

Table 7.3.4.25 Comprehensive table for farming types (2/4)
Agricultural development plan area (1)

Note: Balance is calculated on the basis of stable farming years

| Classification of settlers | | Group capable of meeting demand for domestic market | | |
|--|--|---|---|--|
| Farming type | Cotton + sorghum + fruit trees + dairy farming + small-medium livestock farming (sheep) | Cotton + sorghum + fruit trees + dairy farming + small-medium livestock farming (goats) | Fruit trees + dairy farming | Fruit trees + vegetables |
| Number of family members | 3.2 | 3.2 | 3.2 | 3.2 |
| Number of family workers | 2.5 | 2.5 | 2.5 | 2.5 |
| Employed labour force | temporary (271/day), full time (0) | temporary (271/day), full time (0) | temporary (800/day), full time (0) | Employed labour force temporary (300/day), full time (0) |
| Land area size | 60ha | 60ha | 35ha | 15ha |
| Cultivation area size | cotton (9ha), fruit trees (4.5ha), sorghum (9ha), grasslands (27ha), etc. | cotton (9ha), fruit trees (4.5ha), sorghum (9ha), grasslands (27ha), etc. | fruit trees (9ha), grasslands (18ha), etc. | fruit trees (9ha), vegetables (0.9ha), etc. |
| Number of livestock | parous cows 10, breeding cows 40, calves 3, fattening sheep 16, mature ewes 1, breeding sheep 14, lambs 35, stud rams 1 | parous cows 10, breeding goats 30, calves 3, goat kids 4, mature female goats 1, breeding goats 111, fattening goats 15, stud male goats 1 | parous cows 10, breeding cows 3, calves 1 | |
| Farming balance (US\$1,000) | Gross income (17), (agriculture 10, livestock 7) Farming costs (10), (agriculture 5, livestock 5) Farm income (7), (agriculture 4, livestock 3) | Gross income (17), (agriculture 10, livestock 7) Farming costs (10), (agriculture 5, livestock 5) Farm income (7), (agriculture 4, livestock 3) | Gross income (26), (agriculture 19, livestock 6) Farming costs (8), (agriculture 5, livestock 3) Farming income (17), (agriculture 14, livestock 3) | Gross income (27), (agriculture 27, livestock 0) Farming costs (6), (agriculture 5, livestock 1) Farm income (22), (agriculture 22, livestock 0) |
| Machines to be used | Tractor, disk plough, disk harrow, wagon, seeding machine, broadcaster, digging machine, rotary cutter, electric generator, roller, fence tensioner | Tractor, disk plough, disk harrow, wagon, seeding machine, broadcaster, digging machine, rotary cutter, electric generator, roller, fence tensioner | Tractor, disk plough, disk harrow, wagon, seeding machine, broadcaster, digging machine, rotary cutter, electric generator, roller, fence tensioner | Tractor, disk plough, disk harrow, wagon, seeding machine, broadcaster, digging machine, rotary cutter, electric generator, roller, fence tensioner |
| Facilities | Sheep house, farm tools, material warehouse, storage house, milking house, paddock, fence, tajamar reservoir, drinking pool, windmill, water pipe | Goat house, farm tools, material warehouse, storage house, milking house, paddock, fence, tajamar reservoir, drinking pool, windmill, water pipe | Farm tools, material warehouse, storage house, milking house, fence, tajamar reservoir, paddock, drinking pool, windmill, water pipe | Farm tools, material warehouse, storage house |
| Area targeted for development plan and number of settling households | eastern Mennonite settlements 20, southern Mennonite settlements 20, northern Pozo Colorado 40, subtotal 80 | eastern Mennonite settlements, 20 southern Mennonite settlements, 20 northern Pozo Colorado, 40 subtotal 80 | suburbs of Asuncion 90, subtotal 90 | suburbs of Asuncion 100, subtotal 100 |
| Remarks | (1) Specialized farming from the outset (2) Estimation for fruit trees is based on sweet oranges and macadamia nuts. (3) Fruit trees = sweet oranges, mandarins, grapefruit, bananas, papaya, pineapples, mango, and macadamia nuts. | (1) Specialized farming from the outset (2) Estimation for fruit trees is based on sweet oranges and macadamia nuts. | (1) Estimation for fruit trees is based on bananas and pineapples. | (1) Estimation for fruit trees is based on and pineapples. (2) Estimation for vegetables is based on watermelons and cabbages (3) Vegetables = watermelons, melons, tomatoes, cabbages, garlic, asparagus and cucumbers. |

7.3.5 Trial research and agricultural support

1) Trial research plan

(1) Basic direction

The Chaco region is characterized by such natural conditions as high temperature and many low wetlands. Thus, it is important to establish a production technology system based on trial research taking these natural characteristics into account in order to develop it as a new agricultural and grazing zone.

In Paraguay, since a trial research system on agriculture and livestock farming was established with a focus on the eastern part targetted for early development, the development of the western region including some areas targetted for development by the plan has been lagging behind on the whole. In the agricultural field, a Chaco Central Testing Station (EECC) was recently established with assistance from Germany, while in the livestock farming sector there is the Chaco livestock farming testing station to which Japan has been giving technical assistance. The newly established EECC is particularly provided with excellent facilities and thus it can be considered as the core trial research centre in agriculture for the entire Chaco region.

Therefore, this EECC should be made responsible for research on agriculture needed for the promotion of the integrated development plan, and the establishment of any new agricultural facilities need not be considered in this plan.

In the case of trial research in livestock farming, however, the existing Chaco livestock farming experimental station is not strong enough. Therefore, efforts should be made to refine it and to newly create stud ranches for the development of livestock farming in the entire Chaco region. Also, these ranches should be required to carry out basic research on the improvement of livestock and supply excellent stud animals, semen for artificial insemination, and so on, based on the results of the research.

Further, for the materialization of the integrated development plan, it is especially important to refer to the excellent production system and organizational structure developed in the Mennonite area and to gain cooperation and assistance from the settlers there.

All concerned experimental research institutes and agriculture and livestock farming assistance organizations are described in fig. 7.3.5.1.

Table 7.3.4.25 Comprehensive table for farming types (3/4)
Agricultural development plan area (2)

| Classification of settlers | Group capable of meeting demand for domestic market | | | indigenous people | |
|-----------------------------|---|--|---|--|--|
| | Cotton + sorghum + fruit trees + dairy farming + small-medium livestock farming (sheep) | Cotton + sorghum + fruit trees + dairy farming + small-medium livestock farming (goats) | Cotton + sorghum + fruit trees + dairy farming + small-medium livestock farming (sheep) + apiculture | Fruit trees + dairy farming cotton + small-medium livestock farming | Fruit trees + vegetables |
| Number of family members | 3.2 | 3.2 | 5 | 5 | 5 |
| Number of family workers | 2.5 | 2.5 | 4 | 4 | 4 |
| Employed labour force | temporary (271/day), full time (0) | temporary (271/day), full time (0) | temporary (800/day), full time (0) | temporary (300/day), full time (0) | temporary (300/day), full time (0) |
| Land area size | 60ha | 60ha | 10ha | 10ha | 10ha |
| Cultivation area size | cotton (9ha), fruit trees (4.5ha), sorghum (9ha), grassland (27ha), etc. | cotton (9ha), fruit trees (4.5ha), sorghum (9ha), grassland (27ha), etc. | cotton (0.9ha), grassland (5.3ha), etc. | cotton (0.9ha), grassland (5.3ha), etc. | fruit trees (10ha) |
| Number of livestock | parous cows 10, breeding cows 40, calves 3, fattening sheep to be fattened 16, mature ewes 1, breeding sheep 14, lambs 35, stud rams 1 | parous cows 10, breeding cows 30, calves 3, goat kids 4, mature female goats 1, breeding goats 111, fattening goats 15, stud male goats 1 | mature ewes 15, fattening sheep 4, stud rams 10, breeding sheep 4, lambs 0.5, honey bee swarms 5 | mature ewes 15, fattening sheep 4, stud rams 10, breeding sheep 4, lambs 0.5, honey bee swarms 5 | None |
| Farming balance (1,000US\$) | Gross income (17) (agriculture 10, livestock 7) Farming costs (10) (agriculture 5, livestock 5) Farming income (7), (agriculture 4, livestock 3) | Gross income (17) (agriculture 10, livestock 7) Farming costs (10) (agriculture 5, livestock 5) Farming income (7), (agriculture 4, livestock 3) | Gross income (1.6) (agriculture 0.5, livestock 1.1) Farming costs (0.8) (agriculture 0.3, livestock 0.5) Farming income (0.8), (agriculture 0.2, livestock 0.6) | Gross income (0.9) (agriculture 0.9, livestock) Farming costs (0.3) (agriculture 0.3, livestock) Farming income (0.6), (agriculture 0.6, livestock) | Gross income (0.9) (agriculture 0.9, livestock) Farming costs (0.3) (agriculture 0.3, livestock) Farming income (0.6), (agriculture 0.6, livestock) |
| Machines to be used | Tractor, disk plough, disk harrow, wagon, sprayer, digging machine, rotary cutter, electric generator, fence tensioner, mower | Tractor, disk plough, disk harrow, wagon, sprayer, digging machine, rotary cutter, electric generator, roller, fence tensioner, mower | None | None | None |
| Facilities | Sheep house, farm tools, material warehouse, storage house, milking house, paddock, fence, tajamar reservoir, drinking pool, windmill, water pipe | Goat house, farm tools, material warehouse, storage house, milking house, paddock, fence, tajamar reservoir, drinking pool, windmill, water pipe | Watch house, farm tools, material warehouse, house, fence, tajamar reservoir, drinking pool, windmill | Watch house, farm tools, material warehouse, house, fence, tajamar reservoir, drinking pool, windmill | Farm tools, material warehouse |
| Area targeted for plan | eastern Mennonite settlements 155, southern Mennonite settlements 160, northern Pozo Colorado 280, subtotal 595 | eastern Mennonite settlements 155, southern Mennonite settlements 160, northern Pozo Colorado 280, subtotal 595 | eastern Mennonite settlements 150, southern Mennonite settlements 70, northern Pozo Colorado 80, subtotal 300 | eastern Mennonite settlements 150, southern Mennonite settlements 70, northern Pozo Colorado 80, subtotal 300 | suburbs of Asuncion 200, subtotal 200 |
| Remarks | (1) With a side business at first (2) Estimation for fruit trees is based on sweet oranges and macadamia nuts. | (1) With a side business at first (2) Estimation for fruit trees is based on sweet oranges and macadamia nuts. | (1) Interest to be paid and taxes are 0 | (1) Interest to be paid and taxes are 0 | (1) Interest to be paid and taxes are 0 (2) Estimation for fruit trees is based on sweet oranges |

Table 7.3.4.25 Comprehensive table for farming types (4/4)
Livestock farming development plan area

| Classification of settlers | Group capable of individual development | | Indigenous people | |
|-----------------------------|--|--|--|--|
| | Beef cattle specialized farming | Beef cattle specialized farming | Small-medium livestock farming + apiculture | |
| Farming type | 3.2 | 3.2 | 5 | |
| Number of family members | 2.5 | 2.5 | 4 | |
| Number of family workers | temporary (500/day), full time (4) | temporary (260/day), full time (0) | temporary (/day), full time (0) | |
| Employed labour force | 5,000ha | 2,000ha | 14ha | |
| Land area size | grassland, etc. (3,195ha), sorghum (180ha) | grassland, etc. (1,278ha), sorghum (72ha) | grassland, etc. (9ha) | |
| Cultivation area size | mature cows 1,500, fattening cows 1,672, stud bulls 670, breeding cows 78, calves 516, horses 30 | mature cows 600, fattening cows 669, stud bulls 268, breeding cows 31, calves 206, horses 12 | mature ewes 20, fattening sheep 5, stud rams 14, breeding sheep 5, lambs 1, bee swarms 7 | |
| Number of livestock | | | | |
| Farming balance (1,000US\$) | Gross income (299) (agriculture, livestock 229) Farming costs (143) (agriculture, livestock 143) Farming income (86) (agriculture, livestock (86)) | Gross income (91) (agriculture, livestock 91) Farming costs (60) (agriculture, livestock 60) Farming income (32) (agriculture, livestock 32) | Gross income (1.6) (agriculture, livestock 1.6) Farming costs (0.7) (agriculture, livestock 0.7) Farming income (0.8) (agriculture, livestock 0.8) | |
| Machines to be used | Tractor, disk plough, disk harrow, wagon, broadcaster, digging machine, sprayer, water pump, forage harvester, rotary cutter, electric generator, roller, fence tensioner, truck | Tractor, disk plough, disk harrow, wagon, broadcaster, digging machine, sprayer, water pump, forage harvester, rotary cutter, electric generator, roller, fence tensioner, truck | None | |
| Facilities | Watch house, farm tools, material warehouse, fence, tajamar reservoir, collar, drinking pool, silo, windmill, rain water storage tank, ground tank | Watch house, farm tools, material warehouse, fence, tajamar reservoir, collar, drinking pool, silo, windmill, rain water storage tank, ground tank | Watch house, material warehouse, fence, tajamar reservoir, drinking pool, windmill | |
| Area targetted for plan | livestock farming development plan area 620 sub total 620 | livestock farming development plan area 620 | livestock farming development plan area 1640 | |
| Remarks | | | (1) Interest and taxes to be paid are 0 | |

(2) Expansion of Chaco Livestock Farming Testing Station

a) General conception

In the area targetted for development by the plan, there is a Chaco livestock farming experimentation station existent in the vicinity of Pozo Colorado. Because of its location, it can be the centre for research on livestock farming for the entire Chaco region. It has been able to get assistance from Japan. For it to perform its function fully as a central organ, however, much work is still needed, such as the distribution of personnel, the provision of facilities, and so on.

Therefore, the expansion and improvement of this station should be included in the plan so that a research system for production technology concerning livestock farming can be improved. Further, this station is required to play a leading role in training held at the "Farmer's training centre" so as to disseminate its research results to farmers.

b) Organizational function and system

Each expert researcher is allocated to the following three departments: "Grassland, forage crop department", "Livestock husbandry management department", and "Livestock hygiene department". Experimental research in each field are carried out in accordance with the organizational research plan. As for the research system, a method for research based on groups divided according to subject matters should be adopted and staff exchanges with outside organs including those in neighbouring countries and the acceptance of their research should considered.

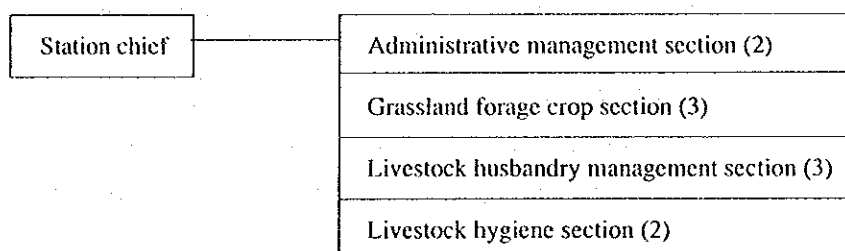


Fig. 7.3.5.2 Organizational structure of Chaco Livestock Testing Station

c) Subjects for trial research

The principal role of this station is to carry out basic research on technical problems limiting the growth of livestock farming in the Chaco region. It is necessary to forecast problems likely to occur as livestock farming progresses and to deal with them as they arise. Basic research areas, however, can be set. These set areas are as follows.

