping up groundwater. Although the field survey was unable to determine the groundwater level a rough figure of 5m was found and a temporary elevation of -0.5m was set.

In order to investigate the groundwater level and water quantity, a boring survey and pumping-out test must be carried out during the detailed design period.

2) ADC Lahat M.S.F.

On the west side of the seed farm, there is a canal for supplying irrigation water from which water will be pumped for irrigation purposes. Since there is a difference in elevation between the field and the canal of 35m, the elevation of the water source is temporarily set at 75m.

3) Tanjungiman M.S.F.

This seed farm has a high groundwater level and even now there are springs on the west side of the farm.

The water level of the water source is temporarily set at 91m as the water level of the springs is about 93m.

When the detailed design is carried out, a pumping-out test will be necessary to determine water capacity.

a.-5. Design of Irrigation System

1. Sprinkler Type and Setting Interval

There are three types of sprinklers, low pressure, intermediate pressure and high pressure. In the calculation of upland rice, besides irrigation, application of weedicide, insecticide and fertilizer will be carried out. Therefore, a sprinkler system which can cover small lots is preferable.

The intermediate pressure sprinkler is recommended for such multi-purpose uses.

Intermediate Pressure Type Sprinkler

Type	:	Type No. 30
Nozzle Caliber	:	4.0 x 3.2 m/m
Spraying Pressure	:	2.5 kg/cm
Spraying Capacity	:	25.3 ℓ/min.
Diameter	:	26m

Number of shifting per day. 2 times/day

Irrigation Hours	:	6 hrs
Sprinkler Interval	:	0.5 0.7D = 17m
End Pipeline Interval	:	0.5 0.6D = 15m
Irrigation Area	:	A = 17m x 15m = 255m²
Irrigation Intensity	:	$\frac{25.3\ \ell/min. \times 60}{255m^2}$ =6.0mm/hr

ii. Pump Plan for Betung H.S.F.

1) Pumping-out Capacity

25.3 ℓ/min. x (73 + 65)= No.3491.4 ℓ/min.
≑ 3.49m^3/min.

2) Submergible Pump

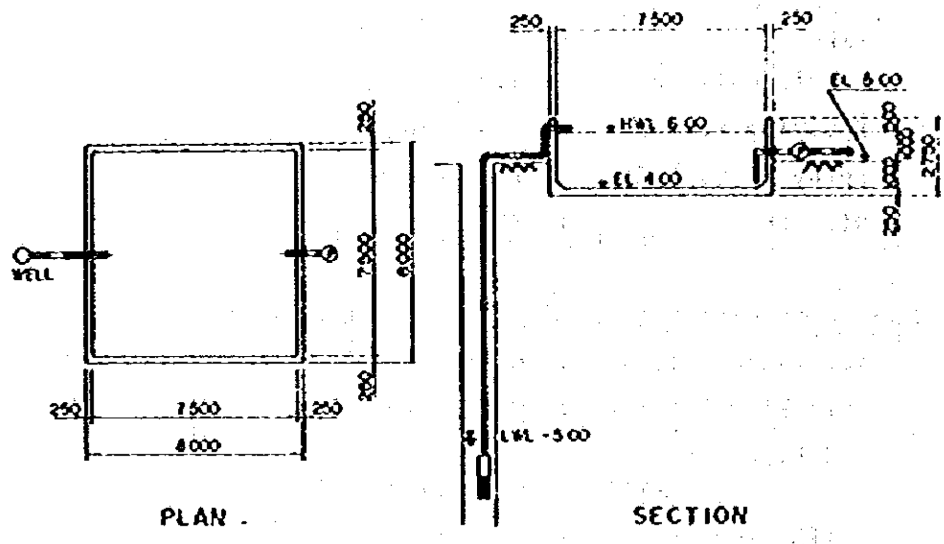
a) Pump Head

Actual Pump Head	Ha = 6.00 -(-5.00)=11.0m
Pump Loss (Pumping-up)	Hb = 3.00m
Total Pump Head	H = Ha+b =14.0m

3) Outlet Water Tank

The water tank volume should be equal to the amount of water pumped in 30 minutes.

where V = 3.49m^3/min. x 30 min. = 104.7
≑ 110m^3



4) Pressure Pump

a) Pump Head

Actual Pump Head	: Ha = 18.50-4.00=14.50m
Main Pipeline Friction Loss	: Hb = 9.93m(Refer to ANNEX Table 4-14(1) & (2))
Main Pipeline Valve Loss	: Hc = 0.99m(")
End Pipeline Loss (Irrigation)	: Hd = 5.45m(Refer to ANNEX Table 4-14-(3))
End Pipeline Valve Valve Loss (Irrigation)	: He = 0.55m(")
Sprinkler Belch Pressure	: Hf = 25.00m
Pump Loss	: Hg = 3.00m
Total Pump Head	: H = Ha~g = 59.42 ≒ 60m

iii. Pump Plan for ADC Lahat Seed Farm

a) Pumping-out Capacity

25.3 ℓ/min. x 84 = 2125 ℓ/min. = 2.125m^3/min.

b) Pump Head

Actual Pump Head	: Ha=123.00-75.00=48.00m
Main Pipeline Friction Loss	: Hb=11.25m(Refer to ANNEX Table 4-15(1))

Main Pipe Valve Loss : Hc=1.13m ("   )

End Pipeline Loss (Irrigation) : Hd=4.99m(Refer to ANNEX Table 4-15(2))

End Pipeline Valve Loss(Irrigation) : He=0.50m("   )

Sprinkler Belch Pressure : Hf = 25.00m

Pump Loss : Hg = 3.00m

Total Pump Head : H = Ha g = 93.87 ≑ 94m

iv. Pump Plan for Tanjungiman Seed Farm

1) Pumping-out Capacity

25.3 ℓ/min. x 65 = 1645 ℓ/min. = 1.65m^3/min.

2) Submergible Pump

a) Pump Head

Actual Pump Head : Ha = 97.2-91.0 = 6.2m

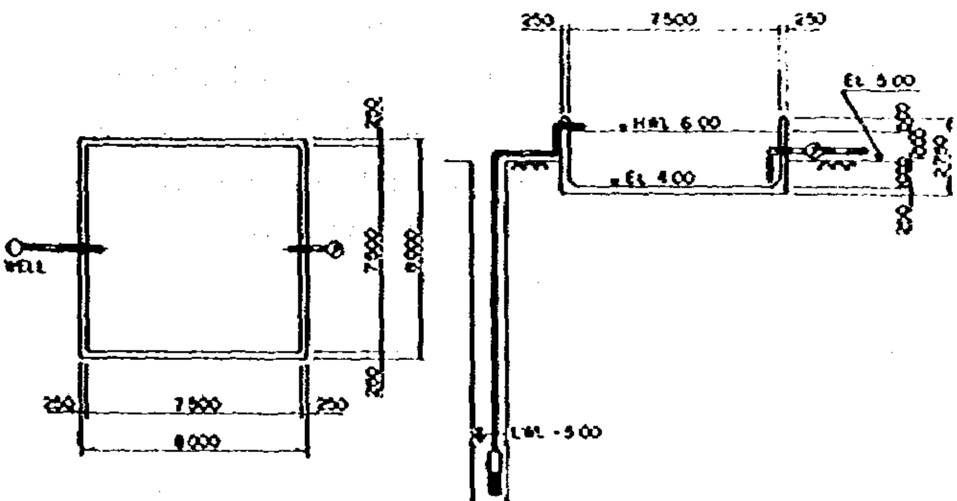
Pump Loss : Hb = 3.0m

Total Pump Head : H = Ha~ b = 9.2 ≑ 10m

3) Outlet Water Tank

The water tank volume should be equal to the amount of water pumped in 30 minutes.

where V = 1.65m^3/min. x 30 min. = 49.5m^3-50m^3



PLAN . SECTION

4) Pressure Pump

a) Pump Head

Actual Pump Head	: Ha=99.0-95.2=3.80m
Main Pipeline Friction Loss	: Hb=7.26m(Refer to ANNEX Table 4-16-(1))
Main Pipeline Valve Loss	: Hc=0.73m(")
End Pipeline Loss (Irrigation)	: Hd=4.83m(Refer to ANNEX Table 4-16-(2))
End Pipeline Valve Loss	: He = 0.48m
Sprinkler Belch Pressure	: Hf = 25.00m
Pump Loss	: Hg = 3.0
Total Pump Head	: H = Ha q = 45.10 ≑ 46m

b. Farm Land Consolidation Plan

b.-1. Determination of Farm Land Slope

For land conservation purposes, the farm land slope should receive special consideration. According to the data of F.A.O., there is a decrease of 50% in soil erosion for a slope of 4-6° and there is an accelerating increase in soil erosion for a slope of more than 12%.

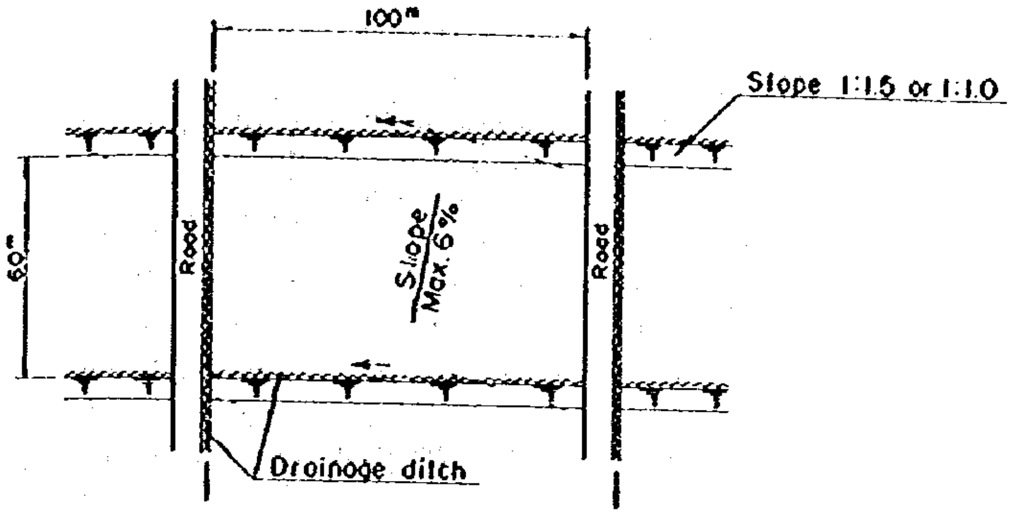
The standard critical slope distances are 92m for a 4-6% slope, 61m for a 8% slope, 24m for a 10% is desired in order to operate farm machinery efficiently and safely.

Consequently, farm land slopes of upland seed farms must be under 6% (angle of inclination 3°26') in order to take land conservation priority into consideration.

b-2. Determination of Field Size

The standard field size is shown below.

PLAN OF UPLAND FIELD



c. Drainage Plan

Drainage discharge of upland rice fields includes only seed farm runoff.

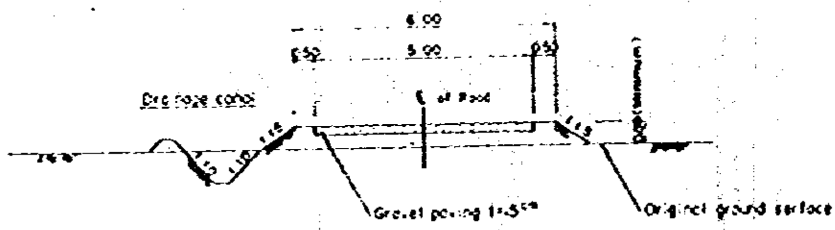
Drainage discharge capacity of the seed farm should be equal to the total rainfall predicted over a 5-year period. The unit drainage discharge of each project is from $0.45m^3$/sec./km^2 to $1.36m^3$/sec./km^2.

The unit drainage discharge is determined to be $1.2m^3$/sec./km^2 (y^2.12.0ℓ/sec./ha).

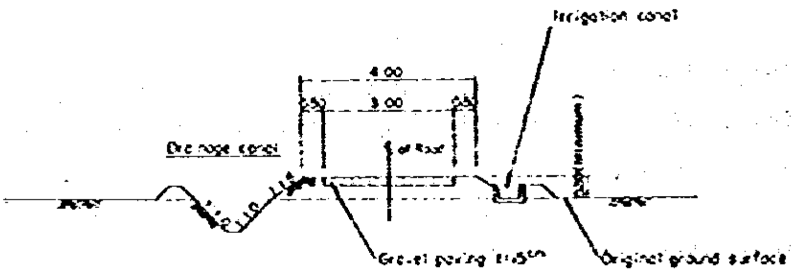
d. Road Plan

The structure of the main and branch roads is the same as in the rice field plan.

TYPICAL SECTION OF TRUNK FARM ROAD
SCALE 1:100



TYPICAL SECTION OF BRANCH FARM ROAD
SCALE 1:100



(6) Staff

Personnel makeup of a C.S.F. or an H.S.F. in Indonesia has already been established. A chief of a seed farm must have more than five years of practical experience and must have graduated from an agricultural high school (SPMA). Other members of the staff also must have finished a course of training equivalent to that of an agricultural high school. A C.S.F. has a staff of one chief, five staff members, and ten workers.

1) Current Conditions

The staff of the Keumala C.S.F., in Aceh, was greatly increased in 1981 to include one chief, three staff members, and eleven workers. Consequently, it was able to produce ten tons of stock seeds and provided S.S. to the field of four hundred hectares for extension seeds. At the Tangan Tangan H.S.F., on the other hand, there are only two workers. In short, this farm is unable to function. For South Sumatera, two central seed farms and three main seed farms are planned in this project. At present, the Belitang C.S.F. has a staff of one chief, eight staff members (only five of whom are directly connected with seed production), and seven workers.