(i) Grassland and forage crop area

- Basic information about natural grassland and forest ecosystem, testing and development of environment preservation technology
- Testing and development of grazing utilization technology and of technology to deal with miscellaneous trees and weeds giving consideration to natural ecosystems
- Testing and development of methods for establishing improved grassland and of technology to utilize artificial grassland
- Testing and research on the selection of pasture varieties, pasture cultivation technology, livestock farming methods, etc.
- Development of forage adjustment and storing technology, testing and research on forage nutrition, preference, etc.
- Testing and research on livestock housing, grassland utilization and others

(ii) Livestock husbandry management area

- Testing and research on environment adaptability of livestock, forage suitability, etc.
- Testing and research on livestock physiology, nutrition, forage supply, forage nutrition, etc.
- Testing and research on livestock farming method, livestock husbandry method, etc.
- Testing and research on honey bee physiology and breeding methods, testing and research on melliferous plants
- Experimentation and research on other related techniques

(iii) Livestock hygiene area

- Testing and research on methods for curing and preventing diseases
- Provision of information on diseases, etc., to related organs and farmer's associations

d) Contents of improvement

This station possesses land of about 3,200ha (mainly grassland), on some of which artificial grassland has been established for pasture cultivation testing. Thus, it suffices as a field for testing and research. Improvement should be centred on research facilities and the provision of machines (for details, refer to Tables 7.3.5.4-1, 7.3.5.8-1, and fig. 7.3.5.10).

(Improvement of facilities)

- Management
- Research house, lodgings for staff, livestock breeding house, farm machine warehouse
- Weather observation facilities, others (*current management house, agricultural facilities will be changed to lodgings for staff, hay house, warehouse, so on)

(Machine)

- Vehicle and truck for communication, tractor, bulldozer, others
- Grassland preparation machine, a set of forage, livestock management machines

(Field)

- Forage field, improved grassland, natural grassland

(Livestock)

- Beef cattle, dairy cattle, small-medium livestock, bees

(Machinery)

- A set of disease diagnosing, curing equipment and forage analyzing equipment
- A set of machines and equipment for testing and research
- A set of equipment for desk work

(3) Setting up of stud livestock ranch

a) General concept

Livestock improvement is most important for increasing the productivity of livestock farming, especially in the case of small-medium scale farming adopting dairy farming, etc., as in the integrated plan.

Livestock improvement can only be possible by a long period of a meticulous planning and thus this is the area where the national testing research institute usually plays a leading role. In Paraguay, research in this field has been carried out mainly by the San Lorenzo stud ranch under the research agency of the Ministry of Agriculture and Livestock. But it is still on a small scale.

The amount of fine livestock and semen for artificial insemination supplied to farmers by stud ranches and artificial insemination centres is small, and thus much of the supply is dependent upon private breeders. Especially in the Chaco region, an organizational system for trial research, stud supply, and so on for livestock improvement has yet to be established.

Therefore, stud livestock ranches should be set up for supplying fine studs and semen while experimental research should be promoted in the Chaco region.

b) Function and system of organization

At the stud ranches, efforts should be made to select fine varieties suited to the regional environment centring on beef cattle and dairy cattle, to introduce suitable ones from outside, and to improve them by mating. They should also try to produce and supply fine stud males so as to promote livestock improvement efforts in the region. Along these lines, they should produce and supply the farmers with semen for artificial insemination. This will lead to the quick dissemination of fine varieties and the improvement of conception rates. In cooperation with dissemination institutes and the like, training should be given to farmers about propagation techniques.

For these efforts, the organization is divided into the following three parts: "Livestock improvement section", "Stud livestock production section", and "Supply and sales section".

Stud livestock and semen for artificial insemination will be sold to farmers inexpensively, although some profit can be gained by the "stud livestock section".

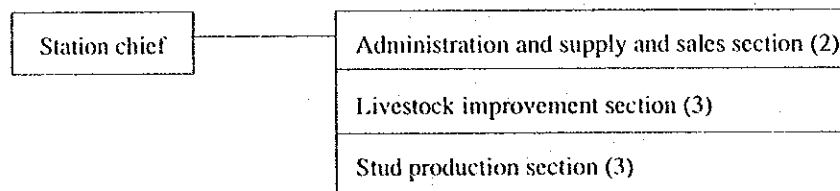


Fig. 7.3.5.3 Organizational structure of stud ranches

The "Livestock improvement section" is regarded as a basic research section, and in future it will possibly become a national trial research centre. In the case of the "stud production section", however, it is preferable that its role be gradually transferred to private production groups as they develop.

c) Work content

(i) Administration and supply and sales section

- Entire business management, sales of studs and semen for artificial insemination

(ii) Livestock improvement section

- Management of natural and artificial grasslands, trial research on forage production

- Introduction of suited varieties, selection of fine individuals, trial research on livestock improvement technology
- Trial research on livestock husbandry management and propagation technology

(iii) Stud production section

- Management of stud production, progeny inspection of fine individuals
- Manufacturing and storing of semen for artificial insemination
- Dissemination and training of livestock propagation technology

d) Size of supply of stud livestock, etc.

In the livestock production plan, as for beef cattle, the number of mature females to be produced at the stable time is due to be around 638,000, and propagation is done mainly by natural mating and partly by artificial insemination. For this, about 17,000 heads of stud bulls are needed and those to be renewed every year amount to about 3,400 heads. As for dairy cattle, the number of mature females to be produced at the stable time is planned at around 88,000, and propagation is mainly done by artificial insemination needing about 203,000 doses annually.

The work of stud ranches should include the supply of selected cows of pure and fine kinds, which is the basis for promoting livestock improvement in the entire region, the supply of beef cattle stud males at the rate of about 300 head annually and the production as well as the supply of semen for artificial insemination at the annual rate of 150,000 doses. As for dairy cattle, semen for artificial insemination should be produced and supplied at the annual rate of about 50,000 doses.

e) Improvement content

It is desirable that stud ranches be located in places convenient for transportation in the study area, given the characteristics of the work. Therefore, the facilities, machines, and so on should be improved utilizing the land of about 3,000ha owned by the Livestock Farming Fund (FG) in the vicinity of Pozo Colorado (for details, refer to Tables 7.3.5.4-2 and 7.3.5.8-4 and fig. 7.3.5.11).

(Improvement of facilities)

- Management house, research house, lodgings for staff
- Livestock husbandry house, farm tools warehouse, weather observation facilities, and other facilities

(Field)

- Forage field, improved grassland, natural grassland

(Livestock)

- Beef cattle and dairy cattle for livestock improvement and stud livestock production

(Machinery)

- Vehicle for communication, truck, tractor
- A set of machines for grassland improvement, management, and livestock management

(Machinery)

- A set of equipment for diagnosing and curing disease, for improving livestock, and for artificial insemination
- A set of equipment for research and office work

2) Agricultural support plan

(1) Basic direction

The integrated development plan aims at agriculture and livestock farming development for the settlers of small- and medium-scale farms. Generally, however, these farmers lack technology and funds. It is often the case that technical and economic difficulties at the beginning of the settlement limit its process and the future growth of the farming. Therefore, support for farms plays an important role in carrying out the integrated development plan.

There are many areas of farming to be supported. Here, however, the following are specified for the purpose of the instruction and dissemination of techniques to the settling farmers. (1) Establishment of a farmer's training centre, (2) the strengthening of national agencies in the regions targetted for development, (3) establishment of agricultural cooperatives for the settling farmers, (4) attraction of a seedling supply centre to achieve the stable supply of fine seedlings, and (5) joint utilization system for machines. As for the supply of fine stud livestock and semen for artificial insemination, the stud ranches should be put in charge of this.

(2) Establishment of a farmer's training centre

a) General concept

According to the integrated development plan, efforts should be made to create new production areas centring on farms operated by small-medium settlers and indigenous people. For this, it is necessary to transfer technology to the farmers.

For the purpose of giving training to improve technical as well as management levels and to increase farming motivation, a “farmer’s training centre” should be established. This centre should be provided with “training and research facilities” and “agriculture and livestock farming fields” for practical training.

b) Organizational structure

The organizational structure of the training centre is shown in the diagram below while the composition of personnel is described in Table 7.3.5.1.

For the management of this organ, a “management committee” composed of ministries and agencies related to the integrated plan should be established.

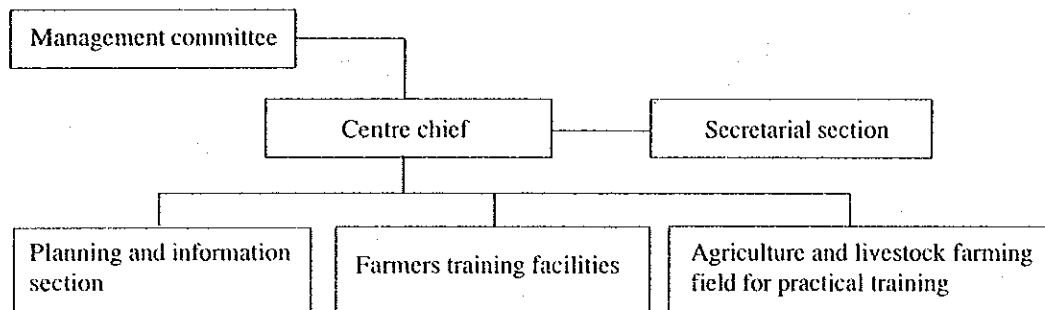


Fig. 7.3.5.4 Organizational structure of farmer’s training centre

c) Work content

The main work for each section and facility is as follows.

(1) Management committee

This consists of the Ministry of Agriculture and Livestock, related agencies, the Paraguay and Chaco Integrated Development Committee, and a committee of indigenous people. The work includes carrying out national policies and evaluating operations.

(2) Planning and information section

- Making of operation and work plans, communication with “management committee”
- Communication with other organs, planning and operation of joint surveys and research
- Grasping of regional situations through surveys on farms, collecting and analysis of technical information

(3) Farmer's training facilities

Various kinds of training, including initial training for settling farmers, should be carried out for the purpose of improving technology and the farming level of the farmers in the regions. Thus, efforts are needed in making training plans, curricula, and instruction manuals, and evaluating the results. For the actual practice of these plans, it is necessary to have close contacts with farmer's committees, indigenous people's committees, local agencies and agricultural cooperatives and to have the participation of other research institutes.

- Training of settling farmers before settlement and phased training
- Agriculture and livestock farming technical training for farmers in the regions (divided into crop cultivation, machine utilization, and livestock husbandry courses)
- Training for indigenous leaders and agriculture, and livestock farming technical training
- Various training for farming housewives and short-term training for other necessary techniques

(4) Field for practical training

This field is formed for the purpose of the effective learning of techniques by the farmers through actual cultivation and livestock farming.

Since the size of this field corresponds to the actual farming size of the farms, it is possible to find ways to tackle the problems of operations, management, etc., including economic aspects that they are likely to face on their farms. For the training, the participation of local agencies is needed. The following are the specified contents of the training.

- Cultivation and display of main crop varieties and newly introduced crops
- Demonstration and display of techniques relating to crop cultivation and livestock husbandry
- Demonstration and display of crop harvesting and storing techniques and animal produce processing technology
- Testing of the economy of livestock husbandry and crop cultivation technology
- Testing of the optimum composite farming system in both livestock and agriculture sections
- Development of methods for making farm management plans, balance plans, and methods for writing the farm management process
- Evaluation of the above results and preparation of practical technique manuals

- d) Content for improvement (for details, refer to Tables 7.3.5.4-3 and 7.3.5.8-3 and fig. 7.3.5.12)

(Facilities)

- Secretarial office and research building (manager's room, secretarial room, lecture hall, audiovisual room, library/resource material room, research lab, testing lab, dining room/kitchen, and others)
- Lodgings (lodging room, meeting room, preparation room, others)
- Lodgings for staff

(Field)

- Farming fields for practical training (normal field, forage field, improved grassland, natural grassland)

(Livestock)

- Beef cattle, dairy cattle, small-medium livestock farming (Farm facilities)
- Livestock stable, farm tools warehouse, water supply facilities, weather observation facilities, and others

(Machinery)

- Vehicle for communication, truck, lightweight truck, tractor
- A set of field crop operation machines, a set of forage production, livestock management

(Equipment for research and training)

- A set of research and training equipment

(Equipment for desk work)

- A set of equipment for desk work

(3) Strengthening of organization for disseminating agriculture and livestock farming

a) General concept

In Paraguay, the dissemination of agriculture and livestock farming technology is carried out mainly by local agencies. In the areas targetted for development by the plan, however, there are only two local agencies. Thus, the techniques are rather slow to disseminate.

The integrated development plan aims at the development of agriculture and

livestock farming centred on the settlement of small-medium scale farmers. Thus, the effective training of techniques for the farmers is extremely important. Also, the training content needs to be practical and all-inclusive based on the actual situations of farming. For this reason, it is necessary to establish a dissemination organization under the local agencies and to expand the content of the training so that it can include not only cultivation and breeding technology but also the economic aspect of farm management and lifestyles. For the actual dissemination efforts, a cooperative system with regional research centres and agricultural cooperatives should be formed. In particular, contacts with "farmer's training centre" mentioned earlier are very important.

b) Organizational structure

In Paraguay, there are usually regional management offices (Coordinaciones Regionales), provincial supervising offices (Supervisiones Zonales), and local agencies under the national agency. Also, in the Chaco region, a similar system will be established in future in accordance with the development of agriculture and livestock farming. For the time being, however, it is better for a regional management office to work also as a supervising office.

Therefore, in the areas targetted by the plan or in its vicinity, a Chaco regional management office should be newly established and four local agencies should be established in accordance with the structure of each settlement.

Efforts should also be made to deal quickly with such emergencies as bad weather damage, crop disease, and so on by, for example, forming a special project team for making inspection rounds at the regional management office.

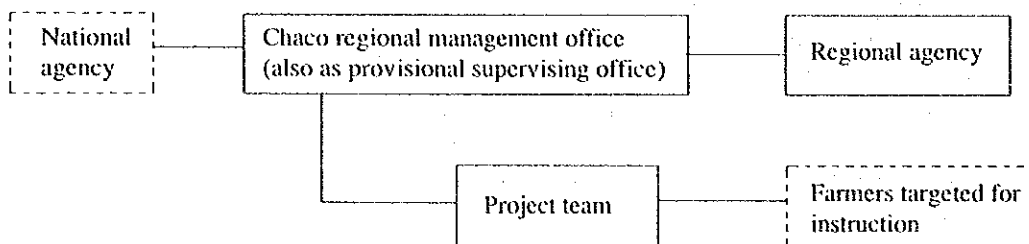


Fig. 7.3.5.5 Organizational structure in the Chaco region

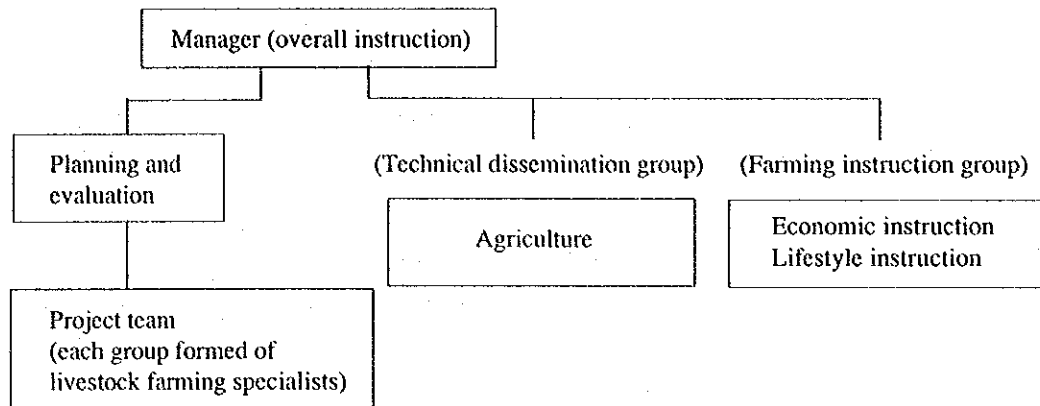


Fig. 7.3.5.6 Structure of Chaco regional management office

Since this regional management office plays a central role in dissemination efforts in the entire region, 4 to 5 specialists should be allotted for making evaluating plans, giving instruction, and supervising. The project team is also formed of specialists when necessary.