Refer to Table 4-18. In 1981, this organization produced E.S. from seven hundred hectares. With a staff of only seven people the Upang C.S.F., serving the tidal-rice region, cultivated stock seeds on two hectares; but, because supervision of the wet fields was poor, the rice plants did not develop well. The South Sumatera Government has decided to increase the staff to include one chief and two staff members trained as specialists in the field of agronomy and breeding. The Betung M.S.F., responsible for upland-rice stock-seed production has a staff of one chief and three staff members. Because of a budget shortage, the Lahat M.S.F., founded in 1979, has only one worker responsible for supervision and therefore does not function as a seed farm at all. The Tanimulyo M.S.F., which has a staff of one chief and seven staff members, raises two hectares of stock seeds and two hectares of foundation seeds, and practice, twice cropping annually.

One C.S.F. and two M.S.F. are planned for Lampung Province. At present, the Wayjepara C.S.F., with one staff member and eight workers, and the Metro M.S.F., with one chief and one staff member, produce only extension seeds. The Tanjung Iman M.S.F. lacks a staff entirely and therefore does not function.

2) Problems

Essentially, F.S. farms (in Indonesia, the C.S.F. participate in this undertaking) are responsible for preserving the individual genetic traits of seed strains. S.S. farms (M.S.F. participate) are responsible for increasing the amount of seed beyond that of foundation seeds and of providing seeds for distribution of S.S. In fact, however, practically none of the seed farms achieves these goals because both C.S.F. and M.S.F. lack even a single specialist trained in this kind of cultivation. To carry out their roles, these organizations must have at least the following staff members.

F.S. Farm
1. Highly skilled technicians (university graduates): Two people combining the specialities of breeding (genetic) and pathology or agronomy and pathology.
2. One of these persons to act as chief. Medium-grade technicians (graduates of junior college or of an agricultural high school): Three persons capable of operating and caring for agricultural machinery.
3. Working staff: Some

S.S. Farm
1. Highly skilled technicians (university graduates with an overall mastery of agricultural science: Chief and staff.
2. Medium-technicians: Similar to those required for foundation-seed farms.
3. Working staff: Some

All of these staff members must be in constant technical training for the production of improved variety's seeds.

4-2-3 Farmers for seed production

(1) Current situation

Seed growers in the three project provinces and the seed production area are shown as below: Those farmers are consisting of two kinds who are officially commissioned by the provincial government to produce E.S. and those who are in a stage preparatory to becoming such a farmer in the future. Groups of the first kind, centering on what are called key farmers, form to produce seeds. Both the numbers and qualifications of the extension worker in charge of offering technical guidance to farmers in this work differ from province to province. As has already been pointed out frequently, cultivation of seeds differs in a number of respects from and demands caution on various points different from those found in ordinary cultivation.

Existing Seed Growers and Seed Cultivating Area (1981)

Table 4-16

Province	Seed grower (man)	Area (ha)
Aceh	258	218
South Sumatera	155	240
Lampung	96	159
Total	509	617

Source: Agricultural service, each provincial Government

But, granted some difficulties, in areas where rice cultivation is on a high technical level, if adequate technical guidance is provided, seed grains also can be easily produced. In Aceh Province, stock seeds are distributed to seed-growing farmers, but no further care is taken to see what becomes of the seeds thereafter and the farmers regulate themselves. The extension seeds grown from them (the same is true of seeds raised on seed farms) demonstrate drastic quality variation.

The annual demand for E.S. from seed-growing farmers depends on the area of land under the control of each household. Concentration and specialization of E.S. farms is extremely important. Therefore, ideally each farm household should be responsible for a large area and should possess a high level of technical skill. The results of this investigation show that in Aceh and South Sumatera, seed-growing farmers were responsible for one hectare each in both wet and dry fields. The area was slightly larger in Lampung. It is estimated that the area for tidal-rice cultivation is two hectares.

In the future it will be necessary to instruct and train seed-growing farmers not to mix this kind of agriculture with the ordinary raising of seed and to strive to produce improved-variety seeds. This will entail organizing seed-growing farmers into groups; consolidating extension-seed farms; rationalizing supervision methods; and providing organized guidance in seed cultivation, irrigation control, and storage methods.

Table 4-17 Estimation on the Number of Seed Grower in Target Year (1988)*

Province	Lowland Rice			Upland Rice			Tidal Rice		
	E.S. demand	E.S. Area	Seed growers	E.S. demand	E.S. Area	Seed growers	E.S. demand	E.S. Area	growers
	ton	ha		ton	ha		ton	ha	
Aceh	2,659	1,063	1,036	480	480	480	-	-	-
South Sumatera	1,675	670	670	1,463	1,463	1,460	769	308	153
Lampung	2,319	927	773	1,304	1,304	1,304	-	-	-
Total	6,653	2,660	2,479	3,247	3,247	3,244	769	308	153

Note: Estimated from cultivating rice area in the final year of pelita IV (1988) in the data provided by Department of Agriculture. in Aceh, South Sumatera & Lampung Province. In Belitang, South Sumatera, proposed 1.022 tons of lowland E.S. is to be produced by P.T. Patra Tani. Therefore 409ha and 409 seed growers will be omitted.

4-3 Seed Processing Center, and Seed Collection and Distribution

4-3-1 General

The Government of Indonesia is planning to establish 12 Seed Processing Centers in Aceh Province, South Sumatera Province and Lampung Province respectively for implementation of the Project.

All of the centers are new and their sites are ready for construction, and the requisition is almost complete.

Locations and conditions of the proposed sites are shown in the Table below.

On the basis of "the required amount of Project E.S." as shown in Table 4-8, a required amount of Project E.S. for the relevant S.P.C. has been calculated. However, the necessary amount of 452t(180.7 ha) of low land paddy designed for producing Project E.S. at the existing S.P.C. in Perum Sang Hyang Seri, Lampung Province has been excluded in this project. Also, in Beltang, South Sumatera originally scheduled construction of S.P.C., and the production of 1,022 ton of lowland E.S. have been omitted as P.T. Patra Tani is involved in the E.S. Production.

Table 4-18 Required Amount of Project E.S.

Province	Location	Lowland (ton/year)	Upland (ton/year)	Total (ton/year)
Aceh	1 Pulo-Ie	376	79	455
	2 Tangan-Tangan	262	111	373
	3 Meureudu	740	5	745
	4 Syamtalira (A)	1,287	285	1,566
	(Sub Total)	2,659	480	3,139
S. Sumatera	5 Upang	*769	-	*769
	6 Betung	-	785	785
	7 ADC Lahat	-	678	678
	8 Tugu-Mulyo	653	-	653
	(Sub Total)	1,422	1,463	2,885
Lampung	9 Wonodadi	918	-	918
	10 Karang-Endah	915	-	915
	11 Tanjung-Iman	-	1,304	1,304
	(Sub Total)	1,833	1,304	3,137
	Total	5,914	3,247	9,161

Note: *Tidal paddy

Based upon the data as shown in the above Table, required amount of raw paddy and area of E.S. field has been calculated.

Table 4-19 Required amount of raw paddy for E.S.

Province	Location	Lowland (ton/year)	Upland (ton/year)	Total (ton/year)
Aceh	Pulo-Ie	450	103	553
	Tangan-Tangan	315	144	459
	Meureudu	888	7	895
	Syamtalira (A)	1,536	370	1,906
	Sub Total	3,189	624	3,813
South Sumatera	Upang	*923	-	*923
	Betung	-	1,021	1,021
	ADC Lahat	-	882	882
	Tugu-Mulyo	784	-	784
	Sub Total	1,707	1,903	3,610
Lampung	Wonodadi	1,100	-	1,100
	Karang-Endah	1,100	-	1,100
	Tanjung-Iman	-	1,695	1,695
	Sub Total	2,200	1,695	3,895
	Total	7,096	4,222	11,318

Note: *Tidal paddy

As for necessary area for the E.S. farm field and amount of paddy and E.S. seed required are as shown in the following Table.

Table 4-20

Province	S.P.C.	Site Situation		Land Acquisition	Area (ha)	Civil work	Floor space for (m^2)
		Land Use	Owner				
Aceh	Pulo-Ie	Rice	Private	available	1.5 Fill	15,000	1,787
	Tangan-Tangan	Rice	Private	available	1.5 Fill	15,000	1,724
	Meureudu	Rice	Private	available	1.5 Fill	15,000	2,103
	Syastalira(A)	Rice	Private	available	2.0 Fill	20,000	2,355
South Sumatera	Upang	unreclaimed land	M.O.A.	Unnecessary	1.5 Fill	30,000	2,031
	Betung	Up land	M.O.A.	Unnecessary	1.1 leveling	10,000	2,103
	ADC Lahat	Up land	M.O.A.	Unnecessary	1.5 leveling	11,000	2,052
	Tugumulyo	Rice field	M.O.A.	Unnecessary	1.6 Fill	17,000	1,655
	Belitang	Rice field	Private	Necessary	1.5 Fill	11,400	1,653
Lampung	Wonodadi	unreclaimed land	Private	available	1.5 Fill	2,600	1,653
	Karang-Endah	yard	Private	available	1.1 Fill	3,600	1,553
	Tanjungiman	UPland	Private	available	2.0 leveling	8,000	2,355

4-3-2 Basic Design for S.P.C.

Since the operation method is descrived in Chapter 5, for basic design, some comments shall be made on S.P.C.s' hard-wear as follows:

i) Drying and coveying method of S.P.C. shall be designed lest they should give any sort of damage to germination characteristics of paddy during its process.

ii) Specific gravity separation of immature paddy shall be implemented, for this purpose, gravity separator must be installed.

iii) Separation of off-type seed shall be made by use of off-type seed separator.

iv) Pit method should be avoided, but the relevant structure must be constructed on the same ground level.

v) Storage Silo shall be set between two processes of drying and cleaning, In precise, S.P.C.s' operation constist of receiving cargo (paddy), pre-cleaning, drying & cleaning weighing and packing in general. In this project also consideration has been made on designing of each S.P.C. scheduled to be constructed in 11 locations, for its standardization regardless each S.P.C.s' total amount of processing capacity.

Accordingly, process-wise total capacity of each process is shown in ANNEX Reference 4-2.

All the data have been calculated on the basis of 20% of max. moisture content calculated for paddy at the time of receiving, whereas max. content of admixture have applied in calculation, (different from the required amount of project E.S.)

As for construction and installation of each S.P.C. care has been taken in its designing, especially for its easy cleaning of machinery, protection against water penetration and others; accordingly as stated in the foregoing, pit method has been avoid.

In addition, for more systematic and rational operation of S.P.C., in the main-building of each S.P.C., both work-shop and storage room have been scheduled, so that entire processes of S.P.C. be conducted in series without delay and fault.

Standardized three types of S.P.C. flow charts, installation, construction and relevant designs are shown in ANNEX Drawing S.P.C. —101,—102,—103. respectively.

(1) Daily Collection of Paddy and its Amount

The maximum amount of the daily collection of the seed paddy received by each S.P.C. is calculated on the basis of the average amount of the daily collection, the daily collection capacity comprising a 20% fluctuation rate in collection, and capacity of the dryer concerned. The details are shown in ANNEX Table 4-17.

(2) Number of Trucks Required

In collection of seed paddy, a truck with a 5 ton capacity shall make three trips a day between the collecting station and the S.P.C. Accordingly, in a day, about 15 tons of the paddy shall be brought into the S.P.C. and the total required amount of the collection of the paddy will be calculated. The number of the trucks required for each S.P.C. is shown in ANNEX Table 4-18.

(3) Receiving Facility

Generally, the receiving facility consists mainly of a receiving hopper, conveyor and precleaner. In the case of the receiving hopper which is individually available as in the facility in Sukamandi, there should be a deep pit hole provided for the receiving operation.

Usually, the cleaning of the pit is troublesome, and it will be a main cause of problems relating to contamination of the off type seed. At the same time it will leave a problem of water penetration and damage when a flood occurs.

In noting the above fact, the receiving facility that treats the paddy containing the admixture and immature paddy shall be designed as per ANNEX Fig. 4-7.

As shown in the ANNEX Fig. 4-7, the slope will enable trucks to move to a higher ground level for easier receiving operations.

Meanwhile, the precleaner should be composed of a receiving hopper and an oscillation sieve to be assembled with an aspirator. In order to control receiving amount of paddy, a weighing machine and a moisture meter shall be installed. The moisture meter can be used to check moisture content so that the relevant lot of paddy can be stored in accordance with its moisture content separately. It is desired that each lot shall be determined on the basis of a moisture difference of 3% to each other for appropriate charging into the silo concerned.

In determining the receiving capacity, the waiting time and time loss incurred in the operation is excluded. The actual net hours required for the operation should be scheduled within four hours which comprises the maximum fluctuation of operation hours, and/or within six hours to meet the maximum amount of the daily capacity of the cargo receiving.

Accordingly, the receiving capacity depends on the scale of the facility concerned, and usually 5 ton/hr, 10 ton/hr and 20 ton/hr is recommended respectively. The receiving capacity of each S.P.C. is shown in ANNEX Table 4-18.

(4) Drying Facility

The drying operation is considered to be the most integral function in the production of the improved paddy seed, because a failure in the control of the temperature of the heated air being utilized for the drying of the grain may cause the degression of germination rate due to moisture. Accordingly, the introduction of drying, applying the equilibrium moisture method would be recommendable to avoid such risks. (ANNEX Fig. 4-8)

The equilibrium ventilation can be realized, provided that 13% of the moisture content of the processed paddy corresponds with 73% of the relative humidity, when the temperature of ventilation is maintained at 35°C.

In the case of such a ventilating condition, an air heater is unnecessary in the daytime but is only required at night time and rainy days.