For dissemination efforts on a daily basis, the agriculture and the livestock farming sections are staffed by one person each, while one person is added to the farming instruction section whenever necessary.

c) Work content

Under the above organizational structure, efforts should be made to diversify the work content and make it more effective. Especially, instructions on farming and economic aspects are important for the fast stabilization of settling farmers. As for giving advice and instructions on the establishment of production systems, the improvement of living standards, etc., the regional management office should be put in charge. This is because various activities are needed on the basis of the actual situations of regional farmers, while for actual practice cooperation with agricultural cooperatives and others is also important.

Dissemination on techniques is carried out mainly by the regional agency. An effective method for this is to demonstrate them in actual fields, and thus a farm is designated as a centre for instruction and a central field is set up in each settlement.

Further, in connection with the training of regional farmers by the "farmer's training centre", a supplementary function should be performed for the purpose of effective dissemination activities.

(Major work of management office and agency)

(i) Making plans and evaluation

- Creation of dissemination plans, evaluation of activities, and instruction of local agency

(ii) Dissemination of techniques in agricultural sector

- Examination of soil fertilizers, cultivation techniques, machine utilization, diseases, etc.
- Provision of information on weather, crop diseases, their possible occurrence, prevention, etc., to farmers

(iii) Dissemination of techniques in livestock farming sector

- Examination of livestock breeding techniques, disease, forage production technique utilization
- Provision of information on the forecast of disease occurrence, prevention, etc., farmers

(iv) Farm management and financial instruction

- Instruction on the establishment of production systems, cooperative operations, joint shipping, etc., in cooperation with the farmers
- Advice and instructions on production plans, balance plans, financing plans, registering methods, etc.

(v) Improving standards of living

- Instruction on improving standards of living, health and hygiene, child education, etc.
- Advice and instructions on activities and the establishment of organizations of housewives in rural areas, the promotion of industries for indigenous people, the improvement of standard of living, etc.

(vi) Project team

- Intensive instruction on measures to deal with emergent weather damages, crop diseases, livestock diseases, etc.
- Education and dissemination of new techniques, newly introduced crops, new policies and systems, etc.

(vii) Local agency

- Organizing an acceptance system for farmers and daily activities for disseminating all agricultural and livestock farming technology

d) Improvement (for details, refer to Tables 7.3.5.4-4 and 7.3.5.8-4)

[Regional management office]

(Building facilities)

- Secretarial house (office, testing lab, material room, meeting room, others)
- Garage, material warehouse, weather observation facilities

(Machinery)

- Vehicle for dissemination activities, compact truck

(Equipment)

- Equipment for dissemination activities, equipment for deskwork, equipment for weather observation, others

[Regional agency]

(Building facilities)

- Secretarial building (office, meeting room, others), garage, material warehouse

(Machinery)

- Vehicle for dissemination activities

(Equipment)

- Equipment for dissemination activities, simple equipment for weather observation, a set of equipment for deskwork

(4) Organizing agricultural cooperatives in the settlements

a) General concept

Many farming difficulties are likely to occur before the settlement of small-medium scale farmers is stabilized. It is important to organize "agricultural cooperatives" to enable farmers to cooperatively solve these problems and to materialize a highly productive farming. The agricultural cooperative functions not only as an organ for production but also as a basis for forming a healthy community in the settlements.

Therefore, the roles and functions of the agricultural cooperative are examined below. The organizing of agricultural cooperatives has already become an important national policy and an agency has been established to give instructions on organizing cooperatives. Thus, it is desirable that the national organs play a central role in this matter.

b) Functions of agricultural cooperatives

The purpose of establishing agricultural cooperatives is to enable farmers to help each other and jointly pursue production activities. Their functions are as follows.

- (i) Joint purchase of production materials (assurance of sales routes and price advantages)
- (ii) Joint sales of products (assurance of sales amounts, uniform quality, assurance of advantages in joint shipping)
- (iii) Planning of production and sales (standardization of products and techniques, adjustment of production and shipping)
- (iv) Sharing of production means (joint utilization of farm machines, etc., systemization of joint work)
- (v) Systematic acceptance of disseminated techniques (cooperation with dissemination organs and the like, transmission of technical data)
- (vi) Increase of added value by processing of products (processing facilities of the cooperative)
- (vii) Provision of credit (lending of cooperative funds and credit assurance for outside financing)
- (viii) Collection of information and transmission of this to farmers (analysis of market trends and price information, and provision of results)
- (ix) Provision of subsistence services (joint purchase of subsistence materials, welfare, etc.)

In Paraguay, as practiced in the eastern region and by the cooperatives in the Mennonite settlements, agricultural cooperatives are expected to play a role in establishing the self-management of social infrastructures and the operations of various public facilities for the village community. These functions, however, are usually practiced on a gradual basis in accordance with the development of the organizational system and the accumulation of funds.

The initial work for newly formed agricultural cooperatives in the settlements is the joint purchase of production materials such as fertilizers, chemicals, seeds, and so on. Thereafter its functions should be increased gradually, to include the joint sales of products, planning of production, processing of products, and so on.

Further, the joint utilization of agricultural machinery is extremely important as part of support for farming at the initial time of settling. Thus, this should be included in the work of the cooperatives.

c) Organizational structure

According to the ministry's guideline, the size of the agricultural cooperative's staff is usually from 200 to 300. In the case of this plan, however, this guideline does not

necessarily have to be obeyed. Each cooperative in the settlements should be organized rather in accordance with such factors as assurance of size advantages, the locations and distribution of settlements, the range of farming activities, and so on.

The basic structure of the cooperative is described below. But additions and changes are possible whenever necessary.

- **General Meeting:** as the highest decision-making organ, it selects directors, decides and ratifies the annual budget, operation plans, and auditing results.
- **Audit committee:** audits accounting and inspects organizational systems.
- **Operation committee:** makes budgets and work plans, and supervises office work relating to operations.
- **Education committee:** educates members, and provides knowledge about farming and organizing.
- **Secretariat:** carries out each operation under the supervision of the operating committee.

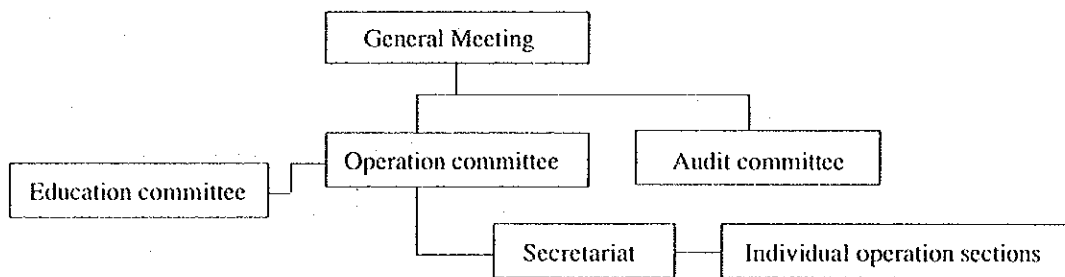


Fig. 7.3.5.7 Organizational structure of agricultural cooperatives

As for beef cattle breeding farmers in the area targetted for development, the organization of a cooperative is not planned, considering the wideness of the area where the farmers are dispersed and small number of areas that allow joint operations differing from seedling and dairy farming productions. As for the indigenous inhabitants, they need to form their own cooperative communities separate to those for the settlers, because their respective lifestyles are different. But it is desirable that neighbouring agricultural cooperatives should give support to the indigenous inhabitants in shipping their products and in the supply of materials.

Therefore, as shown in Table 7.3.5.2, four agricultural cooperatives are due to be established on the basis of the settling plans. The biggest of these has 1,200 farming households while the smallest has 200.

Contacts among cooperatives should be actively pursued, since they are basically formed as a body to assure profits to the farmers. Quantitative assurances of purchases of production materials and sales of products often lead to advantageous prices and distribution. Thus, wide-ranging contacts between the cooperatives have been promoted by the Ministry. As for the four cooperatives due to be formed in the settlements, it is necessary to promote participation in nationwide organizations.

d) Support for organizing

Instructive operations need to be strengthened by such national bodies as the cooperative agencies under the Ministry, local agencies, and so on, besides the instructions of village welfare committees at the time of settlement.

As for the procurement of farming funds, cooperative operation funds and machinery utilization funds, all due support should be given by public organizations.

On the other hand, as regards promoting the organization of cooperatives, efforts should be made to educate farmers through training at the farmer's training centre.

(5) Organization for joint utilization of agricultural machinery

a) General concept

A large financial burden results if small-medium scale farmers try to equip themselves with farm machinery, leading to a bad balance situation.

This is particularly true for large machinery. Thus, as part of the means to help individual farmers, a system should be established to enable joint utilization of this machinery.

As for the joint utilization of the machines, although utilization cooperatives may be formed among small farmers for the joint use of the machines, organizing this system may prove to be difficult because they lack sufficient funds. Thus, the creation of an "organization for joint utilization of agricultural machines" should be promoted as part of the support for farmers.

It is desirable for this organization to be large, in terms of the stability of procurement of necessary funds and the efficiency of organizational operations. It is also necessary to structure this organization so that farmers can actively take part in it. Thus, this organization is due to be formed in connection with the agricultural cooperatives mentioned earlier.

In future, when farmers have accumulated the requisite funds, the possibility of this becoming a utilization cooperative shared by the farmers should be considered.

b) Organizational structure

This organization is to be formed with joint funding from the agricultural cooperatives for the cultivation of short-term crops and oil crops in the northern part of Pozo Colorado, and the southern and eastern parts of the Mennonite settlements. As for its operation, an operation committee and a secretariat should also be set up jointly.

Further, it is difficult for the agricultural cooperatives themselves to procure funds to buy machinery. Thus, the national government and financial institutions are required to give special assistance to these cooperatives, while tax exemptions and other measures will also be required.

Depending on how the preparation of the settlements develops, it often happens that a 4 to 5 year time lag occurs between the setting up of the cooperative and the start of farming. Therefore, each cooperative has to undertake the initial procurement of machines for this organization and its operation, and many difficulties are likely to occur. To prevent such a situation, the government and related agencies should try to give necessary instruction and assistance.

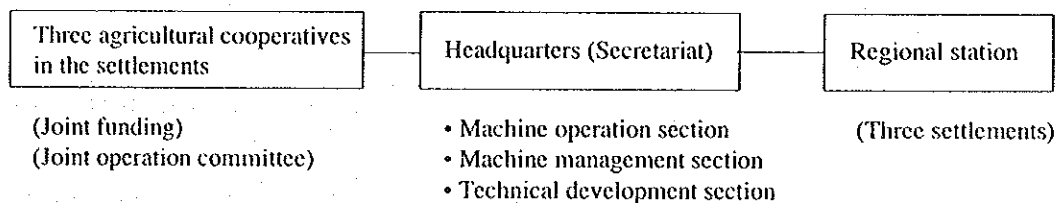


Fig. 7.3.5.8 Organizational structure for joint utilization of agricultural machinery

(Operations)

The main work of this organization is to possess and manage large harvesting machines, etc., which individual farmers cannot afford and to lend them when the farmers harvest their crops. The service of repairing these machines, the improvement and development of machines, and instruction on machine utilization techniques to farmers are also part of its work

- Machine operation section
 - Planning of machine leasing
 - Practice of machine leasing, accounting

- Machine management section
 - Management of machines it possesses and their repair
 - Repair services to farmers who have own machines
- Technical development section
 - Testing of improved machines and improved utilization technology
 - Instruction on machine utilization technology to farmers
- Regional station
 - Resident operator at busy times
 - Temporary storage of machines and daily checking

c) Size of operations

Machinery to be provided to this organization comprises the following three: a cotton harvester, a peanut harvester, and a general harvester mainly for harvesting short-term oil crops. The required numbers of these machines are shown in Table 7.3.5.5. The number of staff is 10 for leasing operation, machine operation and management and repair.

d) Improvement (for details, see Tables 7.3.5.4-5 and 7.3.5.8-4)

(Facilities)

- Office, machinery storage house, repair workshop, fuel supply facilities, others
- Regional station facilities (machinery storage house, office, lodgings, others) 4

(Machinery)

- Cotton harvester, peanut harvester, general harvester and attachments, a set of machine repairing tools
- Vehicle for operational communications, large truck for transporting machines, others

(6) Setting up seedling supply facilities

a) General concept

The integrated development plan aims at the production of field crops including cotton, peanuts, oil crops, fruit trees, vegetables, forage, and green manure crops and pastures. But the climatic and land conditions of the areas targetted by the plan are different from those of the eastern region (currently the main agricultural production region). Thus, it is necessary to introduce new suited varieties and to supply their seedlings to farmers for the purpose of the stable production of fine farm produce.

Since assurances of fine seedlings require a high level and large scale system and costs, thus basically public special bodies should be put in charge of this field.

In Paraguay, the Ministry's seedling agency (SENASE) has been carrying out the systematic supply of seedlings targetted at the eastern region. So far, however, this has not been so successful because of the limitations on selection and storage facilities. In the Chaco region, the Mennonite settlements have production systems, but their kinds and quantity are limited. Therefore, seedling production facilities of SENASE are due to be established and seedling producing farmers are due to be organized for the Chaco region.

b) Organizational structure

The current seedling production system of SENASE is as described below. Its work includes receiving original seeds from trial research centres and contracting with farmers and producers to provide seeds for distribution.

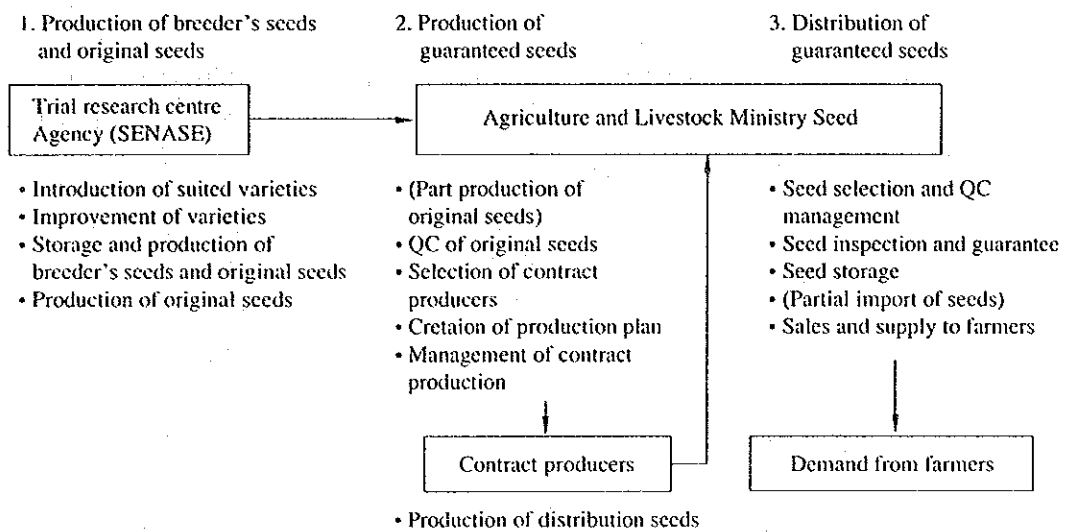


Fig. 7.3.5.9 Production system of SENASE (current situation)

The setting up of the SENASE system in the Chaco region should be based on the above and, as a regional institution managing seedling production, a "SENASE Chaco Operation Office" should be established.

As part of the office facilities, a seed selection house, an inspection house, and a storage house are due to be set up. The production of seeds is on a contract basis. But some original seeds and distribution seeds should be produced directly by setting up seed orchards for the adjustment of supply/demand and emergencies. The production and supply of seedlings is a new field of work for SENASE. In the integrated development plan, however, seeds should be supplied to farmers at the time of initial planting by adding the role of dissemination of fine varieties, since the proportion of production of fruit trees and perennial craft crops is rather large.

c) Operation

- (i) For the provision of breeder's seeds and original seeds, a cooperative system should be established between regional trial research stations including the Chaco Central Testing Centre (EECC), technical instruction centres of the Mennonite settlements, and nationwide research institutes. Thus, the original seeds of suited varieties selected and cultivated at these centres can be supplied, and some seeds are due to be produced directly in its own seed orchards. Also, a production management system should be established for the purpose of giving necessary technical instructions to contract producers.
- (ii) The seeds distributed to farmers will be produced by advanced farmers in the Mennonite settlements or by seed producers in the eastern region on a contract basis; some will be produced directly.
- (iii) The seeds to be supplied to farmers will be inspected carefully, especially in the case of those produced by contract, then sold to farmers as SENASE guaranteed seeds at reasonable prices.
- (iv) For the seedlings of fruit trees, the varieties selected and bred at research centres are used as mother trees. Grafts and cuttings will be produced by seedling producers on a contract basis. But some will be directly produced at this organization and sold to the farmers at reasonable prices after a SENASE inspection.
- (v) The need for the introduction of new varieties should be considered in accordance with production and demand trends, and when it is found to be difficult to supply seeds, they will need to be imported from abroad.

d) Size of operations

Crop seed varieties, the requisite amount of seedlings, and the necessary sizes of seed orchards and seedling nurseries based on the agricultural plan are shown in Tables 7.3.5.3 and 7.3.5.6 to 7. The size of fields for direct production is due to be around 200ha, expecting that about 10% of the entire seed orchard will be used for seed production. As for seedlings, nurseries of 100ha should be required for breeding three year-old grafts and cuttings, and assuring mother trees and stocks.

e) Setting up (for details, see Tables 7.3.5.4-6 and 7.3.5.8-6)

(Building, facilities)

- Management house (office, lab room, inspection room, others)
- Selection and storage facilities (selection facilities, low temperature storage house)
- Lodgings for staff

(Field)

- Original seed and seed orchard, seedling nursery

(Machinery)

- Vehicle for communications, transportation truck, a set of field machines
- Seed inspection equipment, dryer, sterilizing device, cooler, others
- A set of deskwork equipment

Fig.7.3.5.1 Organizational structure of experimental research and agricultural support

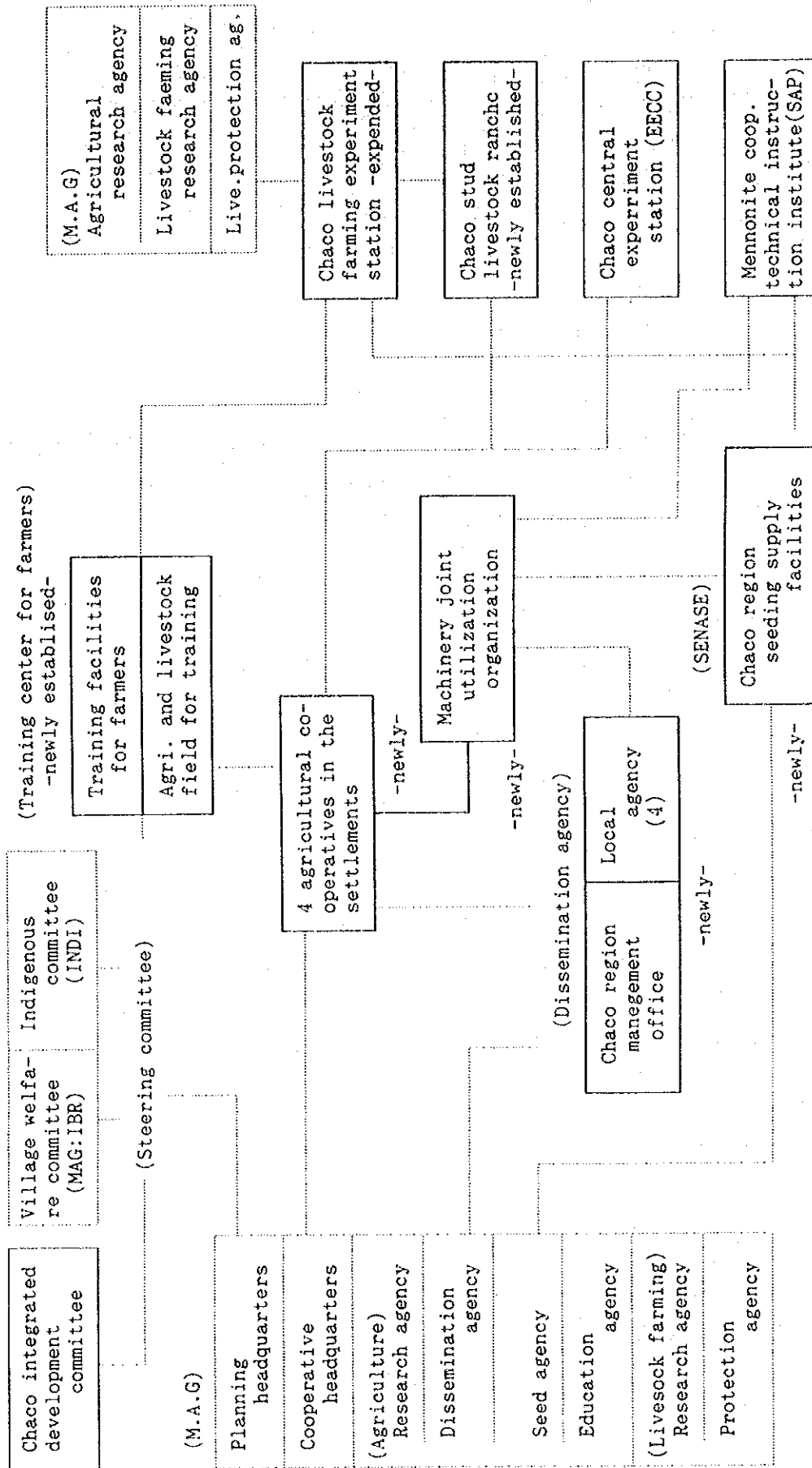
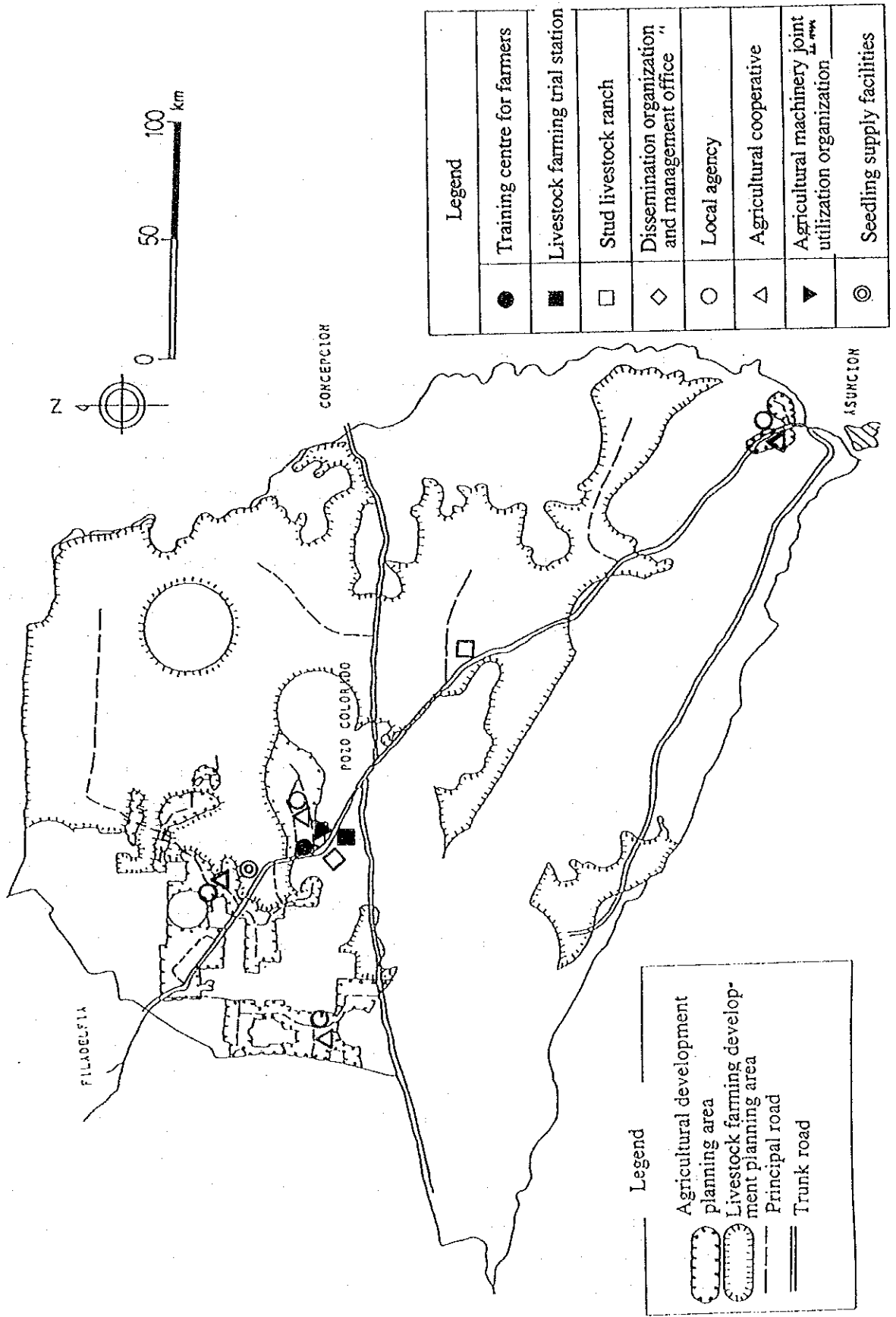


Fig. 7.3.5.13 Trial research map for locations of agricultural support facilities



7.4 SOCIO-ECONOMIC PLAN

7.4.1 Settlement plan

1) Basic policy

The objective of the Integrated Development Plan is to contribute to

- (i) the balanced development of the national land,
- (ii) the stabilization of trade balance through the increased production of agricultural export products, and
- (iii) the protection of small-scale and landless farmers.

For the purpose of the balanced development of the national land, the sufficiently developed eastern region should focus on the protection of environment and the improvement of land productivity. The western region (Chaco) is seriously underdeveloped due to less favorable natural and socio-economic conditions than in the east, with livestock farming in natural forests and grassland being prevalent except in the Mennonite settlements and in the suburbs of Asuncion. Therefore, the priority of development should be given to the less developed western region. The Development Plan should pay attention to natural resources and the environment so as to realize sustainable development and include support measures for the indigenous people, landless farmers, and small-scale farmers. It is also important to promote agriculture and livestock farming in the study area by preferentially settling farmers already living in the study area on the project site.

The settlement plan determines the settlements, settlers, and number of settled households to engage in agriculture and livestock farming according to the Integrated Development Plan. In this case, planning should consider an appropriate balance between countermeasures for impact on the environment and the improvement of land productivity. On this particular point, the plan respects the minimum requirement for forests in the development area (25%) stipulated in the upcoming Forest Preservation Act. Table 7.4.1.2 shows the number of settled farms in each district.

In order to increase the production of agricultural export products, the prices of agricultural products need to be reduced to a level equivalent to, or even lower than, those produced abroad. For this purpose, the production scale should be enlarged by generally introducing modern production methods. If the production cost is to be reduced through the mechanization of agriculture and enlarged production scale, farmers will need to be able to acquire start-up capital and sufficient technology required for this type of agricultural management. Therefore, medium and large scale farmers should be candidates for settlements intended to increase the production of agricultural products.

Small and landless farmers as well as the indigenous people lack start-up capital and are equipped with low technological standards. Settlements of these farmers should undertake types of agricultural activities which would be relatively easy to manage and would require a small-scale production base and a relatively simple system of labour.

According to the plan, the management scale of existing farms in the production site is expected to be enlarged through settlement, as compared with the current conditions of land use and the land area presently owned by these farms. It is for this reason that such farms are to be transferred within the project area.

Settlement activities in Paraguay to this day have simply awarded a lot to each settler. One of the features of the current settlement plan is that it incorporates the ecological use of natural pastures in due consideration of the need to avoid causing unnecessary damage to the existing ecosystem.

2) Settlements

The land use plan divides the study area into zones fit for agriculture and those fit for livestock farming. The agricultural zones include (i) the southern part of the Mennonite settlements, (ii) the eastern part of the Mennonite settlements (three estates), (iii) the northern part of Pozo Colorado, and (iv) the suburbs of Asuncion. The zones fit for livestock farming include (i) a large area extending from the north-eastern district in the study area to the Rio Negro, and two small areas of (ii) the area to the south of the Mennonite settlements and (iii) the district adjacent to the Rio Pilcomayo. Since the cultivation, farm management, and livestock farming plans designate a particular type of farm management for each of these zones, the five zones (nine estates) shall be determined as settlements with a total area of 2,993,000ha. Table 7.1.1 shows the locations of the settlements, while a breakdown of the area is indicated in Table 7.1.13.

3) Number of settled farms

In principle, the projected number of farms in each settlement is determined from the scale of business calculated in the farm management plan and the development area (settlement) calculated in the land use plan. Similarly, the number of existing farms is calculated using the number of existing farms in the study area and the proportion of the settlement area to the study area. Thus, the number of newly settled farms can be obtained by subtracting the number of existing farms from the number of farms projected to be settled. If the number of existing farms exceeds that of the farms projected to be settled, the surplus farms should have priority in the settlement of the other settlements. Subsequently, the number of settled farms in total, the number of existing farms and the number of farms newly settled shall be

640, 357, and 283 respectively for the southern Mennonite zone, 1,360, 247, and 1,113 for the eastern Mennonite zone, 630, 120, and 510 for the northern Pozo Colorado zone, 390, 477, and -87 for the suburban Asuncion zone, and 2,260, 2,505, and -245 for the livestock farming development zone. The number of existing farms, the number of settled farms for each zone, and the number of farms by category of farm management are shown in Tables 7.4.1.1, 7.4.1.2, and 7.4.1.3 respectively. These figures are actually calculated according to the following method.