In the drying operation, the capacity of 0.4 - 0.5%/hr is necessary to operate the 10 ton drying capacity, and for the In-Bin-Dryer 0.4 - 0.6 m^3/sec. per paddy/ton of air volume is recommended. In addition it would be constructed outdoors. The seed paddy should be dried uniformly as much as possible. As for the flow of the drying process, a rotation circuit is necessary as well as charging and discharging flow of the paddy.

With employment of this type of drying system, the facility would be multipurposed i.e. used for drying of soybeen, mongbean and shelled corn etc.

A diesel engine can be used for the ventilator as well as for the heater.

Type of a proposed In-Bin Type-Dryer is shown in ANNEX Fig. 4-8.

Usually, processing of paddy which has excessive amount of moisture will cause a damage on germination of paddy to some extent, therefore collection of paddy of this type should be avoided or in case this type of paddy is collected, it must be adequately dried before it is stored. In determination of required volume of In-Bin-Type-Dryer, care should be taken for its processing capacity which can process upto 120% of average amount paddy collected, though sometimes a trouble may occure in handling of small lot of paddy consisting local variety or other varieties which are not have been designated are collected. Moreover there will be a peak time in collection of paddy also, for which an appropriate measure should be scheduled to avoid deterioration of paddy.

In view of the above, three(3) units of flat bed type dryers each having 3.2 ton in capacity would be installed.

Ample amount of fuel shall be provided for air-heater and generation of electricity but for this arrangement also care should be taken for selection of location for storing the fuel concerned.

For emergency sake, a concrete made drying floor having 1,000 m^2 of drying capacity shall be facilitated.

1) System of In-Bin-Dryer

A decrease in initial moisture of the paddy from 20% to 13% is needed, i.e., 7% of moisture decrease is actually required. Provided with the 4.5%/hr of drying capacity, it will require a maximum of 16 hrs/day to complete the drying operation.

Details of the required capacity as well as the daily drying processing operation are shown in ANNEX Fig. 4-9.

Required capacity and processing procedure of the In-Bin type dryer is shown ANNEX 4-10, whereas number of units of the dryer for each S.P.C. is shown in ANNEX Table 4-18.

(5) Silo Facility

The number of silo units to be installed plays an important role in the operation and management of the S.P.C. Bearing the above factor in mind, a preferable type of the proposed silo is clarified in compliance with the number of seed varieties, processing operation, management, and risks which might occur in the processing.

In view of the number of the existing seed varieties, the number of varieties to be processed by each S.P.C. per season, shall be less than six in number, though it depends on the plan of cultivation.

Meanwhile, from the processing operation point of view, the fewer the number of units (silo), the easier the operation, and the more the number of units increase, the more the operational losses and errors will be involved in the processing.

As for the risk is concerned, usually when the number of units increase, the capacity becomes smaller whereas the smaller number will require greater capacity of the silo.

Ultimately, the relation between the number of the units and its capacity always reflect the merits and demerits of the efficiency of the processing.

Therefore, in the case of the former, should any damage occur in the silo because of the smaller capacity, the extent of the damage would be small in quantity, whereas, troublesome handling might cause an error which ultimately would creates a contamination of the variety.

In the case of the latter, the merits might be in its easy handling, which can avoid the operational risks, whereas it might cause bigger damage when problems arise.

Accordingly, 40~60 ton capacity of silo is preferably be constructed, i.e., actually 4 units of 20~30 ton of silo would be constructed to handle small amount of different kind of varieties separately.

For security in various aspects, perfect control of the temperature of the paddy in storage shall be maintained. Rotation circuits, such as silo to silo are recommended.

At the time of charging the paddy into the silo, phostoxin as a fumigant, either in powder or pellet form shall be mixed into the paddy when it is carried by the belt conveyor.

The capacity and number of silos required are shown in ANNEX Table 4-18.

The Silo shall be constructed, especially its skirt and a bottom of hopper section, shall be made of steel structure, and the bottom of the hopper shall consist of two(2) sided declivities as shown in Fig. 4-6. A sweep floor will be furnished for the paddy conveying section, so that both discharge and aeration purposes be fulfilled.

A blower intending for aeration and discharging the paddy shall be engine driven type being mounted on a cart provided for each line of processing facility.

It should have air volume of 300m³/min. for which static pressure of 250-300 Ag would be required.

Siding wall of the silo to be fabricated with a keystone plate and silo itself should be square type.

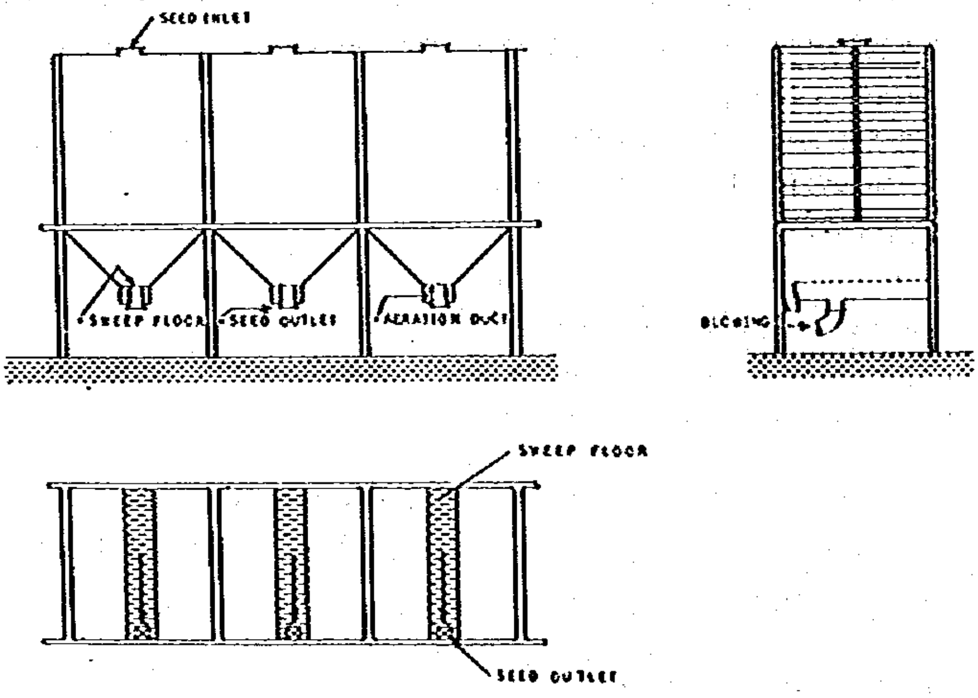


Fig. 4 - 6

Housing of the silo should be provided with ample space for ventilation, and an upper section of the silo to be furnished with a zebra plate, while ample space should be provided for both charging and discharging, and for each aeration purposes.

In consideration of local condition, all silos should be built indoors to avoid direct sunshine.

A junction belt conveyor to be provided for charging and transaction of the paddy, while belt conveyor similar to that of Sukamandi type shall be installed, too.

Formation of the silos will be consisted of four(4) lines for Syamtalira-A and Tanjung-Iman, and each two(2) lines shall be provided for other locations.

For checking of weight of paddy to be charged and discharged, and general control of stored paddy, weighing machines shall be provided. Required capacity of silo and number of units concerned are shown in ANNEX Table 4-18.

Meanwhile the paddy should be adequately cleaned and dried before it is charged into the silo, so that further separation of the smaller admixtures by the aspirator can be done easily.

(6) Seed Processing Facility

After the completion of a two months long receiving and drying operation, the processing of the paddy will be commenced. In order to reduce operational costs as well as a rationalization of the operation and management concerned, the processing facility should be designed to have enough capacity to operate for 2 to 4 months.

Accordingly, as for the capacity of the processing facility, either 1 ton/hr or 3 ton/hr is recommended, and details of each S.P.C. are shown in ANNEX Table 4-18. On the other hand, based on an average of 8 hr/day working condition, the required number of days to be scheduled for the actual processing operation is shown in ANNEX Table 4-19.

Details of the process are as follows:

1) Cleaning of large size admixtures should be done by an aspirator and an oscillation sieve; through this process, straw, wooden tip, sand in large size, stone and weed seeds can be removed.

2) Cleaning of small size admixtures should be done by a width separator; through this operation the small size admixture such as empty husk, immature grain and its particle, husked rice, small size sand, stone and weed seeds can be removed.

3) The gravity separator is employed to separate the twisted paddy, immature, sand, stone, weed seeds which have the same dimensions as whole seed paddy.

4) The length separator will remove the off type paddy from the objective paddy.

Accordingly, the paddy thus cleaned, is weighed then forwarded to either the packing line or the line for charging of storage in the silo.

(7) Weighing and Packing Facility

These facilities should have enough capacity to enable it to handle components of 5∿10 kg/bag being prepared at the rate of 1 ton/hr.

In accordance with the distribution plan and by adjusting the operation hours required, the daily amount of processing must be coordinated.

For the packing of the seed, usually polyethylene bags are preferable, but paper bags can also be used if the material is adequate, as it is considered to be the most preferable material for the packing.

Concerning the processing after the packing, i.e. casing and storing, a mobile flat belt-conveyor would be required, of which the angle of the head portion is adjustable to meet the piling operation.

(8) Electric Facility and Control Panel for S.P.C.

A system for the generation of electric power is necessary for all the S.P.C.s.

Generally, for the In-Bin-Dryer, an engine drive ventilator is installed whereas for the continuous flow dryer, a motor drive ventilator is recommended.

For each S.P.C., three generators are required to facilitate the necessary amount of electricity. For the efficiency of the operation, ordinarily, two units of the generator are utilized out of the above three generators in rotation for the receiving, drying, processing and packing respectively.

Using this method, the one generator not in operation can receive maintenance and if necessary a full overhaul, which is beneficial to further operation and management.

The required amount of electric power generation of each generator for each S.P.C. is shown in ANNEX Table 4-20.

Regarding the control panel installed in the S.P.C., it must be as simplified as possible in mechanism. However in order to avoid any operational problems, the securing of the minimum mechanical and electrical system and the installation of interlocking circuits is recommended.

As for wiring work, in order to avoid any damage caused by rodents, underground distribution of wiring is recommended. In the case of terrestrial wiring being required, it must be protected by metal tube.

(9) Others

In the designing of S.P.C., the following points should be considered for its efficient operation.

1) To avoid any kind of impact damage which may affect the germination rate of the paddy when the relevant bag is dropped from a higher place, installation of a shock absorber at every 2 - 3m section of the chute pipe is required.

2) All the equipment shall be structured as simple as possible so that easy cleaning of interior portion of them can be made. This should apply especially to the bottom section of the bucket elevator for which an opening with a cover being provided for the discharging and drainage of the residue.

3) For the horizontal conveying system, neither screw nor flow conveyor system should be applied, but a belt conveyor system preferably be installed for efficient work.

4) A compressor, which has ample amount of capacity suitable for cleaning of each machine of the relevant facility, and air cylinder of weighing machines, shall be installed.

4-3-3 Storage for the Products

For efficient operation of S.P.C. and delivery of the products, it is required that both S.P.C. and the storage area should be facilitated in the same premises. By doing so, the timely packing and casing of the seed paddy is approprietely completed in accordance with the adequate requirement. In this connection storage capacity should be large enough to capacitate a buffer stock meeting the amount of the delivery required.

Storage capacity of the relevant S.P.C. is shown in ANNEX Table 4-21. In addition, in storage, the pile of the products should be less than approximately 3.6m in height. On the second floor of the store house, necessary material and spare parts required for packing are stored.

4-3-4 Building and Related Facilities

(1) Building plan

A Seed Processing Center consists of a main building with related facilities; a generator room, blow equipment room, silo, and house for staff. The structure of these buildings will be considered as wood, brick, concrete blocks, steel and reinforced concrete.

Taking into account the seed processing method and relative conditions, the size of the buildings is quite large; for example, width of entrance: 8m, height of ceiling: from 10m to 20m, floor space: from $664m^2$ to $1044m^2$ etc.

In addition to this matter, machinery and equipment of the Seed Processing System should be kept safe from any damage, spilling spillage or fires.

Reinforced concrete or a steel skeleton construction can be adopted for the Seed Processing Center, but according to the layout of the machinery and related conditions, a steel skeleton construction is the most suitable structure for the Seed Processing Center.

In each main building of S.P.C., machinery room, warehousing room for goods, operation room, office room, laboratory workshop and shower room shall be facilitated.

Additional buildings; a generator room, fan equipment room and staff house, will not be so large or important as the main building. These buildings are made of brick or concrete block because of lower costs.

At Upang Island, the site is far from docking facilities and transportation costs are relatively expensive. So, buildings are made of wood, except the main building.

The structure of the silo should be preferably made of steel sheet. Detailed data on buildings are shown in ANNEX Table 4-24 (1)~(11).

(2) Equipment

Roof materials for the main building shall be 12m/m thick pressed wood board and zinc coated iron panels to protect against noise and heat.

Electric fans shall be fixed at the roof beam, and the top beam of the roof will require installation of lightening rods. The control room and administration office shall be divided by a concrete block wall and have a ceiling for heat resistance and also air conditioning to decrease the room temperature to 5°C below the outdoor temperature in order to maintain efficiency of control

The working room has a water tank for bathing and a toilet facility.

The Indonesia Government, Financial Bureau of the Ministry of Finance, has criteria for staff housing, and is shown below;

Table 4-21

Grade	Area	Floor space(m^2)	Facilities
Senior Staff	200	70	local toilet, water tank Electricity 110V, 10A
Middle rank staff	120	50	local toilet, water tank Electricity 110V, 10A
junior Staff	100	36	Public toilet & water tank Electricity 110V, 10A

Regarding the Water Supply System, resources are 7m deep wells and water is pumped up to the head tank, capacity 600 ℓ, to distribute directly to each house using ∮ 25m/m plastic pipes.

Concerning the drainage systems, a ∮ 150m/m concrete pipe is used to carry sewage from each house to a septic tank whose location should be far from the wells.

Electricity for common use shall be generated at the main building; Single unit 110V, Average 6∮m/m.