(1) Number of existing farms

- (i) The total number of farms in each zone was calculated by apportioning among the zones in the study area the total number of farms obtained in the 1991 Agriculture and Livestock Farming Census for Departamento Presidente Hayes, according to the share of each zone in the whole study area. For the southern Mennonite zone and the suburban Asuncion zone, our research has shown that farms with a relatively small land area amounted to 300 and 310 respectively. In consideration of this, the above-mentioned figures are adjusted for the two zones by the share of farms with less than 100 hectare of land. As regards the livestock farming development zone, the adjusted number of farms is subtracted from the total number of farms calculated according to the proportion of land area.
- (ii) For the southern and eastern Mennonite settlement, northern Pozo Colorado, and Asuncion suburban zones, the number of indigenous households is determined as the number of households on land owned by communities and various support agencies in each zone. In the livestock farming development area, the number of indigenous households is determined by subtracting from the total number of households in the study area (estimated to be 4,000) the above-mentioned number of households, the number of households living in the area (owned by ASCIM) around the Mennonite settlements (estimated to be 1,500) and the number of households indisposed to engaging in agriculture and livestock farming ($4,000 \times 0.1 = 360$; estimated according to the preference survey).

(2) Projected number of farms

- (i) From the following considerations, the number of farms to be settled is determined by dividing the farmland area calculated in the land use plan by the farm area projected in the farm management plan for each category of farm management.
 - a. For the purpose of realizing sustainable agriculture, natural grassland should be maximally preserved and used for livestock farming (beef cattle, dairy farming),

except that some dry and wet grasslands are projected to be improved for agriculture.

- b. Farmland, forest, and bush not included in the forest area determined in the land use plan should be used as fields, planting fields for fodder crops, land for perennial crops, improved grasslands, etc.
- c. The current conditions of land use in individual zones.

(ii) Furthermore, special consideration is given to the indigenous population as well as to small and landless farmers. Thus, the projected number of settled households is adjusted to include all indigenous households in the project area, all small and landless farmers and those with 20-50ha of land in the study area, and all farmers with over 50ha of land in the project area.

3) Selection of settlers

Priority for the selection as settlers is given in the following order.

- (i) Farmers and indigenous people in the project area.
- (ii) Farmers and indigenous people in the study area.
- (iii) National farmers meeting the specified conditions.
- (iv) Paraguayans meeting certain conditions.
- (v) Expatriate candidates with considerable potential for the introduction of technology etc.

These people are classified for selection into the following five groups, determined as successors to farming.

- (1) Farmers with production technology and capital for agriculture and livestock farming who can individually continue development and farming practice, engage in large-scale business, and lead the future progress of agriculture and livestock farming in Paraguay. In farm management, they are categorized as full-time beef cattle breeders with 5,000ha or 2,000ha of land. Farmers currently possessing over 300ha of land shall be qualified for this group.
- (2) Farmers with modern production technology for export crops and a certain amount of initial investment capital who shall engage in middle-scale business, form the nucleus of settled farmers, and become the models for farmers cultivating on a smaller scale. With about 200ha of land, they fall within the following four categories of farm management.
 - a. peanuts + cotton + sorghum + dairy farming

- b. short-term oil crops + sorghum + dairy farming
- c. permanent plants used as materials for handicrafts and plants + dairy farming
- d. full-time dairy farming

Farmers currently possessing 60-300ha of land shall be qualified for this group.

- (3) Farmers with technological standards to meet the domestic demand who shall be small independent (full-time) farmers producing export crops, cash crops (for domestic supply), and subsistence crops. With 45-60ha of land, they fall within the following four categories of farm management.

- a. cotton + sorghum + fruits + dairy farming + small livestock (sheep)
- b. cotton + sorghum + fruits + dairy farming + small livestock (goats)
- c. fruits + dairy farming
- d. fruits + vegetables

Farmers currently possessing 20-50ha of land shall be qualified for this group.

- (4) Farmers who do not have the technological standards to meet the demand of the domestic market but have the potential to become small independent farmers (part-time or full-time farmers) producing export crops, cash crops (for domestic supply), and subsistence crops by improving their technical ability through measures such as training. With about 45-60ha of land, they fall within the following two categories of farm management.

- a. cotton + sorghum + fruits + dairy farming + small livestock (sheep)
- b. cotton + sorghum + fruits + dairy farming + small livestock (goats)

Farmers currently possessing less than 20ha of land as well as Paraguayans in general shall be qualified for this group. Since these farmers lack the agricultural technology required to produce marketable products and can barely afford the initial investment, their business shall start by cultivating traditional crops which would require a relatively simple system of labour, and shall gradually develop in scale thereafter. For these farmers, it is expected to take twice as long as in other cases before their farming practice becomes stabilized. This long period required for the stabilization of activities would reduce the income of these farmers. Therefore, they are expected to compensate for the loss by selling their surplus labour to other farmers.

- (5) Small-scale farmers producing cash crops, small livestock and subsistence crops who fall into the following three categories of farm management.
- a. cotton + small livestock + apiculture
 - b. fruits
 - c. small livestock + apiculture

The indigenous people are eligible for this group. Since they have preserved their own language, culture, and customs up until now, forming a very unique society, they are experiencing difficulty in contacts with different peoples and adapting to the society and economy. Their agricultural technology is at a far lower level compared to other farmers. They are thought to possess very little capital. According to the new constitution enacted on June 22, 1992, the indigenous people are entitled to collective ownership of land granted by the government, which should be sufficient in quantity and quality for the preservation of their own lifestyle. However, it also stipulates that the lease, assignment etc. of the land thus provided is prohibited along with the transfer of residential districts without the consent of the indigenous population. Furthermore, according to the preference survey conducted within the framework of the present study (Estudio de intenciones y expectativas de la poblacion indigena del Departamento de Presidente Hayes 1991: JICA), about 90% of the indigenous population prefer to remain in the current residential districts, while about 90% of them want to engage in professions related to agriculture and livestock farming. In this consideration, measures for the indigenous people shall include the establishment of lots reserved for them in each of the project sites. Ownership of these lots shall be given to indigenous communities, which in turn shall grant the right to use about 10 hectares of land on average to each family. However, independent farm management by individual households is quite difficult at this moment due to the strictly limited standard of technology concerning the management of agricultural activities and the scarce availability of necessary capital. Therefore, agricultural development shall be undertaken collectively until the required technology and capital have been obtained, at which time individual farms shall take on independent activities on the land they are entitled to use. In the light of the long traditions in their own lifestyle, it seems difficult for the indigenous people to change their habits overnight. The present plan shall not go any further than the said stage, and further development should be considered in the framework of another project.

Based on these criteria, the selection of settlers shall be conducted by a Settlers Selection Committee to be established under the Paraguay Chaco Integrated Agricultural Development Commission.

4) Settlement activities

Settlement activities are identified as a national project. The Rural Welfare Agency shall take the principal responsibility for executing this project. INDI shall also participate in the activities.

It is preferable to apply the existing Farmland Act to settlement activities. In this case, however, the plan would be incompatible with the Farmland Act on certain points. For example, according to the act, farmers can only purchase up to 100 hectares of land and those possessing more than a certain amount of land are not eligible to apply for settlement. If we insist on the application of the Farmland Act, it will be necessary either to execute the plan within the framework of the Act or to make special amendments to the Act. Consequently, the plan shall be executed outside the framework of the Farmland Act.

Therefore, settlement shall be designated as a national project whose execution shall be assigned to the Paraguay Chaco Integrated Agricultural Development Commission. The procedure for land purchase shall be conducted outside the framework of the Farmland Act.

Small and landless farmers with low levels of agricultural technology shall be settled after being trained. As for the indigenous people, leaders of each community shall take priority for training.

Settlement shall proceed progressively after the construction of social infrastructure, the installation of various agriculture support organizations vitally related to farm management, and the establishment of required systems and measures etc.

At present, small and landless farmers are not equipped with the necessary technology to produce marketable products. For other farmers in the study area, it is difficult to engage in the activities envisaged in the farm management plan, for, apart from beef cattle breeding, only a few of them are currently engaged in the production of cotton, dairy products, sugarcane, citrus fruit, vegetables etc. Therefore, farmers to be settled for activities other than full-time beef cattle breeding shall receive initial training in the training facilities to be established in the framework of the agricultural support plan. These farmers shall be settled only after they have mastered the skills enabling them to realize the expected result in farm management. As regards the indigenous people, priority for training shall be given to leaders of each community, who shall then give other farmers a lead in the collective management of farms.

Settlement shall start as soon as the necessary production basis, social infrastructure,

agricultural support organizations etc. have been completed. Accordingly, to keep pace with the progress of business activities, settlement shall commence one year after start-up. The order to be followed in the settlement is outlined in fig. 9.2.1 of 9.2 Execution plan.

5) Land ownership

The land in the project area is owned by 3,706 farmers, of whom 2,799 are small-scale farmers, 331 are medium-scale farmers, and 576 are large-scale farmers. So-called large-scale farms with more than 1,000 hectares of land take up 93.5% of the total land in the area. In determining settlement areas, measures should be taken to make this land available for acquisition or use by settlers.

However, the present plan is at the stage of a master plan, and the solution to this problem should be found in consideration of future developments, possibly after the completion of the related feasibility study.

The methods concerning land ownership in this plan are as follows.

(1) Methods involving the government

(i) Effective use of land

For the purpose of the effective use of the land, the government should give special status to the project area or take other administrative measures with similar effects, so as to make sure that the land in the project area shall be developed according to the land use plan.

(ii) Value added tax on farmland

Land owners in the project area are expected to receive considerable benefits from the execution of the project. Therefore, the execution of the project shall be accompanied by the introduction of value added tax on farmland to be levied upon the increment of value added to land in the project area. The effective use of this taxation system should enable financing for debt repayment.

(2) Methods involving the transfer of ownership

(i) Relative transaction

Transactions shall be conducted privately between current landowners and settlers. In this case, the unification of selling prices and transaction period shall be required.

(ii) Land purchase

Executors shall purchase land from land owners and sell it to settlers. This method

is advantageous for it would facilitate the regulation of selling prices and assure the uniformity of activities. However, some financial problems remain to be solved. For example, executors would need a huge amount of money to purchase the land, the collection of loans to settlers may require some time, and interest costs would be incurred meanwhile.

(3) Method not involving the transfer of ownership

(i) Land tenancy, gain-sharing cultivation

- a. Landowners shall directly grant cultivation rights to settlers.
- b. Land shall be leased from landowners to agricultural cooperatives etc., which shall grant cultivation rights to settlers.

(4) Others

- (i) Introduction of a road use tax.
- (ii) Collection of water use fees (designation of irrigated areas).

By effectively combining the above measures, land ownership and land use can be oriented toward the objectives of the project.

Table 7.4.1.2 Number of settled farms by district

| Farm management category | Estimated number of existing farms | | | | | Livestock farming area | Total |
|-----------------------------------|------------------------------------|-----------------------------------|----------------------------------|-------------------------|-------|------------------------|-------|
| | Northern Poso Colorado | Southern Mennonite settlements | Eastern Mennonite settlements | Suburban of Asuncion | Total | | |
| Indigenous households | 80 | 70 | 150 | 200 | 1,640 | 2,140 | |
| Small independent(i) | 20 | 20 | 40 | | | 80 | |
| Small independent(ii) | 20 | 20 | 40 | | | 80 | |
| (Small part-time independent(i)) | 155 | 160 | 280 | | | 595 | |
| (Small part-time independent(ii)) | 155 | 160 | 280 | | | 595 | |
| Small independent(iii) | | | | 90 | | 90 | |
| Small independent(iv) | | | | 100 | | 100 | |
| (Sub total) | | | | | | (1,540) | |
| Medium scale(i) | 100 | 100 | 100 | | | 300 | |
| Medium scale(ii) | 100 | 100 | 100 | | | 300 | |
| Medium scale(iii) | | 10 | 20 | | | 30 | |
| Medium scale(iv) | | | 350 | | | 350 | |
| Sub total | | | | | | (980) | |
| Full-time beef cattle breeding | | | | | 620 | 620 | |
| Total | 630 | 640 | 1,360 | 390 | 2,260 | 5,280 | |

Note: Farm management categories represent the following.

Small independent (i): small-scale farms supposed to be independent from the initial stage and producing dairy products, sheep, cotton, and fruit.

Small independent (ii): farms managed in the same way as the above but producing dairy products, goats, cotton, and fruit.

Small part-time independent (i): small-scale farms geared for part-time independent management and producing the same products as in small independent (i)

Small part-time independent (ii): farms managed in the same way as the above and producing the same products as in small independent (ii).

Small independent (iii): small-scale farms in suburban Asuncion and producing dairy products and fruit.

Small independent (iv): farms managed in the same way as the above and producing vegetables and fruit.

Medium scale (i): medium-scale farms producing dairy products, cotton, and peanuts.

Medium scale (ii): medium-scale farms producing dairy products and oilseeds.

Medium scale (iii): medium-scale farms producing dairy products and craft crops.

Medium scale (iv): medium-scale farms engaged in full-time dairy farming.

Full-time beef cattle breeding: large-scale livestock farms engaged in full-time beef cattle breeding.

7.4.2 Distribution plan

1) Supply and demand of agricultural and livestock products (see Appendix)

Agricultural and livestock products in the study area The preparation of the production plan has to consider the expected conditions on the supply and demand of products. The following is an analysis of market trends for promising items produced in the study area (1. meat, 2. milk, 3. cotton, 4. oil crops, 5. rice, and 6. fruit and vegetables).

(1) Meat

General world market trends in the past indicate that beef has been growing less rapidly than other kinds of meat in production, export, and consumption, and has even declined in per-capita consumption. The following two points can be noted concerning the future exportability of Paraguayan beef.

- (i) The total demand for beef in the world is expected to increase in proportion to the rise in the world's population.
- (ii) Asia is expected to record the most significant increase in the demand for meat, but it is difficult for Paraguay to enter this market for it lacks competitiveness in quality and cost.
- (iii) European countries, the traditional importers of Paraguayan meat have recorded the smallest increase in the demand for meat and therefore cannot be expected to increase their imports considerably.
- (iv) Some countries in South America, such as Brazil, Chile, and Peru, have substantially increased their demand for beef. Therefore, exports of Paraguayan beef in the region can be expected to increase.

(2) Milk

As regards milk and milk products, Paraguay will be highly dependent on the future trends of demand and supply in neighbouring countries, taking into consideration its geographical location between exporters (Argentina and Uruguay) and an importer (Brazil) as well as the expected market expansion subsequent to the establishment of MERCOSUR. Therefore, we have examined the possibility of expanding milk production in the future by analyzing past conditions of supply and demand in seven countries including neighbours. The following points can be noted concerning the possibility of increasing milk production in Paraguay.

- (i) In Paraguay, future domestic demand for milk is expected to exceed supply, bringing about a shortage of milk.
- (ii) In the light of the supply and demand situation, similar shortages can also be expected in neighbouring countries, significantly relaxing the competition in trade between them. Milk is therefore a promising product for export.

(3) Cotton

Recent trends in the international cotton market indicate that demand will rise steadily by 1-2% annually. Cotton prices will continue to fluctuate reflecting a short-term imbalance between supply and demand, but a significant rise in price cannot be expected. In order to consider cotton production in Paraguay, it is necessary either to establish a production system efficient enough to cover the cost of transport to the open sea, or to switch to quality products with high export competitiveness.

(4) Oil crops

Production of and demand for oil crops have been increasing steadily in the international market. However, market conditions vary according to the characteristics of each product. When we consider the producibility of oil crops in the study area, the following points could be noted for individual products.

- (i) In South America, Argentina and Brazil not only have large shares in the production of peanuts but also export peanut oil. Their potential production capacity is considerable, though production has been on the downturn in recent years. Cost reduction is indispensable to increasing production.
- (ii) As in the case of peanuts, competition with Argentina and Brazil will be inevitable in the production of cottonseeds, and cost reduction will be necessary. However, cottonseed exports are currently restricted in Paraguay.
- (iii) Argentina has a large share in the production and export of sunflowers, which are still increasing year by year. In the world market, trade in sunflower oil and oilcake is increasing more rapidly than that in sunflower seeds. Demand for sunflower oil and oilcake processed in Paraguay can also be expected on the market.
- (iv) South America has only a small share in the production of rapeseeds, whose demand is limited within the region. However, global demand for rapeseeds is increasing, for European countries export rapeseed oil processed from imported rapeseeds. The world market is less accessible by Paraguay than by Argentina and Brazil.

- (v) Brazil and Paraguay are the major producers of castor beans in South America. Brazil supplies 30% of the global demand for castor oil, but declining castor bean production and the ensuing shortage of castor beans as a raw material has made Brazil a major importer of castor beans produced in Paraguay, a country unequipped with processing plants. Favorable effects of the increase in demand for castor oil on the world market is being more than offset by the rapid increase in castor oil production in Asia, thus resulting in stagnant exports from Brazil. New customers need to be found.
 - (vi) Sesame production in the world has remained stagnant in recent years. Exports from South America have been increasing year after year, though insignificant in their share in the world market. Sesame can be a promising export product if cost reduction turns out to be successful.
 - (vii) Safflower production in the world has been declining slightly. Trade statistics are not available. Considering the increasing production in Argentina, safflower may become a major product for Paraguay if producible.
- (5) Rice
- Increase in the domestic demand for rice in Paraguay is not expected to surpass population growth. The supply-demand situation fluctuates annually and is not stable. Recently, rice has been in rather short supply due to the tight Brazilian market. The existence of low-priced Asian rice and neighbouring exporters such as Argentina and Uruguay makes it necessary to lower production costs and improve product quality so as to avoid increasing pressure on import. Maintenance of self-sufficiency in rice should require a considerable improvement of production and distribution systems.
- (6) Fruit and vegetables
- Future increases in demand are expected for low-sufficiency crops such as onions, potatoes, carrots, and tomatoes, as well as products for which demand has already been increasing, such as melons, cabbages, and watermelons. Furthermore, the establishment of MERCOSUR should give Paraguay a comparative advantage in crops such as citrus fruits, bananas, and pineapples.
- 2) Basic policy in preparing the distribution plan
- Distribution usually represents a large sector including transportation, facilities, and distributive organizations as well as the establishment of a distribution system integrating these elements, which are necessary to assure the transfer of products from producers to

domestic consumers or to distribution centres on the way to foreign markets. However, the present distribution plan only deals with plans for the amount and system of distribution which should provide a basis for the installation plan of distribution and agricultural processing facilities necessary for the efficient distribution of agricultural and livestock products in the market. Actually, the plan shall be prepared in accordance with the following process.

- (i) The production potential in the study area shall be estimated from the production amount and production area according to the production plan.
- (ii) The usability of existing processing facilities shall be examined in consideration of the production amount.
- (iii) If the existing processing facilities cannot meet requirements, the necessity of a new distribution system shall be examined.
- (iv) In case new distribution and processing facilities are required, their scale shall be calculated from the projected production amount.
- (v) With reference to existing facilities in other areas, necessary equipment and machinery shall be determined.
- (vi) The location of distribution and processing facilities shall be selected.

Items (iv)-(vi) shall be treated in 7.4.3 Farm product processing plan.

- 3) Estimation of the production amount of agricultural and livestock products accompanying the development plan

Table 7.4.2.1 shows the production amount of agricultural and livestock products in the development area calculated on the basis of individual programs. According to the estimate, 47,000 tons of cotton, 24,000 tons of peanuts, 31,000 tons of oil crops, 57,000 tons of fruit, 33,000 tons of tropical fruit, 3,000 tons of vegetables, and 255,000 tons of milk will be produced at the highest production point. As for livestock, 2 million head of cattle and 252,000 sheep and goats shall be produced. Table 7.4.2.2 compares these figures with the total production in Paraguay. It indicates that 7% of cotton, 71% of peanuts, 18% of oil crops, 13% of citrus fruits, 2% of vegetables, 9% of tropical fruits, and 111% of milk will be produced in the development area. After the execution of the plan, the development area

will also account for 24% of the total head of cattle and 41% of the total sheep and goats bred in the country.

4) Estimation of the usability of existing processing facilities and distribution amounts

No distribution centres exist within the development area. Except for some agricultural products processed by the agricultural cooperatives of the Mennonite settlements in the northwest of the development area and at Villa Hayes in the suburbs of Asuncion, most of the agricultural and livestock products produced in the area are transported directly to Asuncion. The usability of processing facilities near the development area could be estimated as follows for each product.

(1) Cotton

According to the plan, cotton production shall be centred in the eastern and southern Mennonite zones and the northern Pozo Colorado zone. About 47,000 tons of cotton shall be additionally produced in the total production area in the three zones, projected to be about 26,000 hectares. Two of the three Mennonite agricultural cooperatives in the northwest of the development area have ginneries. They purchase raw cotton from farmers and separate it into cotton fibre and cottonseed. Cotton fibres are then packaged and sold to traders in Asuncion. Cottonseeds are separated into cottonseed oil and cottonseed cake in the adjacent oil extraction plant. Cottonseed oil is sold for consumption in the settlements, whereas the cooperatives utilize cotton cake as a raw material for compound fodder so as to ensure efficient use of the product. Table 7.4.2.3 indicates that the ginneries in the three cooperatives have been working at about 40% capacity in the last five years and therefore have a surplus capacity of 15,000 tons. However, in view of the limited harvest period and the risk of quality deterioration due to neglect, it is impossible for the existing plants to cover future cotton production.

(2) Peanuts

As in the case of cotton, peanut production shall also be centred in the eastern and southern Mennonite zones and the northern Pozo Colorado zone. The Mennonite cooperatives sell peanuts to exporters in Asuncion after unshelling them. Unshelling of peanuts is carried out by machines. As shown in Table 7.4.2.4, their unshelling capacity permits the input of 28,000 tons of raw peanuts.

(3) Oil crops

Rapeseeds, sunflowers, and sesame are to be cultivated for oil crops mainly in the eastern and southern Mennonite zones and the northern Pozo Colorado zone, the same as for cotton and peanuts. The Mennonite cooperatives also possess oil extraction plants

usable for these oil crops, but as indicated in Table 7.4.2.5, their surplus capacity currently stands at only 2,000 tons. The oil crops shall therefore be transported directly to Asuncion and Concepcion, where they shall be processed in oil extraction plants. Table 7.4.2.6 indicates that eight factories in Asuncion and Concepcion, whose oil extraction capacity is known to us, can process oil crops equivalent to 760,000 tons of cottonseeds. In the light of the current capacity usage ratio, which is 60%, they should be able to process the oil crops (31,000 tonnes) and cottonseeds (28,000 tonnes; equal to 60% of raw cotton) to be produced in the development area.

(4) Milk

Milk shall be produced in the four zones in the agricultural development area. An outline of the production capacity of milk producing plants in Paraguay is shown in Table 7.4.2.7. Milk production in the Mennonite cooperatives has almost reached maximum capacity and cannot be charged with any additional input. On the other hand, the three plants in the suburban Asuncion zone have a daily processing capacity of about 60 tonnes. It seems therefore possible to process the projected average daily production of 7 tons in the existing facilities.

(5) Beef cattle

Beef cattle bred in the study area are transported live to Asuncion, where they are slaughtered, dismembered, dressed, and frozen as necessary, to be supplied to domestic and foreign markets. Table 7.4.2.8 shows the production capacity of meat dressing plants in Asuncion. Accurate numbers of the beef cattle bred and slaughtered are not available, but it is said that about 600,000 beef cattle are slaughtered each year in Paraguay. When the objective of the plan has been reached, 365,000 beef cattle should be added to this figure, which means that new dressing facilities shall be required.

5) Outline of distribution plans for each district

In view of the production and processing plans according to the Integrated Development Plan and other factors such as future distribution channels, the outline of distribution plans for each district is determined as follows.

- (1) In each of the three development zones neighbouring the Mennonite settlements, collective sorting facilities for citrus fruits shall be established as distribution facilities to cater for fruit production by small-scale farmers. No distribution facilities are planned for agricultural products produced by medium-scale farmers, who are supposed to market their products individually. As regards processing facilities, a ginnery and a milk plant shall be established in each zone.

Jajoba is cultivated in a small area. Its oil is exported after primary refining and general oil extraction equipment will do for this type of processing. It shall therefore be processed in the existing plants and no processing facilities shall be constructed for this purpose.

Macadamia nuts are also produced for export, because there is no demand for them on the domestic market. The international market only accepts unshelled nuts and there is no market price for damaged nuts, which are in fact not tradable. Only small farmers are currently engaged in the cultivation of macadamia nuts on part of the land for perennial crops, and their cultivation is planned in later stages of the development. Therefore, farmers to be initially engaged in the cultivation of macadamia nuts shall unshell them and jointly deliver their products. Unshelling machines shall be introduced after production has proved successful, and shall be utilized collectively in sorting facilities.

- (2) The suburban Asuncion zone, in spite of its small development area, is located near the large market of Asuncion. Cooperative delivery and sorting facilities shall be constructed in the zone to facilitate the sorting of quality products and the standardization of forms of distribution as well as to establish a distribution system geared to the formation of a main producing district for fruit and vegetables.

The existing system of fruit and vegetable trading favours the interests of distributors to the detriment of producers. In order to deal with wholesalers on favorable terms, producers should organize a system to constantly put a certain amount of products on the market. Therefore, it is important for producers to maintain certain delivery quotas by sharing collective delivery facilities, and to differentiate their merchandise by establishing specific standard selection criteria. Apart from favorable trading, these measures are also indispensable for improving the production techniques of individual farmers as well as for creating a collective field for large-scale production which would not be eliminated by imported fruit and vegetables from Argentina, Brazil etc. following the establishment of MERCOSUR.

The collection and transfer of information as well as diffusion and guidance on production and shipping techniques shall be possible by attaching a farm management guidance section to the administrative department of collective delivery facilities.

- (3) No new distribution and processing facilities shall be constructed for the distribution of beef cattle raised in the livestock farming development area, for such reasons as that the managers are owners of large-scale farms who do not need special distribution facilities,

and that the risk of water shortage and environmental pollution makes it difficult to locate processing facilities in the area. Therefore, existing distribution channels shall be utilized. Hereafter, beef production should be export-oriented. In view of the poor cold storage capacity in Paraguay, meat processing facilities should be established in the vicinity of the development area with sufficiently acceptable equipment for importing countries.

6) Others

Concerning future distribution routes, the construction of two roads is under contemplation. These are to be connected to National Highway No. 9 running through the study area. Namely, these are the Pozo Colorado-Concepcion-P.J. Cavellero (Brazilian border) route and the Filadelfia-Pozo Ondo (Argentine border) route. The road construction should enable land transportation to bypass the urban area of Asuncion, plagued as it is with traffic jams, and promote the development of Filadelfia and Concepcion, both adjacent to the study area, as distribution centres. It is therefore desirable to improve access to these two cities.

Peanuts, oil crops, and cotton are planned as exportable products, whereas fruit, milk, and beef shall be exported only after having satisfied domestic demand. European countries such as the Netherlands, Germany, and Italy are expected to remain the main importers of peanuts and cotton. Oil crops shall be exported to areas of large demand, namely Europe and North America. On the other hand, neighbouring countries such as Brazil, Peru, and Argentina are selected as potential importers of beef and milk, for their demand is expected to increase in these countries. Large-scale cold storage facilities are currently scheduled for construction in Asuncion. High quality species to be introduced for production in the development area shall be exported raw via these facilities after being packed and cleansed on the spot. Potential importers of the products include not only neighbouring countries such as Argentina and Brazil but also European, North American, and other developed countries.

Table 7.4.2.1 Agricultural and livestock production by development zone

| Zone | ① | ② | ③ | ④ | ⑤ | Total | Remarks |
|-----------------------|--------|--------|---------|--------|--------|---------|-----------------|
| Agricultural products | t | t | t | t | t | t | |
| - Peanuts | 8,100 | 8,100 | 8,100 | | | 24,300 | Shelled |
| - Cotton | 13,900 | 14,000 | 18,700 | | | 46,600 | |
| - Oilseeds | 9,000 | 10,000 | 11,700 | | | 31,100 | Ave. 1t/ha |
| - Fruit | 14,400 | 14,000 | 26,300 | 1,200 | | 57,300 | Ave. 10t/ha |
| - Tropical fruit | | | | 33,300 | | 33,300 | Ave. 19.5t/ha |
| - Vegetable | | | | 2,700 | | 2,700 | Ave. 30t/ha |
| Livestock | (1000) | (1000) | (1000) | (1000) | (1000) | (1000) | |
| - Cattle | 21 | 23 | 76 | 1 | 1,888 | 2,009 | Projec. figures |
| - Sheep and goats | 47 | 47 | 85 | 0 | 73 | 252 | Projec. figures |
| Milk | t | t | t | t | t | t | |
| | 45,100 | 47,700 | 160,100 | 2,600 | | 255,500 | Shipped amount |

Note: 1. The numbers stand for the following zones

① Northern Pozo Colorado Zone

② Southern Mennonite Zone

③ Eastern Mennonite Zone

④ Suburban Asuncion Zone

⑤ Livestock Development Zone

2. Oilseeds includes Jojoba

3. Fruit includes citrus fruit and macadamia nuts.

4. Average harvest of vegetables concerns tomatoes

Table 7.4.2.2 Comparison of production in the whole country and in the Development Plan

| Category | Whole country ① | Development Plan ② | ②/① (%) | Remarks |
|-----------------------|-----------------|--------------------|---------|---|
| Agricultural products | t | t | | |
| - Peanuts | 34,000 | 24,300 | 71 | |
| - Cotton | 259,000 | 18,600 | 7 | Cotton X 0.4 |
| - Oilseeds | 470,000 | 85,300 | 18 | Castor oil plant, Sunflowers, Cottonseeds |
| - Fruit | 436,000 | 57,300 | 13 | Oranges, Grepefruits |
| - Tropical fruit | 390,000 | 33,300 | 9 | Mangoes, Pinapples, Bananas, Papayas |
| - Vegetable | 151,000 | 2,700 | 2 | Tomatoes, Melons, etc. |
| Livestock | (1000heads) | (1000heads) | | |
| - Cattle | 8,260 | 2,010 | 24 | |
| - Sheep and goats | 610 | 250 | 41 | |
| Milk | t | t | | |
| | 230,000 | 255,500 | 111 | |

Source: FAO ProuctoIn Yearbook, 1991

7.4.3 Farm product processing plan

1) Basic rationale on the location of facilities

In each of the agricultural development zones in the study area, a considerable number of farmers are expected to be settled, and it is considered that a specific community shall be created there. Each central settlement should therefore be equipped with necessary infrastructure such as transport, electricity, and telecommunications for the establishment of product processing facilities.

Generally, if the main agricultural products produced in a zone need processing, processing facilities shall be located at the central settlement in that district. Farm product processing facilities shall be run by private enterprises or collective production organizations of farmers.