Detailed data are shown in attached drawings for S.P.C.

4-4 Central Seed Storage Center

The Collection and distribution of the breeder seed required by the central seed farms located throughout Indonesia are conducted directly by the central government itself in order to administrate smoothly the rice seed production and distribution system.

Breeder seed is produced by the Central Research Institute of Food Crops and its branch institutions. Produced seeds are collected and stored in the central seed storage house at Pasar Minggu for a time, and then distributed to central seed farms.

However, these seeds sometimes lose their germination ability during the storage period due to injury from high temperatures. This occurs because the existing central seed storage house has no facility to control the temperature of its air.

Thus, the existing seed storage house should be improved to keep room temperature constantly at 15 - 17°C with the use of an air controlled facility, thereby ensuring that the stored seeds can keep their high germination ability for the period of one to three years.

The necessary amount of the breeder seed to be stored in the central seed storage house will be estimated approximately 1.0 - 1.1 ton according to the data of Table 24. Table 24. shows a ten year rice seed production and distribution program from 1980 to 1989 made by the Government. The quantity of the breeder seed required in 1980, the first year of the program, was 950 kg and it will be 1,075 kg in 1986.

The storage capacity of the breeder seed concerned, however, shall have 3 tons in capacity including an extra amount to be on the safe side.

In the case of an emergency, when it is necessary to supply the seed farms with foundation seed i.e. when damage to the seeds by disaster or accident occurs, about 10 tons of the foundation seed shall be stored in the central seed storage house.

This improved seed storage house will be called the Central Seed Storage Center.

An outline of the Central Seed Storage Center is shown as follows:

Location: at the premises of Pasar Minggu

Temperature: 15 - 17°C

Duration of storage: one to three years

Size: cold storage house including an office and preparation room $10^m \times 20^m$

Details of building and facility are shown in the ANNEX DWG. JCS-001.

Table 1. Amount of Breeder Seed necessary for Foundation Farm, and its planted area and amount of seed at F.S., S.S. and E.S. Farm produced in order, and cultivated area of renewed seed in each year in the 10 year program from 1980 to 1989.

Table 4-22

Year	Amount of Breeder Seed (kg)	FS Acreage (ha)	FS Production (Ton)	SS Acreage (ha)	SS Production (Ton)	ES Acreage (ha)	ES Production (Ton)	Rice Area planted by Renewed Seed (ha)
1980	950	38	38	-	-	-	-	-
1981	975	39	39	1,506	3,102	-	-	-
1982	1,000	40	40	1,579	3,158	124,063	248,125	
1983	1,025	41	41	1,608	3,215	126,300	252,600	9,925,050
1984	1,050	42	42	1,637	3,273	128,575	257,150	10,104,000
1985	1,050	42	42	1,666	3,331	130,888	261,775	10,286,000
1986	1,072	43	43	1,691	3,391	133,238	266,475	10,471,000
1987	.	-	-	1,726	3,452	135,638	271,275	10,659,000
1988	.	-	-	-	-	138,088	276,175	10,851,000
1989	.	-	-	-	-	-	-	11,047,000

Note: Amount of seeds sown in F.S. Farm is 25 kg/ha,
Yield of F.S. is 1,000 kg/ha,
Yield of S.S. and E.S. is 2,000 kg/ha, respectively.

4-5 Scope of the Project and Costs

4-5-1 Central Seed Farm and Main Seed Farm (C.S.F. & M.S.F.)

As described in Chapter 4-1-3, by the target year 1988, the target in the aspect of paddy field development, irrigation and intensification in the rice production program in the objective provinces, inferred from the results carried out in the past in each objective provinces, will be nearly completed.

As a result, from the standard rate of the renewal of seed and seeding rate per hector, the quantity of ES demand estimated in the target year is shown in ANNEX Table 4-22 & 23.

Based on the above estimation, the problems should be settled for seed production as follows;

(1) The need for the arrangement and enlargement of fields in F.S. and S.S. production farms.

(2) The need for the new construction or renovation of office, warehouse, workshop, storehouse, training facilities and staff's house etc.

(3) To supply equipment needed for seed production such as machinery.

(4) To increase the complement of staff in seed farms.

(5) The need for the supplement of investment and running costs for the project.

(1) Arrangement and enlargement of ES. and SS. production farms.
As per the description in Chapter IV, in the three objective provinces, the arable land for seed production in the Keumala central seed farm only, is not sufficient. Therefore, the waste land in the farm must be reclaimed. Other seed farms in each province have sufficient land for setting up seed farms.
However, the arrangement of fields, roads in the field, ditches for irrigation and drainage should be constructed in all project farms. The actual status is shown as under.

Table 4-23 Present Status of the Seed Farm and Area Allocated

Province	Seed Farm	Existing Area (ha)	Required Area (ha)	Projected Area (ha)	Area Allocated for Structures (m^2)
Aceh	Keumala	6.9	9.5	10.19	485
	Tangan Tangan	9.6	8.3	8.73	272
South Sumatera	Upang	20.7	4.7	4.84	947
	Belitang	11.4	7.9	9.14	300
	Betung	28.9	21.0	21.00	220
	ADC Lahat	20.0	18.0	18.49	130
	Tugumulyo	8.4	3.3	5.53	142
Lampung	Way Jepara	8.1	8.0	8.00	517
	Metro	11.5	12.2	11.24	346
	Tanjung Iman	11.1	11.0	11.02	318

For the seed farm, the road, drainage and irrigation system shall be provided and the details of the same are shown in attached drawings for Seed Farm.

In addition, an irrigation channel is provided for Kemala, while one bridge each is to be constructed for Tugumulyo and Metro, and for the upland areas such as Betung, ADC lahat and Tanjung Iman, a sprinkler system shall be provided for irrigation.

Moreover, at present there are some structures existing in each seed farm available for the work concerned, however, the training facility as well as new houses for the resident officers are necessary for the project areas as shown in the above Table

The required agricultural equipment, seed processing machinery and means of transportation are shown in attached drawings for Seed Farm.

(2) Building facilities in seed farms.
The scale of building facilities is a little different between central seed farm and main seed farm. The existing facilities in all project farms will have to be more or less renovated.

(3) The complement of staff in the seed farms.
In the central seed farm, F.S. and S.S. production and the technical training of staff and seed growers concerned would be done in order to carry out the seed project.
On the other hand, main seed farms will produce only S.S. So, as described in chapter 4, central seed farms and main seed farms should be provided with staff and workers. (Refer to 4-2-5)

(4) Rationalization of work in seed production
Land preparation in rice growing, namely in plowing, hallowing and puddling need much labour. Therefore these works should be all done with machinery in all seed farms in this seed project. (Refer to 4-2-1)
At the present time, there are equipment and instruments in each project seed farm as shown in ANNEX Table 4-9.
But furthermore, some additional equipment should be supplied in order to perform this project (ANNEX Table 4-10).
In the present state of Indonesia, other works such as transplanting, weeding etc., would be done by hand by field workers.

(5) Other equuipment required for the seed project.

As for other equipment, motor bicycles will be provinded in both the central seed farms and main seed farms.
Minibuses for the training of seed growers and extention work must be provided for the central seed farm. (ANNEX Table 4-10).

(6) Budget of seed production in this project.

As described before, the investment costs and running costs needed to carry out this project for seed production are estimated as shown in ANNEX Table 4-23.

The total combined cost in foreign and local currency for the investment is Rp. 2,146 million. The total running costs payable in local currency is estimated at Rp. 336 million.

4-5-2 Seed Processing Center (S.P.C.)

(1) Machinery and Processing Facilities

In order to process the objective amount of E.S. seed; 12,539 M/T / year as specified by the project and controlled by each state, a total of eleven (11) S.P.C.s shall be constructed, and the break down is as follows:

Province	No. of S.P.C.
Aceh	4
South Sumatera	4
Lampung	3
Total	11

In Tugumulyo in South Sumatera, Wonodadi and Karang Endah in Lampung where double cropping is possible the S.P.C.s are to be capacitated theoretically to handle 50% of the total processing capacity as scheduled for one (1) year's operation. For each S.P.C.s' annual capacity, the details are shown in ANNEX Reference 4 - 2.

Meanwhile, the number of required machinery/equipment and necessary capacity, calculated on the basis of the required amount of processing for each S.P.C. concerned, are detailed in ANNEX Table 4 - 18.

For the collection and distribution of the seed required, a total of seventeen (17) trucks, each having 5 M/T in capacity, shall be facilitated for the realization of the project. However, for the S.P.C. in Upang located in South Sumatera, both collection and distribution of the seed shall be done by riverine transportation.

Regarding the seed receiving facilities, five (5) each having 5 tons in capacity, four (4) each having 10 tons and two (2) each having 20 tons in capacity, shall be installed.

As for the drying facilities, the following number of the dryers should be constructed, with 10 ton/unit and 0.4 - 0.5% / hr of drying capacity.

State	No. of Unit
Aceh	12
South Sumatera	10
Lampung	9
Total	31

The above dryers should be In-Bin-Dryer types, being constructed for out-door use.

Silos, which play an important role in rice seed processing and its distribution activities, are necessary, and in accordance with their processing capacity, steel silos each having a capacity of 50 and 25 ton per unit shall be adequately installed.

For each state concerned, the following silo facilities are to be installed.

State	Capacity (ton)
Aceh	3,100
South Sumatera	2,600
Lampung	2,600
Total	8,300

Regarding the processing facilities, a total of six (6) facilities, each having 1 ton/hr in capacity and another total of six (6) of the same, each having 3 ton/hr in capacity shall be provided.

For the weighing and packing facilities, semi-automatic types of machinery having either 1 ton/hr (200 bags x 5 kg/hr) or 2 ton/hr (400 bags x 5 kg/hr) in capacity is necessary.

(2) Job Site Areas and Structures

A brief summary of the eleven (11) units of S.P.C. to be constructed is as follows:

Generally, for the structures to be constructed in each S.P.C. premises, the main building shall include a machinery room, operation room, office, workshop, seed distribution and storage room, whereas a generator room and houses for the resident officers are to be constructed separately.
Accordingly, the total required area for each S.P.C. is summarized as follows:

Table 4-24

Province	Seed Processing Center	Job Site Area (ha)	Area for Structures (m^2)	Remark
Aceh	PULO-IE	1.5	1.787	to be constructed opposite the S.F.
	TANGAN-TANGAN	1.5	1.724	
	MEUREUDU	1.5	2.103	
	SYAMTALIRA-A	2.0	2.385	
South Sumatera	UPANG	1.5	2.031	to be constructed in the S.F.
	BETUNG	1.1	2.103	"
	ADC LAHAT	1.5	2.052	"
	TUGUMULYO	1.7	1.655	"
Lampung	WONODADI	1.5	1.880	
	KARANG ENDAH	1.1	1.880	
	TANJUNG IHAN	2.0	2.385	to be constructed opposite the S.F.

As for the locations provided for the construction of the S.P.C.s, at present the ownerships still belong to each private owner concerned. However, they can be easily procured by the government which is also responsible for to securing 1 to 2 ha of the area which is considered to be enough for the construction.

Land consolidation may be required for some of the areas concerned and for these areas (job sites), the necessary construction shall be executed one or two years after the completion of the consolidation.

In order to minimize the required construction costs, excluding the main buildings, all required structures shall be built by using bricks and block systems for which assigned local contractors are responsible. Regarding the main building, it will require ample space for the installation of the processing facilities, flooring for operation, adequate frontage and hight.

Moreover, as a precautionary measure, the buildings and other relevant structures shall be built adequately to meet their requirements and to protect seed from fire and other causes of damage.

Accordingly, steel structures shall be utilized for the minimization of cost and number of days required for construction.

The details of the S.P.C.s are shown in ANNEX Table 4-24.

1) Installation Costs

Total costs required for the total eleven (11) S.P.C.s are calculated as follows:

Foreign Currency	:	Rp 12,445,835,000
Local Currency	:	Rp 10,612,065,000
Total		Rp 23,057,900,000
		(as of March 1982)

Foreign currency shall be applied for goods to be imported on C.I.F. Jakarta basis, which also includes machinery, steel structures, various equipment and vehicles being produced in Indonesia through knock-down processes.

Local currency is applied to the construction costs, machinery and equipment transportation charges between the port of Jakarta and the job sites concerned, as well as the various costs for procurement of local goods.

All the estimates of the required costs are based on the market price of the relevant goods, and the rate concerned being applicable in Jakarta as of March, 1982.

The details are shown in ANNEX Table 4-25.

2) Operational Costs

For the management of the entire S.P.C.s, a total amount of R/p503,775,000 is required.

This will include staff costs, labor charges, costs required for collection and distribution of the seed, transportation charges, all the running costs of the entire S.P.C.s, including cost of fumigants, packing material and general traffic charges etc.

The details of each S.P.C. are shown in ANNEX Table 4-26.

4-5-3 Central Seed Storage Center

The Central Seed Storage Center is installed at Pasar Minggu under the following conditions.

Storing temperature	:	15°C to 17°C
Storing duration	:	One to three years
Size	:	a) Cold storage 10m x 10m
		b) Preparation room including an office having 10m x 20m in size.
Compound	:	Area of 700 m^2 shall be alloted for the above purpose, by the Ministry of Agriculture. The above area includes the site for loading car.

The investment cost and the recurrent cost are shown in ANNEX Table 4 - 27.

4-5-4 Training

(1) A system for Cooperation of Education and Training

The project is one of the agricultural programmes of the Government and executing agency; Directrate of Food Crop Production has been responsible for its realization under direction of the Directrate General of Food Crop Agriculture, Ministry of Agriculture.

As stated in the foregoings, for the increase of the seed production which is a basic element for agricultural produce, a special consideration and technology is quite necessary. In this respect, for those who work in the relevant institutes and research centers, and the seed growers as well, an appropriate technical training and education is imperative and to be implemented accordingly.