Construction of the facilities is not planned in case the existing facilities in a surrounding area have enough surplus capacity to absorb the extra production. The surrounding areas are determined as follows.

| | |
|------------------------------|--|
| Northern Pozo Colorado zone: | (i) Mennonite settlements, (ii) Asuncion |
| Southern Mennonite zone: | (i) Mennonite settlements, (ii) Asuncion |
| Eastern Mennonite zone: | (i) Mennonite settlements, (ii) Asuncion |
| Suburban Asuncion zone: | (i) Asuncion |

2) Farm product processing facilities that need to be established

The marketing and processing of agricultural and livestock products as well as the necessity of processing facilities in the study area are referred to in the distribution plan. In this plan, construction of the following facilities is examined for each zone.

Northern Pozo Colorado zone: (i) ginnery, (ii) collective sorting facilities for citrus fruit, (iii) production plant for milk and dairy products.

Southern Mennonite zone: (i) ginnery, (ii) collective sorting facilities for citrus fruit, (iii) production plant for milk and dairy products.

Eastern Mennonite zone: (i) ginnery, (ii) collective sorting facilities for citrus fruit, (iii) production plant for milk and dairy products.

Suburban Asuncion zone: (i) collective sorting facilities for citrus fruit.

All zones (including the livestock farming development zone): (i) meat dressing facilities.

The following is the establishment plan of these facilities.

3) Ginneries

(1) Outline of the facilities

Harvested raw cotton is separated into fibre and seeds in ginneries. Cotton fibre, after refining and packing, is delivered to Asuncion. Cottonseeds are sent to oil extraction plants after selection.

Cotton is harvested between February and April. In general, ginneries operate without interruption in the harvest period and cease their operation after four months.

A cotton plant consists of an administration office, a warehouse for raw materials, and a ginnery (ginning room, machine room, storage for cotton fibre, storage for cottonseeds).

(2) Location

Cotton production is planned in northern Pozo Colorado, and the southern and eastern Mennonite zones. The planted area in each zone ranges from about 8,000 to 10,000 hectares.

As shown in fig. 7.4.3.1, a plant is planned to be located in each of northern Pozo Colorado, and the southern and eastern Mennonite zones.

(3) Scale of the plant

The unit harvest is estimated to be 1.8 tons per hectare, which means that about 16,000 tons of raw materials are supplied annually to the plant in each district.

In view of the present situation of ginneries in Paraguay, the scale of the plants is determined as follows.

- a. Maximum processing capacity per day: 160 tons
- b. Annual working days: about 100 days
- c. Annual operating days: about 130 days
(30 days are reserved for dry run, adjustment, maintenance, and so on)
- d. production yield: cotton fibre 34%
seeds 55%
impurities etc. 11%
- e. daily production capacity: cotton fibre 54 tons
seeds 88 tons

(4) Management

The plant shall be managed by private enterprises.

(5) Production process

Production process in the plant is shown in fig. 7.4.3.2.

(i) Receipt of goods

Raw materials are bagged and carried to the plant by farmers. At the place of reception, products are graded according to the result of tests on water and impurity contents and then weighed. The preferred water content is 12-17%.

(ii) Storage of raw materials

Raw materials are stored according to their grades.

(iii) Ginning

Ginning machines separate raw cotton into fibre and seeds. Raw materials with a high water content are sun-dried before processing.

(iv) Removal of impurities

Cotton fibre derived by machines contains impurities such as leaves and dust, which should be removed carefully. Fine cotton fibre left around the seeds is collected and marketed as a second grade product.

(v) Press

Fibre cleared of impurities is pressed into cubes by pressers.

(vi) Packing

Products are packed in cotton cloth.

(vii) Storage & delivery

Products are temporarily stored in the warehouse. Cotton fibre is then delivered to Asuncion for export, while cottonseeds are delivered to oil extraction plants in the country. General transporters are used for delivery.

(6) Required manpower

In total, 135 workers can be employed (120 for production, 15 for administration). The production workers shall be employed for 130 effective working days per year, while the administrative personnel shall be employed throughout the year.

(7) Conditions of location

The location of the plants should meet the following conditions.

- (i) Transport system including roads are sufficiently established to enable farmers to deliver raw cotton.
- (ii) Power supply is available.
- (iii) Sufficient labour is available for a limited period (130 days from February to May each year).

(8) Required investment for construction

With reference to similar plans formulated by MIC, MAC, and the World Bank as well as to interviews with those concerned, the amount of investment required for the construction of ginneries is estimated as follows.

| | |
|---|-------------|
| Maintenance, formation, and arrangement of land | 20,000 US\$ |
| Ginning machines | 1,500,000 |
| Instruments | 30,000 |
| Plant construction | 200,000 |
| Machine assembly | 50,000 |
| Equipment and others | 70,000 |
| Reserve fund | 100,000 |
| Total fixed cost | 2,000,000 |
| Management cost | 600,000 |
| Total investment | 2,600,000 |

4) Collective sorting facilities for citrus fruit

(1) Outline of the facilities

At present, citrus fruit produced in Paraguay is generally distributed by brokers, who purchase directly from farmers on the spot by truckload and bring the products into the central market. Purchase prices from farmers are often seriously undervalued due to the lack of uniformity of products both in quality and quantity.

Therefore, increased uniformity and added value of products through sorting should enable the producers to bypass brokers and put their products on the market directly, at higher prices.

Oranges, grapefruits, and tangerines are the raw materials to be sorted in the facilities. After sorting, high-grade products shall be packed in cartons for export and then delivered to cold storage in Asuncion. Medium-grade products shall be transported to the central market in Asuncion for domestic consumption.

A plant consists of the product reception department, sorting machine department, packing department, and delivery department.

(2) Location

Citrus fruit shall be produced in northern Pozo Colorado, and the southern and eastern Mennonite settlements. The planted area shall be about 1,400 hectares for northern Pozo Colorado and the southern Mennonite settlements and about 2,600 hectares for the eastern Mennonite settlements.

The plan designates an area of 1,400 hectares as a production unit. Therefore, northern Pozo Colorado and the southern Mennonite settlements shall have one plant each, whereas the eastern Mennonite settlements shall have two. The locations of the plants are shown in fig. 7.4.3.1.

(3) Scale of the plant

Unit harvest of citrus fruit is estimated to be 10 tons per hectare for representative species of orange. About 14,000 tons of raw materials will be supplied annually to a plant.

The harvest period for citrus fruit is from March to November for oranges, from March to October for tangerines, and from May to July for grapefruit. Accordingly, the plant shall operate for 9 months from March to November on the following scale.

| | | |
|----|---|---|
| a. | Maximum processing capacity per day: | 15,000 tons |
| b. | Annual operating period: | 9 months |
| c. | Annual working days: | 230 days |
| d. | Daily processing capacity (at normal level): | 50 tons |
| e. | Daily processing capacity (at maximum level): | 100 tons (for about four months) |
| f. | Hourly processing capacity: | 7 tons (7 tons X hours = 50 tonnes/day) |

In the maximum operation period, the employees shall work in two shifts.

(4) Management

Fruit is to be cultivated by small-scale farmers. The producers shall organize agricultural cooperatives to manage their activities up to the delivery of products. It is of primary importance to grasp market needs and to reflect them in production and delivery.

(5) Production process

The production process in the plant is shown in fig. 7.4.3.3.

(i) Collection

The producers shall be small farmers who do not possess trucks and other means of transport. Therefore, the produced fruit shall be collected in the farmers' orchards. The sorting facilities shall own three transport vehicles (with capacity of six tonnes) for fruit collection. Supposing a distance of 60 kilometres should be covered per collection, a vehicle shall be able to make three round trips in a day.

(ii) Reception & measurement

Each producing farmer's products are measured for sweetness and sourness and then weighed in the sorting facilities.

(iii) Rough sorting

Each farmer's products are put into machines as a lot. The workers examine the products carried on conveyor belts by eye and remove rotten or blackened fruit before cleaning.

(iv) Cleaning

Fruit is washed in water, wiped, dried, waxed, and polished by the automatic cleaning machine.

(v) Sorting

Sorting is divided into two processes; grade sorting and class sorting. Grade sorting is classification in quality according to the colour, shape, damage etc. of the fruit. Class sorting is classification according to the size of the fruit. Each sorting shall be made in about three categories. Grade sorting shall be conducted by the workers, while class sorting shall be carried out by automatic sorting machines.

(vi) Packing

Packing shall be done carefully by the workers. Cartons or wooden boxes shall be used as packing materials. In general, high-grade products shall be packed in cartons

for export and delivered to cold storage in Asuncion. Medium-grade products shall be packed in wooden boxes for domestic consumption and delivered to the central market in Asuncion.

(vii) Measurement, temporary storage & delivery

Products shall be delivered to Asuncion soon after measurement. General transporters are used for shipping.

(6) Required manpower

In total, 45 workers can be employed in a normal season (36 for production, 7 for administration). 36 production workers shall be additionally employed in the high season. The production workers shall be employed either for a long term between March and November or for a short term between June and September, while the administrative personnel shall be employed throughout the year.

(7) Conditions of location

The location of the plants should meet the following conditions.

- (i) Transport system including roads should be sufficiently established.
- (ii) Power supply should be available.
- (iii) Cleaning water can be secured.
- (iv) Sufficient labour is available for a limited period.

(8) Required investment for construction

With reference to similar plans formulated by MIC, MAC, and the World Bank as well as to interviews with those concerned, the amount of investment required for the construction of collective sorting facilities for citrus fruit is estimated as follows.

| | |
|---|----------------|
| Maintenance, formation, and arrangement of land | 5,000 US\$ |
| Cleaning and sorting machines | 600,000 |
| Instruments | 10,000 |
| Containers (wooden boxes) | 5,000 |
| Transport vehicles etc. | 100,000 |
| Plant construction | 180,000 |
| Electric and water supply facilities | 30,000 |
| Equipment and others | 20,000 |
| Reserve fund | 50,000 |
| Total fixed cost | 1,000,000 US\$ |

| | |
|------------------|----------------|
| Management cost | 100,000 US\$ |
| Total investment | 1,100,000 US\$ |

5) Production plant for milk and dairy products

(1) Outline of the facilities

In Paraguay, it is since the 1980's that milk has been widely disseminated and produced in the present large-scale facilities. Thus, the milk industry is one of the newest and more promising industries in the country. At present, the largest milk processing plant in Paraguay is managed by the Loma Plata cooperative in the Mennonite settlements, and has a daily processing capacity of 120 tons. Dairy farming related activities are also given high priority in the plan. The scale of facilities to be constructed exceeds that of the existing facilities.

In the light of future trends in demand, about half of the milk shall be produced for drinking, the rest for processing into cheese etc. The production of cheese has not been sufficiently developed yet, and Paraguay remains mostly dependent on imported cheese. Cheese producing plants in the country constitute a sector of low productivity and low profitability. Production of natural cheese, greatly influenced by the environment and weather, would not succeed without the testing and development of production and ripening methods. Therefore, the plan envisages plant construction in two phases. The first phase concerns production facilities for products without risk such as milk, dairy cream, and yoghurt. The cheese production department shall be added in the second phase.

A plant consists of an administration department, technological development department, milk production department, yoghurt production department, dairy cream production department, and cheese production department.

(2) Location

Milk shall be produced in northern Pozo Colorado, the southern and eastern Mennonite settlements, and the suburbs of Asuncion. For the suburban Asuncion zone, the existing facilities nearby will be sufficient, for only a small number of cows shall be bred there. Therefore, the plan envisages the construction of facilities in northern Pozo Colorado, and the southern and eastern Mennonite settlements.

17,000 cows, the number that is to be bred in northern Pozo Colorado, shall constitute a basic unit for milk production. Accordingly, a plant shall be constructed in northern Pozo Colorado and the southern Mennonite settlements, while the eastern Mennonite

settlements shall have four new plants. Their locations are shown in Table 7.4.3.1.

(3) Scale of the plants

Three tonnes of milk are the expected yield from a mature cow, which indicates that about 51,000 tons of raw milk will be supplied to each plant. Regardless of seasonal fluctuations in raw milk supply, the plants shall operate on the following scale.

- | | | |
|----|---------------------------------------|---|
| a. | Maximum processing capacity per year: | 51,000 tons |
| b. | Annual operating period: | throughout the year |
| c. | Daily processing capacity (total): | 140 tons (80 tons in the first phase, 60 tons in the second phase) |
| | of which, milk (long-life): | 70 tons (in the first phase) |
| | yoghurt: | 9 tons (in the first phase) |
| | cream: | 1 ton (in the first phase) |
| | cheese: | 60 tons (in the second phase) |

(4) Management

The plants shall be managed by general private companies.

(5) Production process

The production process in the plants is shown in fig. 7.4.3.4.

(i) Collection

For collecting milk, the plants shall be equipped with tank trucks and milk collection vehicles for buckets. Collection shall be conducted twice a day, i.e. once in the morning and once in the afternoon. For farmers owning 60 or more milk cattle, collection shall be conducted on the spot. In settlements of small farmers, collection points shall be established at appropriate intervals along principal roads. Small farmers bring their buckets to the collection point.

The milk collection vehicle shall be loaded with the buckets at collection points and shall then transport them to a plant. The capacity of the transport vehicles shall be 6 tons, and four tank trucks and three bucket transporting vehicles shall be procured initially. Collection shall be conducted twice a day, i.e. once in the morning and once in the afternoon.

(ii) Reception & measurement

The plants shall receive raw milk, whose weight and quality shall then be examined.

- (iii) Filtering
Raw milk shall be cleared of impurities by filtering.
- (iv) Refrigeration & temporary storage
Raw milk shall be stored in tanks after being refrigerated down to two to four degrees centigrade.
- (v) Removal of impurities
After being heated up to 40 degrees centigrade, raw milk shall be further cleared of impurities by centrifuge.
- (vi) Standardization of butterfat content
Butterfat content shall be adjusted to 2.8-3%.
- (vii) Pasteurization
Since the milk is scheduled to be delivered as a long-life type, it shall be pasteurized at 140 degrees centigrade for two seconds.
- (viii) Filling
Milk is filled into containers for long-life type milk. The work is to be conducted by automatic machines in asepsis.
- (ix) Preservation & delivery
The product shall be preserved for a week at room temperature and delivered to the market unless any deterioration has been detected.
- (x) Production of yoghurt
The production process of yoghurt is shown in fig. 7.4.3.5. Up to the standardization of butterfat content, the process is the same as in the case of milk. Thereafter, sugar shall be added to the raw milk, which shall then be sterilized, put into a tank, subjected to lactic fermentation at 40 degrees centigrade, cooled to four degrees centigrade for four to six hours, perfumed with essence and packed. The product shall be preserved in refrigerators until the time of delivery.
- (xi) Production of dairy cream
The production process of dairy cream is shown in fig. 7.4.3.6. Up to the standardization of butterfat content, the process is the same as in the case of milk. Thereafter, the raw milk shall be creamed, neutralized, sterilized, cooled, bottled, and preserved cold.

(xii) Production of cheese

Table 7.4.3.7 shows the production process for cheese.

(xiii) Delivery

The products shall be delivered to Asuncion by general transporters.

(6) Required manpower

In total, 45 workers can be employed in the first phase (35 for production, 10 for administration). The workers shall be employed through the year.

(7) Conditions of location

The location of the plants should meet the following conditions.

- (i) Transport system including roads should be sufficiently established to facilitate collection and delivery.
- (ii) Power supply should be available.
- (iii) Cleaning water can be secured.
- (iv) Sufficient labour is available.

(8) Required investment for construction

With reference to similar plans formulated by MIC, MAC, and the World Bank as well as to interviews with those concerned, the amount of investment required for the construction of production plants for milk and milk products is estimated as follows.