However, in implementation of training and education for the seed production, exclusively selected experts would be despatched from 1) Agricultural Institute which concerns seed improvement and cultivating technology of food crops and 2) Seed Control and Certification Service which is responsible for seed production, distribution and marketing, as well as quality inspection related to the above activities.

(2) Cooperation through Foreign Experts

For rice seed improvement, Indonesia has been enjoying more than forty years of its history and experience, whereas more than 10 years of seed production and distribution activity of the Government has been also encouraged people who engaged in these lines.

In spite of existance of many number of experts in the Central Government, unfortunately number of experts are still few in local institutions. Actually in execution of this project also, number of experts is increased.

As stated in Chapter 4-2-1 and 4-2-2, necessity of training and education would be materialized by inviting adequate expert from abroad who are responsible to provide all trainers concerned with technical knowhow and to cooperate with actual implementation, management and coordination of seed production industry.

As for the expert is concerned, he would be qualified in agronomy with adequate years of experience in cultivation, farming and rice seed production.

The seeds expected, should be naturally improved and good ones, and more than anything else, they must be met with favorable reception of the farmers concerned.

Regarding the technical cooperation of expert from foreign country, one expert shall be invited for four years assignment, starting from first year of implementation of the project. The expert thus assigned shall be responsible for training and education of personnels as well as transaction of technical know-how of seed production.

(3) Objective of Training

The objectives are to give education and training to 1) staff of the authorities concerned who are responsible to establish relevant policy of seed industry and execution, and staff of both provincial and local government level, 2) staff of C.S.F./H.S.F. (including SCCS and experimental station) concerned who directly engage in seed agriculture. 3) technical staff in charge of seed processing and distribution and, 4) seed growers (4) Scale and Method of Training

(4) Scale and Method of Training

Methods of the training shall consist of two categories as follows:

1) Overseas Training

Short term and long term overseas training are there, in which the former objective is to facilitate administrative staff with training and education, while the later concerns technical training of seed production.

2) Domestic Training

Those who assigned for seed production and its relevant industry shall be designated for the training. In detail, one is done by the Central Government on the basis of job designation and the other is made by the Provincial Government who is responsible for training of seed grower at C.S.F., through training course and travelling lecturers, including S.P.C. staff members.

Costs of domestic training is estimated at Rp 132,435,000.
(Refer to ANNEX Table 4-28)

4-5-5 Seed Control and Certification Service (SCCS)

SCCS has been organized as one of the increase of food crops production and distribution programs in Indonesia, and their organization, work and present working condition in the objective provinces are mentioned in next Chapter 5-2-5.

Needless to say, the success of the project entirely depends on the seeds which have high purity and germination capacity, and also endorse sound growth of rice plant with high yielding characteristics which can meet the farmers' requirement.

In this connection, SCCS is responsible for its inspection required for each process of seed production as well as distribution and marketing together with supervisory works required.

Accordingly, it is the most important that the project must be executed actively by the authority as smooth as possible with necessary cooperation of the parties concerned.

Necessary installation of equipment (equipment for laboratory and vehicles) is shown in Annex Table 4-29 in detail as well as installation charge, and the brake down of the cost is as follows:

a)	Foreign currency	:	Rp 46,530,000
b)	Local currency	:	Rp 3,207,000
	Total amount		Rp 49,737,000

The local currency, include Indonesian made germination test equipment, and inland transportation charges.

CHAPTER V MANAGEMENT OF THE PROJECT AND ORGANIZATION

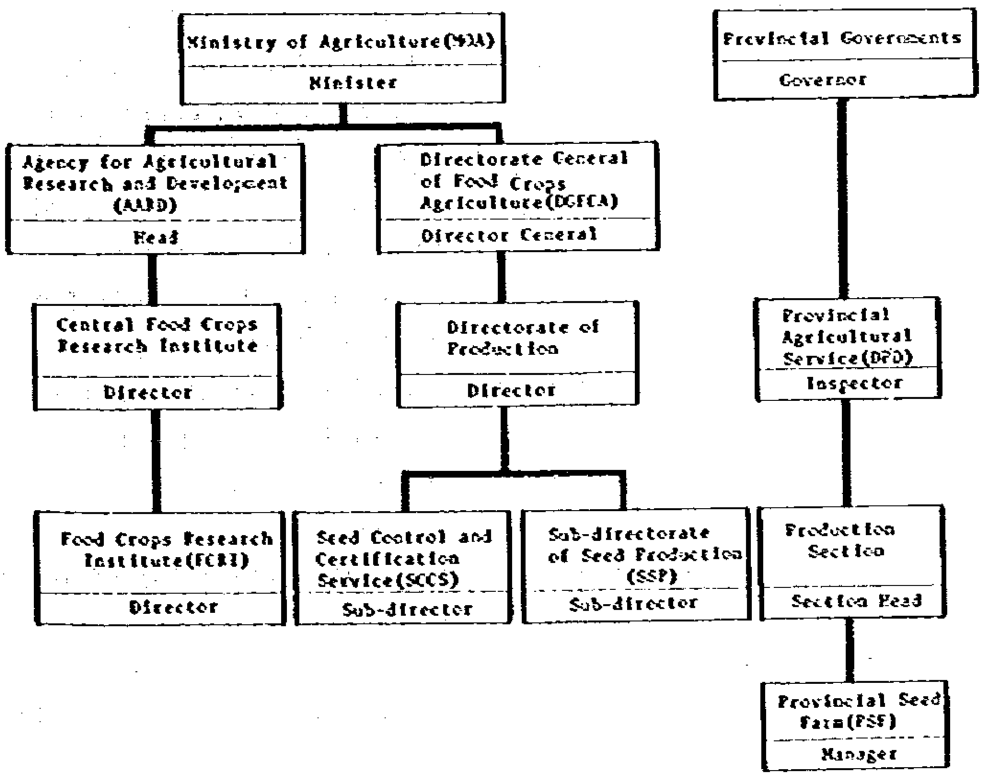
CHAPTER V MANAGEMENT OF THE PROJECT AND ORGANIZATION

5-1 Administrative Organization

The administrative organization for the project is the Ministry of Agriculture, and the DGEC as one of the five offices controlled by the Minister of Agriculture is responsible for the operation of the project. Actually, the GDFC has entrusted the Directorate of Food Crop Production with the responsibility for the administration of the project.

The Directorate of the Agricultural Service of the objective province carries out the project under orders from the Directorate of Food Crop Production. The governmental organizations directly responsible are as mentioned above, however, in the execution of the program, it is necessary to have coordination with SCCS, the Agricultural Extension

PRIMARY GOI AGENCIES WITH PROJECT RESPONSIBILITIES



and Educational Training Agency, and the Agricultural Development Research Agency which control CRIF (Bogor) and other experimental stations.

As for coordination with the former Extension and Educational Organization, it is indispensable that guidance be given to seed growers and other general farmers and that the latter be closely connected with the education of the staff members concerned and seed growers.

The management of seed processing centers in Aceh and South Sumatera, which are two out of the objective three provinces, is entrusted to P.T. Pertni , whereas it is entrusted to Perum Sang Hyang Seri in Lampung. The seeds thus certified by SCCS after processing are delivered to farmers through KUDs etc.

5-2 Management of the Project

5-2-1 Production

(1) Production system for foundation and stock seeds

As was explained in section 4-2-1 knowledge and experience are needed for the production of foundation seeds in Indonesia. In general, it is required that a strain be of good quality, uniform in characteristics, and fixity. But since genetic purity is not 100 percent, care must be devoted to preserving the genetic traits of foundation seeds while producing adequate quantities of stock seeds. Stock seeds are the intermediate stage between foundation seeds and extension steeds. Their function is to increase quantities of foundation seeds of high purity for the sake of extension-seed production. Foundation seeds and stock seeds are both produced on official seed farms. The following are points that deserve attention in connection with their production.

1) Distributed breeder seeds are used in the production of foundation seeds.

2) Foundation seeds produced on seed farms are submitted to strict selection and used in the production of stock seeds.

3) As preceding preparation, the seeds are selected with salt-water thoroughly washed, disinfected, and force-germinated.

4) They are then sown in seedling beds and allowed to grow strongly and healthy.

5) Since the seedling-bed growth period is short in tropical zones, it is essential to avoid overaging.

6) Fertilization of the planting fields should be somewhat lighter than in the case of rice cultivation, though the degree varies depending on the fertility of the soil.

7) Seedlings for foundation-seed cultivation must not be set more than one seedling to a hole. If precautions against mixing are taken, it is permissible to set two or three plants to a hole in the case of stock-seed cultivation.

8) It is good to set the plants in something like parallel rows to facilitate removal of off-types throughout the growing period.

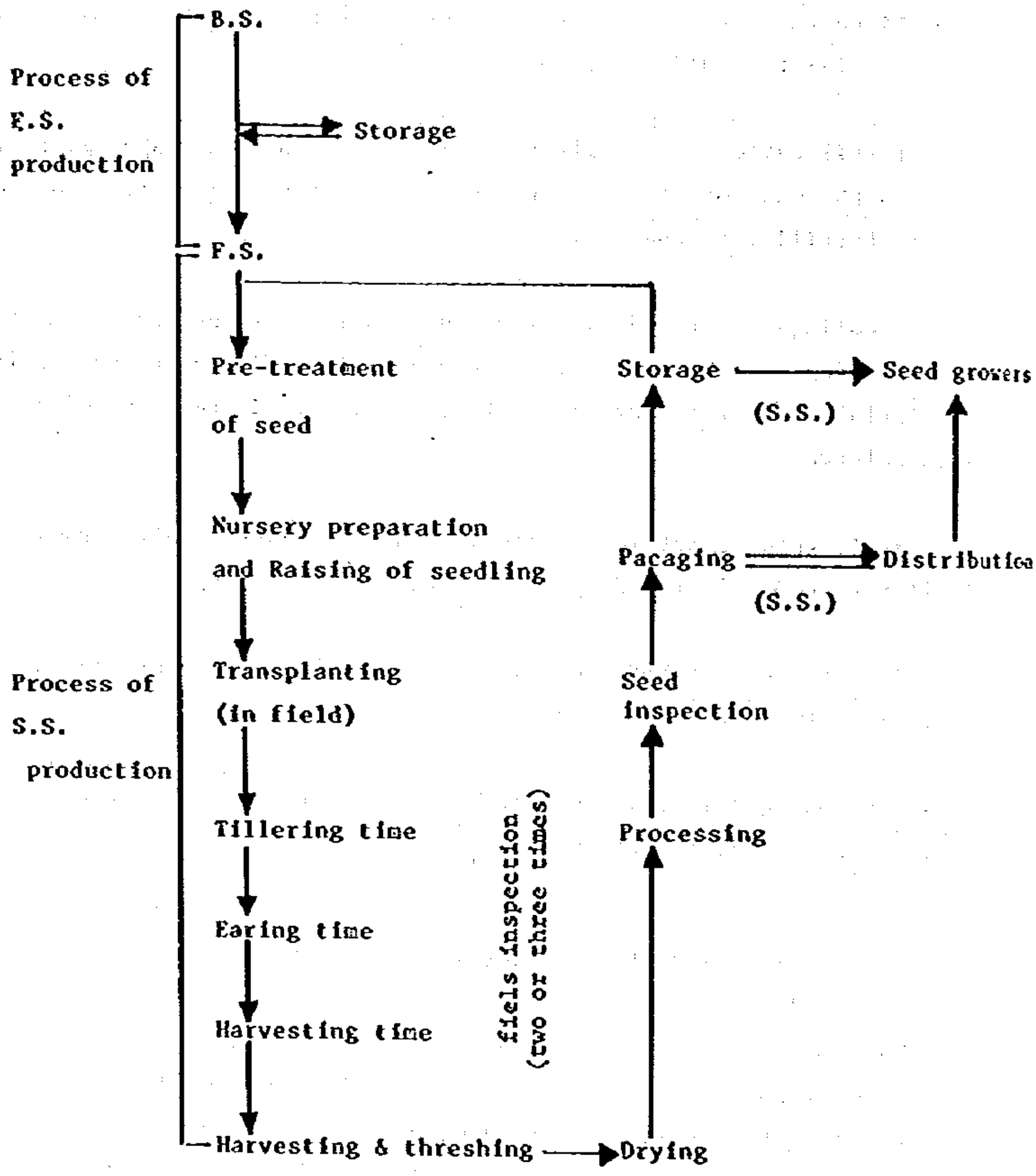
9) In the cases of both foundation and stock seeds, off-types and weeds must be antinously removed in each cultivation stage.

10) Thoroughgoing measures must be taken to ensure good health by protecting against insects and diseases.

(2) Production system for extension seeds

For the production of improved seeds, the seed farm should have natural environmental conditions: (a) stable climate with no radical changes in a place relatively free of plant disease, insects pest and natural disasters, (b) soil should be moderately and fertile land especially not low-level production land especially, (c) the area should be sunny and well ventilated and should be free of fogs and mists, (d) upland rice requires irrigation at several degrees of intensity; wet

Fig.5-1 System of F.S. & S.S. Production



fields should have a good supply of irrigation water and must be well drained.

In this project, seed-cultivation districts are set up around the S.P.C.. Within the district groups of seed-cultivating farmers (from twenty to thirty to a group) are formed and include key farmers who are enthusiastic about agriculture, technically skilled, and able to absorb new technical ideas and who therefore take the lead in disseminating seed-raising technology.

The following are the manuals of production methods for wet-field (lowland) and dry-field extension-seed (upland) cultivation. Extension seeds for tidal rice are produced in the same way as those for wet-field rice, though they are grown in a region that suits their particular nature.

Since they will be used for the actual raising of rice, extension seeds must be pure and full and of good quality. Careful supervision, similar to that required in the production of stock seeds, must be carried out. And investigations must be made during the growing period and prior to harvest to determine whether the seeds are suitable for use as extension seeds.

Often during harvest control, seeds are split and their quality reduced, or contamination occurs. This matter is discussed under the section of Seed process.

Manual of Cultivation for E.S.

(Lowland)

Work	Practical method
1. Seed supply	1. Use the good seeds selected carefully at seed farms and certified and distributed. 2. Seeds:25 kg/ha.
2. Seed preparation	
(1) Seed selection	1. Select good seeds by specific gravity and then wash the seeds, thoroughly. 2. Separate good seeds by soaking water before sowing at least.
(2) Seed disinfection	1. Put seeds into a hemp sack and then soak it into a solution of Uspulun for 6 hours. 2. Uspulun solution is needed twice of seed quantity.
(3) Soaking of seeds	1 Soaking seeds in a hemp sack into flowing water after seed disinfection.
(4) Pre-sprouting	1. Take out seeds with sack from water and seeds with sack is kept for thirty or thirty six hours for hastening.
3. Nursery	
(1) Preparation of nursery bed	1. Nursery bed must be prepared one day before transplanting. 2. Remove different variety's hill and paddy stalk for the protection of contamination if required
(2) Type of nursery bed	1. Narrow rice nursery and semi-irrigated nursery. 2. Watering is shallow, but be careful for squall shower and birds.
(3) Area for seed bed	1. 1/30 - 1/20 of the area of transplanted seedling.
(4) Fertilizer	1. All basic fertilizer 20 g Urea +30 g TSP/m^2
(5) Seeding time	1. According to traditional manner
(6) Rate of seeding	1. Seeding density and seeds amount 0.1 - 0.09 /m^2. Push the seeds slightly after seeding.

(7) Age of seedling	1. Age of transplanting: 20 - 25 days.
(8) Management and water control	1. Stand variety's name notice board in field. 2. Be careful for water control.
(9) Plant protection from disease and pest control	1. Take a suitable measure.
4. Paddy field	
(1) Preparation of paddy field	1. Remove the different variety's hill and stalk paddy before transplanting.
(2) Plowing	1. The first plowing: 25 days before transplanting.
(3) Harrowing	1. The second plowing and harrowing: 12 days before transplanting.
(4) Puddling	1. Puddling and leveling: 2 days before transplanting. (Above those are usefully for weed control)
(5) Transplanting	1. Planting density must be changed according to soil fertility. 2. But row transplanting is better for weeding and ploughing and other works of field.
(6) Weeding	1. The first weeding: 20 days after transplanting. 2. The second weeding: 45 days after transplanting.
(7) Disease and pest control	1. The first protection on tillering stage. 2. The second protection on young ear formation stage. 3. The third protection on earing time.

(8) Fertilizer application	1. Change fertilizer by soil fertility in each region. 2. Basic fertilizer : one third urea, all amount TSP. 3. Top dress: Urea. — the first top dress: one third Urea. the second top dress: one third Urea.
(9) Roguing	Roguing anytime if found out in field. Contamination will easily be found out during beginning of heading stage to ripening stage.
(10) Harvesting	Optimum harvest time is the ripening stage with a little number of blue rice grain. Be careful contamination.
(11) Drying	Don't expose to rain again after drying of grain, if so, it become the cause of occuring notched-belly rice kernel (split grain).
(12) Collection	1. Seeds will be collected by S.P.C. at appointed day.

Manual of Cultivation for ES

(Upland)

Work	Practical method
Seeds prepatation	1. Preparing good seeds such as full and healthy. 2. Seeds 40 kg/ha.
Land preparation	1. Pull and cut weeds in field. (Growing green manure crops as pre-crop on the field would be better.) 1. Plowing on two weeks before seeding. 2. Harrowing on 4 days before seeding. 1. Cutting furrow distance 60 cm 2. Applying fertilizer into the furrow. 3. Cutting furrow on the day of one day before seeding, and fertilizing into the furrow and covering with soil.
Seeding	1. Seeding between 5~10 cm in row, 10 grain/one hole.
Weeding	1. The first weeding: 20 days after seeding 2. The second weeding: 40 days after seeding 3. The third weeding: 60 days after seeding
Intertillage	1. Intertillage is desirable at the same time of each weeding (three times).
Molding	1. Molding also is desirable three times after weeding. The first, second be slightly. The third be heavy. 2. This is very useful for the control of tiller and the prevention of lodging.
Harvesting and processing	1. Be careful for seed contamination.
Rotation	1. Rotation is very useful to prevent continuous cropping injury, specially for upland rice cropping.

5-2-2 Collection, Processing and Distribution of Paddy Seed.

1. Organization

For the details of the organization, refer to ANNEX Fig. 5-1

Usually, the organization of the S.P.C. consists of two functions; one is a marketing section and the other is engineering.

While the marketing section controls collection of paddy, storage of the product, distribution operation and administration, the engineering section controls the S.P.C.'s operation and management. In detail, apart from the operation of the plant itself, maintenance of the facility and equipments of the plant is required, at the same time the section is responsible for the management of the workshop as well as the control of spare parts.

In addition, an adequate laboratory is required for the independent management of quality control of Extension Seed (E.S.) produced in the S.P.C. concerned.

The Manager of S.P.C. is responsible for establishing each plan of operation, collection of paddy and distribution in compliance with the plan of cultivation of the seed paddy, and general administration.

The following is a recommendation applicable for the management of the S.P.C. provided with a minimum number of staffs.

1) During the two months of paddy receiving period at the S.P.C., the receiving, precleaning and drying of the paddy are executed. Upon the completion of the drying, according to the varieties concerned, the processed paddy shall be carried into silos together with the fumigant.

2) Upon the completion of the receiving operation, stored paddy shall be discharged for further processing, weighing, packing, delivery and distribution.

2. Operation of the Seed Processing Centers

The plan of the operation for the S.P.C. shall be established in compliance with the cultivation schedule of the seed paddy. This should include the plan for collection and distribution.

a) Collection of the Paddy

The plan of collection shall be established in accordance with the plan of operation duly arranged by the relevant S.P.C.

The management of the S.P.C. is responsible for the establishment of the plan for collection which is applicable to the seed growers in the village unit assigned, by designating the seed variety concerned, date, time and location of the collection.

Meanwhile, the seed grower should apply for S.C.C.S.'s inspection before the harvesting at the paddy field. Then the harvesting shall be done by cutting the stalk of paddy at the section, about 50 to 75cm from the panicle.

The stalk of the paddy thus harvested, shall be dried in the shed as shown in ANNEX Fig. 4- 1, being left there for several days for drying and storing purposes. During the period, and until the date of collection designated by the S.P.C., threshing and winnowing the paddy shall be conducted in the traditional method as shown in ANNEX Fig. 4-2.

In order to avoid any kind of damage which will affect germination rate, as well as for the rational operation of the S.P.C. on and after the collection of the paddy and further processing, adequate care shall be taken for the harvesting so that the paddy be harvested with the moisture content kept less than 20%.

At least the seed grower should be instructed to do so accordingly.

The paddy shed can be constructed easily and economically by using the material available around the seed growers premises. Since it is considered to be the integral part of the collection and control system, the seed growers should be trained to the full extent in the importance of the subject matter.

In general observation, it is assumed that the time of the collection, moisture content of paddy should range between 20% and 16% when it is dried naturally, before it is threshed.

In comparison with the paddy whose moisture content ranges more than 20%, the paddy whose moisture content ranges between 20% and 16% might not be affected by damage, especially that of deterioration of quality within the short-term storage. Accordingly, it is preferable that the threshing shall be done on or just before the date of collection. Also, in this case after threshing, sun drying should absolutely be avoided. For this purpose, the seed grower will be trained to meet the above requirement.

A step chart of the paddy collection system is as shown in ANNEX Fig. 5-2.

At the time of the collection, the following points must be checked:

Moisture content	:	Should be less than 20%
Temperature of paddy	:	Heat damage shall be checked
Damaged paddy if any	:	Other than heat damage
Admixture	:	Content of admixture
Weight	:	As required

In case any damage is found, the faulty material shall be returned to the seed grower.

Payment for the good collected seed shall be made in accordance with quality concerned, for which the unit price is specified.

For example, for a crop season, approximately 60 days shall be assignd for the paddy collection, out of which about 45 days be alotted for actual days for receiving, while another 15 days be scheduled for preparation of machinery and instruments required for variety changes and/or for cleaning operation, including days off due to bad weather (flood damage), holidays; religious holidays inclusive.

A list of the necessary equipment required for weighing and moisture tests at the time of collection is shown in ANNEX Table 5-1.

b) Operation of S.P.C.

The entire picture of the function of the S.P.C., centralizing the silo itself as an integral function, is shown in ANNEX Fig. 5-3.

Since the plan of the operation is scheduled in accordance with the plan of cultivation and the plan of collection complying with the varieties concerned, a daily receiving operation should be made basically on a"one day/one variety" system.

However, in the event where many varieties would be involved, ultimately, there would be an increase in the rate of cleaning which would result in a time loss. Therefore, it is recommended that "a week/a variety" method be applied.

The interior cleaning applicable for the S.P.C.'s machinery shall be arranged so that the cleaning will take about two days, though it depends on the S.P.C.'s capacity. For cleaning, a manual shall be prepared for the complete works. At the same time, check sheets such as cleaning check sheets, shall be used to facilitate the above work.

In order to maintain a successful weight control, adequates weighing machines are installed for the control of receiving and charging of the paddy as well as discharging of it from the silo and other controlling purposes in accordance with the flow of the paddy in processing. For the processed seed, that is intended for storage and inspection purposes, a weighing machine with an automatic sampler should be installed.

On the basis of the silo operation; since receiving, drying, cleaning, packing, storing and delivery are conducted in two stages (periods), the staff will have to work concurrently. Therefore arrangement for job description and duties of the mill supply according to the relevant operation shall be made, as well as an adequate employment and manpower schedule being established.

By increasing number of operators, the series of the above mentioned operation can be achieved in parallel with other necessitated works.

For the operation scheduled on and after the required cleaning, it should be established in accordance with the delivery schedule.

The product, packed in a case containing a total of 60 kg of the seed; in 5~10 kg small bag x 12 small bag/large bag, shall be stored in accordance with the variety.

For delivery and distribution, a truck with a 5 ton capacity, which is used for the collection, shall be employed.

A list of the number of staff and laborers is shown in Annex table 5-2.

5-2-3 Distribution

(1) Distribution system

At present, in Indonesia breeder seeds are delivered to CSFs, foundation seed to MSFs, stock seeds to seed-cultivating farms, and extension seeds to general rice growers (Fig. 5-2) Central or regional government organizations distibute all breeder, foundation, and stock seeds. Though various methods are used for delivering seeds to seed farms and rice growers, in general, farmers obtain seeds directly from related organization or from seed-producing farms. But it carrying out this project it became obvious that, unless this negative distribution system is revised in favor of a positive on operated by official authorities, it will be impossible to stimulate further development of improved-seed cultivation. To this end, official organizations must carry out a thorough program of intensified guidance. And for the distribution of stock seeds to government-designated and commissioned seed farmers, groups of seed farmers should be formed around SPCs (4) which have mobility enabling them to cooperate in distribution. In this way a distribution system that fits most smoothly into the local tradition can be evolved.

(2) Distribution methods

At present, the stipulated amounts of seed per unit of land area are as follows: 25 kilograms for ordinary wet fields, 30 kilograms for tidal fields, and 40 kilograms for dry fields. SPCs pack seed in 5∿10 kilogram sacks to prevent waste after it has passed into farmers' hands. In addition, upon receipt of orders, SPCs or agent deliver seeds directly to agricultural villages, where either the village or the farmer-group organization sees to smooth distribution to individual farmers. ("agent" means branch office of P.T. Pertani or Sang Yang Seri,; KUD; sales agent for seed)

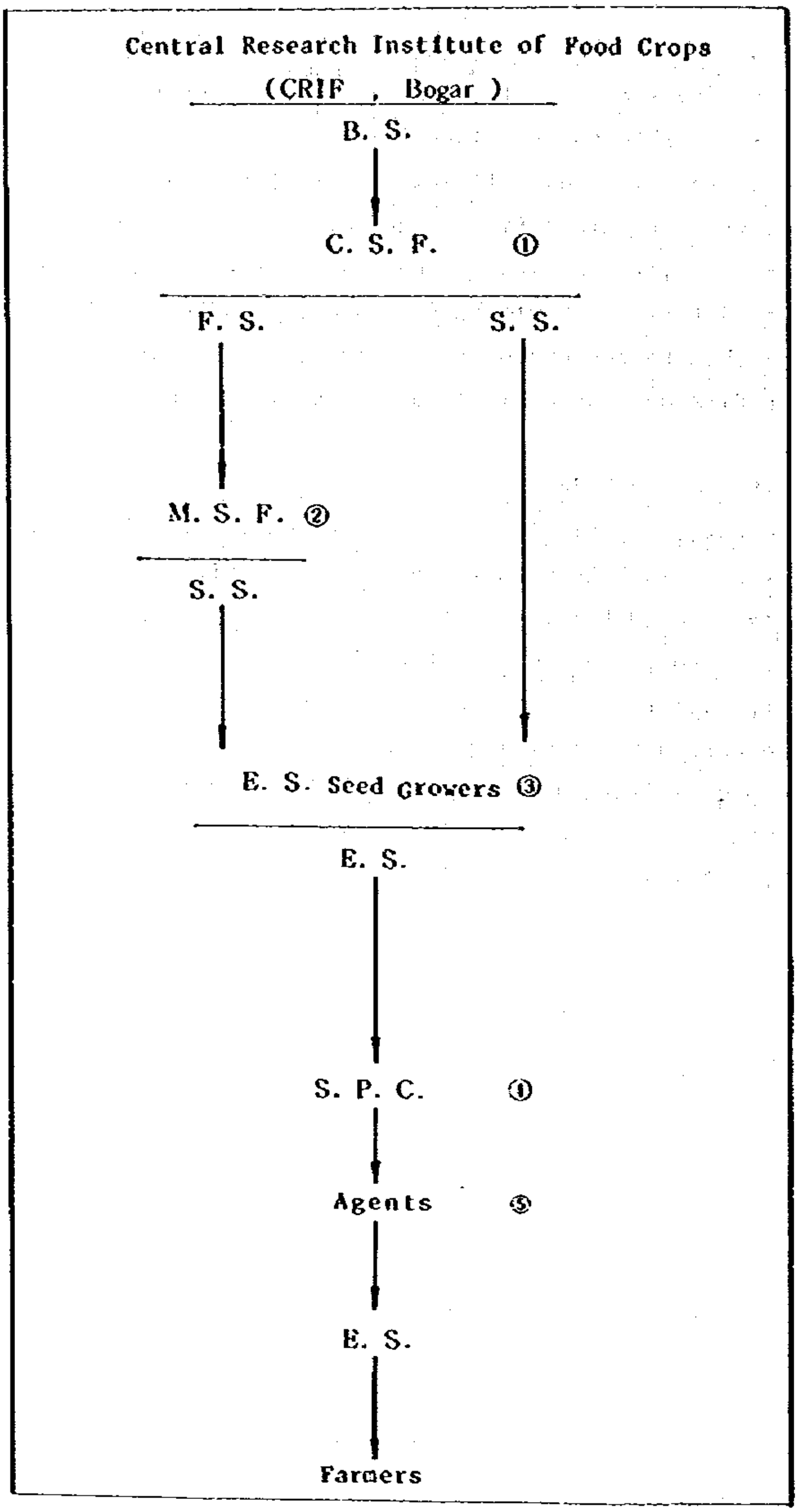

Central Research Institute of Food Crops
(CRIF , Bogar)
B. S.
C. S. F. ①
F. S.
S. S.
M. S. F. ②
S. S.
E. S. Seed Growers ③
E. S.
S. P. C. ④
Agents ⑤
E. S.
Farmers

Fig. 5 – 2

5-2-4 Training

(1) Outline of training (Refer to 5-2-1)

Agricultural improvement and extension activity is very active in Indonesia. In order to make the extension activity much more effective, 20-30 farmers should organize one unit centering on a key farmer which can then be regarded as a neucleus.

In some provinces (for example: Aceh) the key farmers are intensively trained once a year for about 5 days at a location belonging to the extension organization. In addition, farmers join training courses directly, opened in demonstration farms or at assembly halls built in fields. However, the seminar and training is not especially concerned with the production of good seeds.

It is necessary that in order to succeed in the project for production of good seeds, the staff members working for governmental seed farms and the seed producing farmers participate in seminars and training.

(2) Content of Seminar on Seed Production (Refer to 5-2-1)

Speciality of rice seed production which is different from ordinary rice cultivation, seed production methods, maintenance of quality and managing techniques are the subjects scheduled for the seminars and training.

1) The following subject matter is dealt with at each stage for the people engaging in seed production.

Contents

(a) Meaning of extension of good variety:
(b) Management and operation of the seed production project.
(c) Management and system of seed growing
(d) Seed control and marketing

Methods

Inspection of advanced areas and carrying out of short course training for about one month.

2) The subject matter and method of training for members of Central Seed Farms (C.S.F.) and Main Seed Farms (M.S.F.) are as follows.

Content:

(a) The technique of seed growing and production.
(b) Introduction of seed variety, evaluation of productivity and study of testing methods.
(c) Management of good varieties and discrimination of hybrids.
(d) Crop protection and policy thereof.
(e) Policies for maintenance of soil fertility.
(f) Method of extension and policy thereof.

Methods:

Trainings is carried out once a year by specific professional organs in Indonesia. While, seminars are held by domestic specialists or with the cooperation of specialists from abroad, training in foreign countries is also considered as a possibility. A period of 6-10 months for training is desired.

3) The content matter of the seminars and training for seed growers and the way of training are as follows.

Contents:

(a) Special characteristics of good varieties
(b) Preparation of fields for seed production.
(c) Seed cleaning for seed production.
(d) The way of sowing in nurseries.
(e) The way of fertilizing.
(f) The way of management for seed production.
(g) Harvest, preservation and control of crops in good condition.

Methods:

Training is mainly held once a year in the agricultural off season at district training centers belonging to the Central Seed Farm (C.S.F.).

The training period is a maximum of 5 days and the trainees will be the representatives of the groups of seed growers, however the maximum number of participants is limited to about 30 at one time.

In addition, the cultivating conditions of seeds in each area must be studied enough so that seminars held in fields run smoothly and efficiently.

4) Curriculum and training method for S.P.C's administraitive officers

Items:

a) Assignment and responsibility of S.P.C. and significance of improved seed

b) Coordination/adjustment of production of improved seed

c) Method of S.P.C.'s administration (see 5-2-2)

i) Collection system

employment

ii) SPC.'s work system

iii) Distribution system

d) Method for Operation of Facilities

i) Basic theory of each function

ii) Hundling method

iii) Repairing work and remedies

Method:

Detailed and precise training shall be made for each of S.P.C. staff concerned jobwisely by either consultant or supervisor who shall assigned during construction of S.P.C. and/or initial stage of its start up.

Special consideration must be paid on training and education of staff for concerning with assignment and responsibility of S.P.C. where the improved seed is proposed to be made.

5-2-5 Seed Control and Certification Service (SCCS)

SCCS was duly established as one of the measures for development of seed production and distribution system organized by the Indonesian Government and its objective is to give a guidance, and to conduct inspection and certification in the process of production and distribution of seeds for quality control.

The objective of establishment of the service was proclaimed by President Decree No.72 of 1971 and the outline of SCCS was described in the Agricultural Ministerial Decree 174/KPTS/ORG/4 issued in the same year and the contents of the system and activity were described in detail in the Ministerial Decree 529/KPTS/ORG/8 of 1978.

(1) Organization

The activity of SCCS is authorized to Director General of Food Crops Agriculture.

The administration offices and laboratories have been installed in 13 provinces including 3 provinces where the project are being carried out, and a central laboratory locates in Pasar-Minggu to guide and supervise the techniques concerned.

The number, location and districts concerned are as follows.

SCCS No.	Location	Supervised district
VIII	Tanjungkarang	Lampung Province
IX	Palembang	South Sumatera Province and Bengkulu
XII	Banda Aceh	Aceh-Province

(2) Inspection and supervision

The objective items of SCCS are seeds such as rice, maize, soybeans and horticultural seeds.

Concretely speaking, the activities of the organization are:

(a) Assessment of seeds (b) Seed tests at laboratories

(c) Issue of seed quality certificate (d) Supervision of distributed seeds.

The test items of rice-seeds at laboratories are certification of variety germination rate, germinating conditions, purity, sound kernel ratio and weight (weight of 1,000 kernel) and tests are conducted in accordance with the regulation of Agricultural Ministrial Decree I, A5, 79 and 54. In order to certify the quality of seeds harvested and processed seeds as samples at seed farms are tested then certificates are issued for good seeds.

The certified seeds are packed at 5 kg or 10 kg each, and 12 packages for 5 kg (6 packages for 10 kg) are put into a bigger bag and distributed. Labels which have different colors according to F.S., S.S. and E.S. are attached and the results of tests for necessary items are mentioned therein.

(3) Based on the team's observation, the objective provinces still need improvement of staff activities, facilities and equipment in order to achieve the objective project. The present staff and laboratories in the provinces are mentioned hereunder: D.I. Aceh has approximately twenty (Target Eighty) staff members and its laboratory, Lampung has approximately thirty five (Target Eighty) staff members as well as its laboratory, but according to the staff the new laboratory will be set up in near future.

In respect of South Sumatera, they are approximately forty (Target One Hundred) staff members and a laboratory has not been provided yet, so that at present the existing laboratory (Belitang) is being used as a SCCS laboratory.

Out of 13 provinces where the activities of SCCS, have been already started and administration offices are under operation, implement and facilities of laboratory in Jawa Island have been developed, whereas the activities have been just started in outer districts.

Even in three(3) objective provinces, it has really started in 1981 and staff members, equipment, facilities, implements and vehicles for activities use are being arranged and adjusted and sufficient adjustment are desired in accordance with progress of project in future.

5-2-6 Consultant

The Project Mainly consists of civil work, design of seed farms, construction of structure, supply of required machinery and installation of facilities concerned.

It is recommended that for the entire works such as construction design, preparation and evaluation of tender, supervisory/consultant works required for implementation, a capable consultant team consisting of specialists and expert engineers shall be assigned.

5-3 Project phasing

The Project implementation would be phased over a five year period, as seen in the following Table 5-1. Since the target year of the project is set at 1988, civil works for CSF and MSF should be initiated in early 1983. Otherwise FS could not be produced within the third year of the project. On the other hand the construction of the SP plant will be completed by the fifth year of the project, before ES production starts.

The distribution of the project seeds to rice farmers will start in the sixth year of the project, while the seed processing will begin in the fifth year of the project.

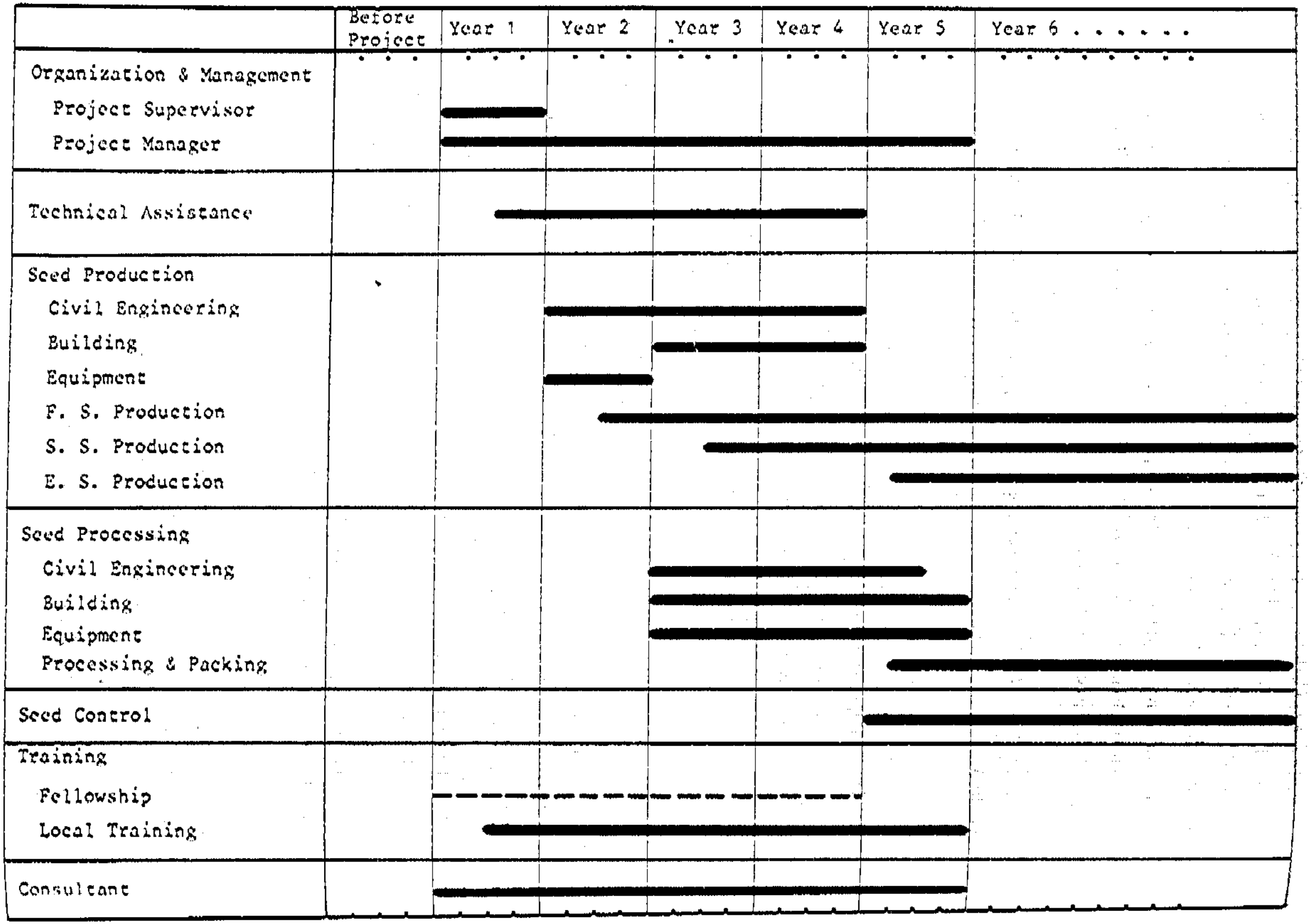
The allocation program for the investment costs, fellowship and training costs by year are indicate in ANNEX Table 4-28 in detail. They are relating to the project phasing.

And the recurrent costs of the project will be expend from the first year because staff wages and salaries will need to be paid, and then the running costs and maintenances for facilities, buildings and vehicles will be needed. Most of the recurrent costs begin to run out from fourth year of the project. From the fifth year, all expenses of recurrent costs will be regularized.

The working capital should be prepared by the seed processing enterprise within the fifth year of the project despite of being included in the project costs.

The allocation of the recurrent costs by year are shown in ANNEX Table 6-3.

Table 5-1 Phasing of Project Actions



CHAPTER VI PROJECT COSTS AND FINANCING

CHAPTER VI PROJECT COSTS AND FINANCING

6-1 The individual work, such as construction seed production and training concerned, for each scale of work and project cost is duly described in chapter 4, paragraph 5. Therefore in this chapter the entire project costs and financing are to be summarized as follows:

At the 1982 price, the total costs of the Rice Seed Production and Distribution Project are estimated at 31,197 million Rp, including about 60 million Rp of additional costs are estimated for the Central Cold Seed Storage in Jakarta. Total project costs 31,197 million Rp include 16,639 million Rp in foreign currency (US $ 25,442,000 or Japanese Yen 5,942 million) and 14,558 million Rp in local currency. Foreign currency has share of 53%.

Total costs include not only investments and recurrent costs but also costs of local training and Central Seed Cold Storage, as well as costs of the consulting work to complete the entire project.

The details are shown in ANNEX Table 6-1 but a brief summary is as follows:

Components of The Whole Costs of Project at 1982 price

	Local		Foreign		Total	
	Value million Rp	%	Value million Rp	%	Value million Rp	%
Investment*	13,115	90.1	15,135	91.0	28,250	90.6
Recurrent*	688	4.7	0	0	688	2.2
Training	132	0.9	0	0	132	0.4
Central seed cold storage*	3		57	0.3	60	0.2
Consultant	620	4.3	1,447	8.7	2,067	6.6
Total	14,558	100.0	16,639	100.0	31.197	100.0

* Physical contingency is included

The cost estimates are based upon the price at the end of February 1982, when the survey was conducted, and each conversion rate of US$, Japanese Yen and Indonesian currency is as follows:

1 US$ = 654 Rp.   1 Japanese Yen = 2.8 Rp.

The cost estimate made for the investment is based upon the data prepared by the Central, Local Governments, local contractors and suppliers of the equipment as well as the international agents for machinery, where applicable unit costs and quantities for different items are given. The costs of imported items are expressed in CIF of Jakarta with additional allowance for local transportation which is calculated in local currency.

The Cost of the machinery scheduled to be produced in Indonesia under the joint venture including vehicles, and agricultural equipment, is calculated based upon wholesale prices to which local trnsportation charges have been added. However, transportation costs are included in Indonesian Local currency whereas the cost of wholesale machinery is included in foreign currency.

Ten (10) percent of the total project costs is alloted for physical contingencies while price escalation during the project years have been omitted from project costs estimation and no interest charges, public duties or taxes during construction have been made due to it being a governmental project.

The costs of procurement of the proposed land have been excluded from the project costs, as the land allocated for the project are State properties.

Consultant costs have been estimated based upon the previous results, and include technical design, tendering and service charges involved for the civil works, construction of structures and facilitation of machinery required. Ultimately 70% foreign and 30% local currency are estimated for the consultant costs.

Operational costs are estimated for seed production of the necessary F.S and S.S as well as seed processing and control.

Moreover, all the operational costs, costs of fuel, repairing and maintenance of the facilities as well as labor charges and salaries of the staff concerned are included, whereas the amount of depreciation of the investment costs and working capital costs required for procurement of E.S., are excluded.

The cost estimates of staff salary and labor charges for F.S and S.S. are based on the data prepared by the Local and Central Governments, while the costs of fuel, repairing and maintenance of the facilities and other expenditures are based upon the data and statistics supplied by experts.

Also for this operational cost of the project a 10% physical contingency is given against the total cost of the project, while a price escalation has not been estimated in this stage.

Since the production of E.S. is carried out by the seed growers upon request by the Local governments concerned, all the expenditures (costs) are deemed not to be included in the Recurrent costs of the project. However, this relates directly to the economic benefits of the project of which details are described in the next chapter.

Production Cost of E.S.

(Rp. 1000)

Province	Lowland Rice	Upland Rice	Tidal Rice	Total
Aceh	205,226	51,592	-	256,818
South Sumatera	50,550	157,271	71,097	278,918
Lampung	176,294	141,235	-	317,529
Total	432,070	350,098	71,097	853,265

Note: Based on 1982 price

Source: The Provincial Agricultural Services

The cost estimates of local training are made based upon travelling expenses, teaching material for which relevent data are supplied by the Government of Indonesia.

Number of required trainees, duration of training are detailed in Chapter 4. Local training costs will be included in local currency.

Finally, costs of the Central Cold Seed Storage shall include costs of facilitation and rehabilitation of the existing storage houses as accounted for in the investment, and the operational costs which include electric power have been estimated based on the data available from the Local Government.

Costs estimated for cooler systems are based on a C.I.F. value calculated in foreign currency while operational costs are included in local currency.

6-2 Estimation on the Project Costs with Price Escalation

All of the costs described above and in chapter four (4) and former section (6-1) are estimated based on the price level established as of February, 1982. However, the project will be conducted over 5 years and its target is set a 1988.

Moreover, construction and civil works will commence in and after 1983 and it is assumed that a price fluctuation will occur in the meantime for which an appropriate price adjustment will be necessary.

The price index used for revision of the part of the project cost belonged to foreign currency is obtained from IBAD's data, while the project costs depend on local currency were adjusted by Indonesian consumers price index forecasted.

The both price indices used for the revision are shown as below:

Price index (Forecast)

Year	International Price	Domestic Price
1982	100.0	100.0
1983	107.1	114.9
1984	114.3	132.2
1985	121.7	152.0
1986	129.3	174.8
1987	137.3	201.0
1988	145.6	231.1
1989	154.1	265.8
1990	162.9	305.6

Remarks: 1. International price index is fixed in accordance with World Bank's basic price forecast in 1980.

2. As domestic price escalation rate, 15% is estimated in accordance with basic consumers price index in 1977 - 78 base.

The project costs after price adjustment are indicated in the table below. The total costs of the project for three provinces are estimated at 45,896 million Rp with 20,921 million Rp of foreign currency, include the recurrent costs amount to 1,383 million Rp a year in the target year.

Summary of the Project Cost based on Actual Prices

(Exclude Central Seed Cold Storage)

million Rp

	Local	Foreign	Total
A. Investments	22,547.8	19,224.8	41.772.6
Civil works	2,222.9	1,264.0	3,486.9
Buildings	17,613.2	5,584.3	23,197.5
Equipments	661.9	10,048.7	10,710.6
Vehicle	0	580.1	580.1
Physical Contingency	2,049.8	1,747.7	3,797.5
B. Recurrent Costs	1,382.6	0	1,382.6
C.S.F., M.S.F.	247.9	0	247.9
S.P.C.	1,004.7	0	1,004.7
Seed Control	4.3	0	4.3
Physical Contingency	125.7	0	125.7
C. Local Training	204.8	0	204.8
D. Consultant fee	840.6	1.695.9	2,536.5
G. Total	24,975.8	20,920.7	45,896.5

Cost of Central Seed Cold Storage

1000 Rp

	Local	Foreign	Total
A Investment Costs	2,587	69,194	71,781
B. Recurrent Costs	2,383	0	2,383
C. Consultant fee	2,232	5,025	7,257
G. Total	7,202	74,219	81,421

Remarks: Investment Costs and Recurrents Costs include physical contingency.

On the other hand, the costs for central seed cold storage are estimated at 81 million Rp with 74 million Rp of foreign currency.

Outside above costs, working capital for E.S. collection and E.S. production cost are required. The working capital is shown in ANNEX Table 6-3.

CHAPTER VII

ECONOMIC ANALYSIS AND FINANCIAC ANALYSIS

7-1 Economic Benefit of The Project

The economic returns resulted from the project is the increase in rice production which was caused by culutivating the good varieties newly produced and distributed and the increase in income due to incremental amounts of rice.

The increase in rice production comes from two areas. One is the increase in the area where improved varieties are already cultivated and the other is the increase in the area where local varieties are still cultivated.

The area of improved varieties and local varieties by low-land rice, upland rice and tidal rice in target year, by 1988, are forecasted on the basis of data presented by the Agricultural Services of the objective provinces, they are shown in the ANNEX Table 7-1.

On the other hand, the yield per ha which is expected by replacing the traditional seeds with project seeds is estimated in accordance with opinions of agronomy specialists and breeding specialists together with the results of field surveys and thus comparing it with the actual rice production made by farmers in objective areas as shown in the following table.

Existing rice yield and expected yield

ton/ha

Province	Low-land rice			Up-land rice			Tidal rice		
	Existing		Ex-pected	Existing		Ex-pected	Existing		Ex-pected
	Improved variety	Local variety		Improved variety	Local variety		Imporved variety	Local variety	
Aceh	4.50	3.20	4.50	-	2.00	2.30	-	-	
South Sumatera	4.16	2.70	4.20	-	1.50	2.20	3.00	2.10	3.10
Lampung	3.92	2.50	4.00	-	1.30	2.20	-	-	

Remarks: Existing yield was estimated on the basis of the data of the Provincial Agricultural Services and the result of field surveys.

The replacement effect of improved seed has been calculated on the basis of standard yield of Common BIMAS

The expected yield of rice mentioned here is to be yield expecting from the replacement the traditionally cultivated improved varieties with project seeds, and the cultivation operated by the following methods for improved rice seeds based on the Intensification program of Indonesia, namely, main input such as fertilizers and agricultural chemicals are used and management practices are employed with same way except seedling. Therefore, the production is not so big as compared with the improved varieties which have been positively cultivated by farmers, but it is naturally larger than that of local varieties.

The difference between expected yield and existing yield is the increase in rice production which is to be obtained by this project. The Inclemental amounts of rice in production can be calculated with multiplying the forecasted area by above yield. The yearly result is about 549,000 tons as shown in (ANNEX Table 7-2).

In the case of international commodity, the shadow price is adopted for the price which is used for estimation of gross revenue (ANNEX Table 7-4). However, Indonesia has established a rice procurement organization and adjusted the demand and supply, and controlled the floor prices of paddy and milled rice. These floor prices are used for estimation of the gross receipt from inclemental paddy production in this project. The price level in the target year is estimated to be 147.7 Rp per kg (ANNEX Table 7-5).

On the other hand, the net receipt was arrived at multiplying above gross receipt by the profit ratio of paddy production per ton.

The profit ratio was estimated by the data on paddy production costs, as the following table.

Profit ratio of paddy per ton after project

Provinces	Low-land Paddy	Up-land Paddy	Tidal Paddy
	%	%	%
Aceh	56.6	33.3	-
South Sumatera	51.5	30.2	44.6
Lampung	49.4	30.2	-

If the value of increase in the net receipt of rice is regarded as being the net benefit in the project, the annual benefit which occur after the target year is 15,343 million Rp for Aceh, 9.695 million Rp for South Sumatera and 11,759 million Rp for Lampung, the total being 36,797 million Rp ($56.3 million or Yen 13.1 million at 1982 price.) (ANNEX Table 7-3(2).

7-2 The balance of economic expense and benefit

As an economic expense, E.S. production consist and E.S. purchase found are further added to the entire expense of the project (but, excluded Central Seed Cold Storage costs) mentioned in Chapter XI.

The economic benefits of the project arise after the project seeds, newly prepared dominant E.S. are processed and distributed.
But one thirds of the objective area is renewed in the first year when the E.S. appeared then next two thirds will be renewed in the second year and finally whole area is renewed in the third year.

Accordingly the revenue in the first year will be 1/3, in the second year will be 2/3 and whole revenue will be achieved in the third year.

The yearly balance of revenue and expense is shown in the ANNEX Table 7-7.

The project term concerned to economic costs and benefit is settled as 20 years by taking consideration of the working life of the seeds processing center and mechanical equipment as 15 years after the completion of construction. Including construction and rehabilitation of seed farms and S.P.C. that is about 5 years, the total of the project period amounts to 20 years.

7-3 Economic Internal Rate of Return and Sensitivity Analysis

In case the project term is 15 years after construction and rehabilitation are completed, the economic internal rate of return (EIRR) of the project is 36.5%. This is lower than 50% over in both projects of Seed I and Seed II Project which have been prepared, by IBRD before. However it is larger than 32%, interest rate of the commercial bank, which is regarded as the highest in Indonesia (Refer to the following table).

Interest rate of various banks in Indonesia

	per month %	per year %
Commercial Bank	2.55	31.87
Government Bank	1.78	22.25
BIMAS Credit	1.25	15.0

Accordingly, it can be said the project is economically beneficial.

In the economic sensitivity analysis of the project;

(1) in case the investment costs increase by 30%, EIRR is 31%.
(2) in case the benefits decrease by 20%, EIRR is 30%
(3) in case the construction period is delayed several years internal rate of return is seldom influenced, consequently, the project does not seem to be economically unstable.

7-4 Financial Analysis of Project

The seed processing which plays the most important role in the project shall be analyzed from the financial view point.

As the financial report from the operating Sang Hyang Seri seed processing center in Metro-city of Lampung shows in the ANNEX Table 7-8 The E.S. collecting expense including freight per ton is 4,190 Rp, processing and proparation seed expenses are 40,020 Rp making the whole expense accounts for 36.5% of total material expense 121,080 Rp.

The percentage of successfully processed seed amount to all seeds amounts before processing is 71.3% (under 30% for low-land rice and the percentage of the seed processing expenses is 191, about 2 times, in the case that the material expense is 100.).

The price of processed seeds is 83% higher than the ES. buying cost even when the income from its by-products is deducted from seed processing, and transportation costs.

As it is shown in the ANNEX table 7-9 in the project, the ratio of successfully processed seeds to all seeds are 80% for low-land rice and 70% for upland rice. However it has a little higher costs of processing, 51,566 Rp per ton for low-land rice, 51,588 Rp for up-land field, than 40,000 Rp in the case of Sang Hyang Seri.

At present, the Indonesian Government is trying to make producer's price of E.S. higher than the marketing price of ordinary paddy from the view point of the encouragement of seed producers and E.S. processed are distributed at low price as much as possible by taking into consideration the farmer's purchasing power.

Therefore, it is afraid to happen that the seed processing firm is forced to sell seeds in at a loss. It is necessary that the Central Government make good policies for the seed project by taking into consideration of this point.