(i) Phase I

| | |
|---|----------------|
| Maintenance, formation, and arrangement of land | 20,000 US\$ |
| Plant construction | 600,000 |
| Electric and water supply facilities | 100,000 |
| Milk collection points (20) | 200,000 |
| Machinery plant | 3,000,000 |
| Laboratory | 30,000 |
| Transport vehicles (7; tank trucks etc.) | 200,000 |
| Equipment & materials | 50,000 |
| Reserve fund | 200,000 |
| Total fixed cost | 4,400,000 US\$ |
| Management cost | 100,000 US\$ |
| Total investment | 4,500,000 US\$ |

| | |
|--|----------------|
| (ii) Phase II | |
| Plant construction | 600,000 |
| Machinery plant | 1,000,000 |
| Laboratory | 30,000 |
| Transport vehicles (7; tank trucks etc.) | 200,000 |
| Equipment & materials | 50,000 |
| Reserve fund | 220,000 |
| Total fixed cost | 2,100,000 US\$ |

6) Meat dressing plant

(1) Outline of the facilities

In the livestock farming development zone, the production of beef cattle shall stabilize at 280,000 head of cattle. On top of this, including old beef cattle formerly used for propagation and old milk cattle in the dairy farming zone, 487,000 head of cattle should be delivered from the whole area.

However, within the study area, 554,000 head of cattle have already been bred for propagation, and the estimated annual supply of 122,000 of these are processed in the existing meat dressing facilities. Therefore, the facilities to be constructed shall deal with the remaining cattle, namely 365,000.

The facilities shall conduct slaughter, carcass dressing, dismemberment into parts, and frozen delivery mainly for export.

(2) Location

As indicated below, various constraints exist for the location of meat dressing facilities. Since there is no qualified location in the study area, the facilities plan considers for the moment the construction at the most favorable spot hopefully in the periphery.

At present, the most appropriate location should be in the vicinity of Asuncion. Among other cities, Concepcion is expected to develop as a distribution centre of agricultural and livestock products through the future improvement of access roads etc. Three plants shall be established in Asuncion, whereas Concepcion shall have two.

Requirements for the location of meat processing facilities:

- a. Availability of sufficient water of good quality.
- b. Easy sewage disposal
- c. Sufficient power supply

- d. Convenient access roads and proximity to markets
- e. Facility of obtaining labour force (considerable seasonal fluctuations)
- f. Existence of a market to easily absorb such by-products as hide and internal organs.

(3) Scale of plants

In view of the scale of existing packers, an efficient model of single line processing is applied to determine the scale of the plants.

- a. Mooring capacity: 500 head
- b. Slaughtering capacity per hour: 50 head
- c. Cold storage capacity (dressed carcasses): 700 head
- d. Frozen storage capacity: 400 tonnes
- e. Average slaughtering per day: 250 head
- f. Annual slaughtering: 75,000 head

Supposing an average plant has the above capacities, five new plants shall be required in total to meet the production plan.

(4) Management

The plants shall be managed by ordinary private companies.

(5) Production process

The following is the process up to the production of dressed carcasses.

(i) Conveyance and mooring of live cattle

In principle, live cattle are brought in by ranchers. The cattle thus conveyed shall be weighed, grouped by ranch, and moored.

(ii) Slaughter & skinning

Following examination, cattle are driven in and slaughtered one by one. After releasing blood, they are hung on a trolley rail to be skinned. The hide is carefully washed in water and sold daily to leather processors.

(iii) Back cutting & refrigeration

First, the chest is cut open to take out internal organs for examination. Then, the back is cut open to examine the dressed carcass. Dressed carcasses are carefully washed in water and refrigerated. Three days are required for refrigeration, including preliminary cooling.

(iv) Processing of internal organs

Each internal organ is processed separately and sold to domestic dealers.

(v) Meat processing

The dressed carcasses in chilled form are largely separated into five parts (plate, round, shoulder, rib, and chuck) to be packed.

(vi) Rapid freezing & delivery

The meat is frozen rapidly (at -30 degrees centigrade) and delivered by freezer trucks for export.

(7) Required manpower

In total, 260 workers can be employed in a normal season (200 for production, 60 for administration). Due to expected fluctuations in the supply of beef cattle, the number of production workers shall be increased or reduced by about 20%. The administrative personnel shall be employed throughout the year.

(8) Required investment for construction

With reference to similar plans formulated by MIC, MAC, and the World Bank as well as to interviews with those concerned, the amount of investment required for the construction of meat processing plants is estimated as follows.

| | |
|--|-------------|
| Maintenance, formation and arrangement of land | 30,000 US\$ |
| Plant construction | 1,600,000 |
| Electric and water supply facilities | 100,000 |
| Machinery plant | 2,000,000 |
| Refrigerating and freezing facilities | 1,000,000 |
| Equipment and materials | 70,000 |
| Reserve fund | 400,000 |
| Total fixed cost | 5,200,000 |
| Management cost | 300,000 |
| Total investment | 5,500,000 |

7) Cooperative delivery facilities for fruit and vegetables

(1) Outline of facilities

A large number of small farmers engage in agricultural activities in the suburban Asuncion zone. The principal crops in the zone are vegetables marketed in Asuncion and tropical fruit destined for domestic and foreign markets. Though each farm works on a small scale, it is geared for high-quality, multi-product production.

Local cooperatives shall take the lead in developing new markets through the collective delivery of quality products.

The following is the planned distribution system of fruits and vegetables.

In the morning, farmers harvest and sort the crops according to standards developed by the cooperative, and pack them in the specified boxes for delivery. In principle, products for domestic consumption are packed in wooden boxes, whereas export crops are packed in cartons.

In the afternoon, trucks owned by the collective delivery facilities go the round of farms to collect the products and group them according to grade.

The next morning, the products are delivered from the facilities to the central market in Asuncion. As necessary, some of the products are preserved cold to adjust market prices.

The functions of the facilities include not only collective collection and delivery but also guidance on cultivation to respond to market needs, the provision of financial and material assistance for farm management, and so on.

Facilities shall consist of a collection and delivery department, refrigeration and storage department, farm management materials department, administration department, and farm management guidance department.

(2) Location

The facilities shall be located in the suburban Asuncion zone. The location is shown in fig. 7.4.3.1.

(3) Scale of the facilities

The following crops are scheduled to be cultivated in the suburban Asuncion zone.

| | | |
|-------------|-------------|------------------------|
| Vegetables: | watermelons | } 90 hectares in total |
| | melons | |
| | tomatoes | |
| | cucumbers | |
| | cabbages | |
| | garlic | |
| | asparagus | |

| | | |
|---------|------------|---------------------------|
| Fruits: | mangoes | } 1,890 hectares in total |
| | pineapples | |
| | bananas | |
| | papayas | |

Assuming a daily maximum delivery of 20 tons of vegetables and 200 tons of fruit, the scale of the facilities is estimated as follows

- | | | |
|----|--|---------------------|
| a. | Collection and delivery department: with a capacity of treating 100 kilograms of crops per square metre; | 2,200 square metres |
| b. | Refrigeration and storage department: | 200 square metres |
| c. | Others: warehouse etc.; | 300 square metres |
| | Total: | 2,700 square metres |
| d. | Office etc.: | 100 square metres |

(4) Management

The producers shall organize agricultural cooperatives to manage their activities.

(5) Required investment for construction

The amount of investment required for the construction of collective delivery facilities for fruits and vegetables is estimated as follows.

| | |
|---|----------------|
| Maintenance, formation, and arrangement of land | 10,000 US\$ |
| Instruments | 10,000 |
| Containers (wooden boxes) | 5,000 |
| Transport vehicles etc. | 100,000 |
| Plant construction | 1,000,000 |
| Electric and water supply facilities | 10,000 |
| Equipment and others | 20,000 |
| Reserve fund | 45,000 |
| Total fixed cost | 1,200,000 US\$ |
| Management cost | 100,000 US\$ |
| Total investment | 1,300,000 US\$ |

8) Other farm product processing

(1) Production of jojoba oil

Jojoba oil, produced in very few locations worldwide, is used solely for cosmetics. It is said that increased production and abundant supply at low prices will considerably

increase its demand for industrial purposes as well.

Jojoba oil is generally traded in the form of roughly extracted oil. It is extracted in exactly the same way as cottonseed oil, peanut oil, and others. Since there exists a considerable surplus capacity in the existing oil extraction facilities in Paraguay, construction of new facilities is not planned at present.

(2) Processing of macadamia nuts

Macadamia nuts have not been processed in Paraguay, but are generally distributed in the market in the form of unshelled nuts. Also in this plan, the development of production should entail the introduction of unshelling machines. The equipment shall be installed by local collective organizations established by producers.

(3) Production of condensed citrus fruit juice

The production plan allocates about 56,000 hectares of land for the production of citrus fruit. Although citrus fruit shall usually be delivered fresh for export, much of it is expected to fall short of the standard. Generally, these substandard fruits can be processed into condensed juice, oil essence etc.

According to 1991 statistics, the world price of fruit juice stood at 1,400US\$ per ton, but it is said that a recent oversupply has pushed the price down to nearly 1,000US\$ per ton. The purchase price of raw fruits represented by oranges currently stands at around 30US\$ per ton (factory price). Furthermore, fruit juice processing requires one ton of cleaning water for each ton of raw material, which is hardly available in the Chaco region.

Therefore, it is fairly difficult at present to construct citrus fruit processing facilities in the Chaco region. However, construction might be considered in future, if increased harvests of fruit result in a large supply of raw materials at low prices.

The required investment should amount to 6 million dollars for the construction of fruit juice processing facilities with a capacity of 4,000 tons per year.

(4) Production of boiled meat

Paraguay is in an area infected with foot-and-mouth disease, and principally exports meat to neighbouring countries and some European countries. In order to increase its meat export, Paraguay needs to consider exporting to non-infected areas.

It is generally considered that meat exports from foot-and-mouth disease infected areas to the non-infected area are made possible by preserving meat in asepsis through such methods as heat treatment. Concrete measures should be first required of the department in charge of meat epidemic prevention in the government of the prospective importing country.

In the case of Japan, the following procedure is required.

- a. In response to an inquiry from the exporting country, certain requirements should be presented on the heating condition of meat and hygiene in processing facilities. When the facilities are suitably equipped, inspectors shall eventually be dispatched by the Japanese government to confirm that they meet the requirements presented earlier.
- b. This procedure is subject to bilateral negotiation and has not been published. Boiled meat is used for limited products such as retort pouched food, but has an insignificant share in total meat distribution. In Japan, according to FY 1992 statistics, boiled meat account for only 0.7% of total meat imports at about 3,000 tons. Demand for boiled meat is not expected to increase in future unless it has considerable advantages over other kinds of meat in price.

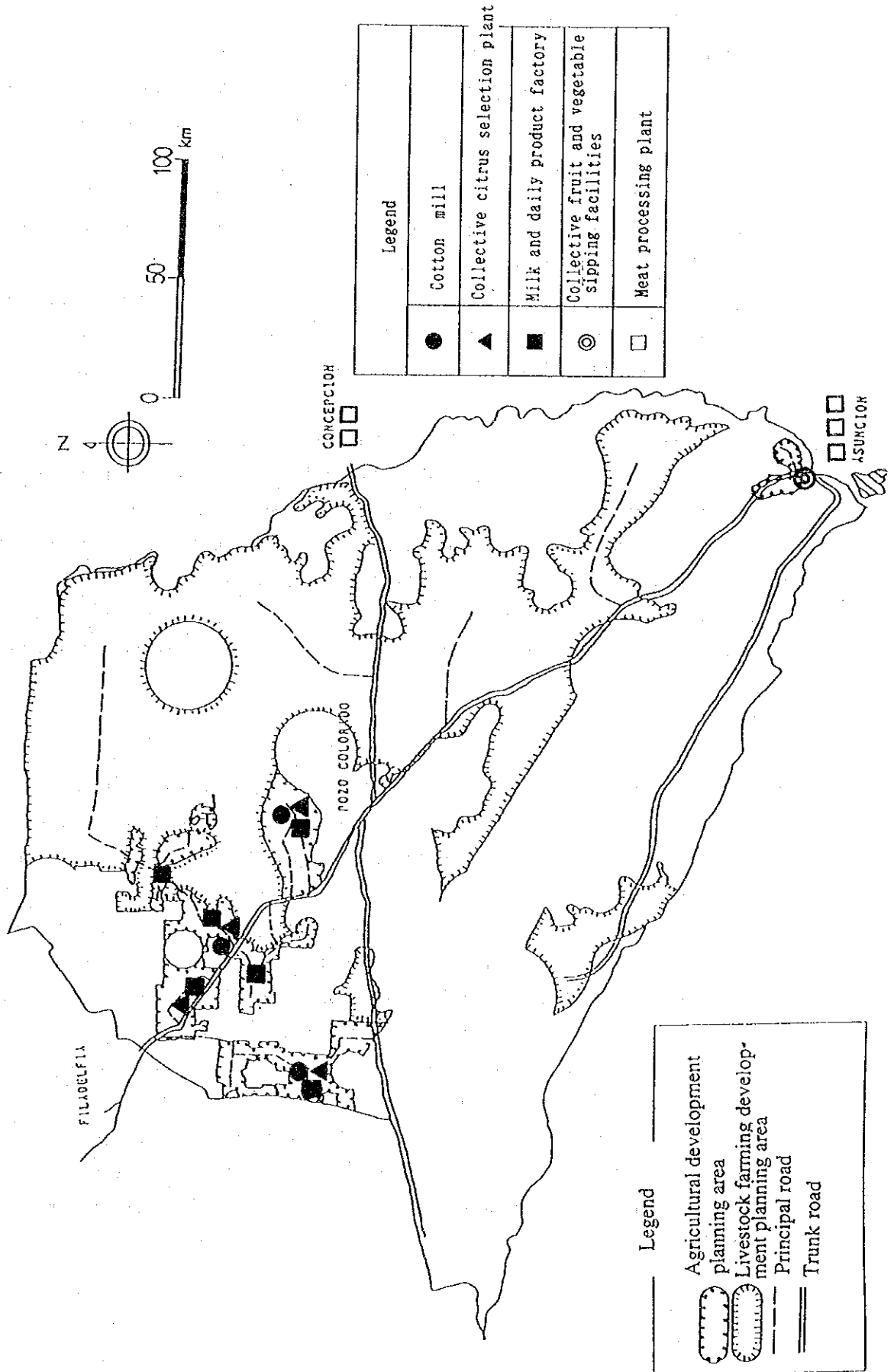
(5) Livestock by-products

Livestock by-products such as leather and bone are derived in the process of meat dressing.

Demand for leather has been increasing significantly in recent years and is expected to be a highly value-added export item, though considerable improvements would be required in the quality of raw materials and in the processing method.

At present, bone is only processed into bonemeal. The production of bone extract and others should be examined in the future.

Fig. 7.4.3.1 Locations of farm and livestock product processing plants



| Legend | |
|--------|---|
| ● | Cotton mill |
| ▲ | Collective citrus selection plant |
| ■ | Milk and daily product factory |
| ⊙ | Collective fruit and vegetable sipping facilities |
| □ | Meat processing plant |

| Legend | |
|--------|---|
| ⋯ | Agricultural development planning area |
| ⋯ | Livestock farming development planning area |
| --- | Principal road |
| == | Trunk road |

7.4.4 Agricultural credit plan

1) Beneficiaries of the agricultural credit plan

Individual plans constituting the Integrated Development Plan include highly public activities through direct investment by the government in the fields of agricultural testing and research, roads, rural development, and so on, and activities intended for private purposes in farmland and grassland development, irrigation facilities, distribution and processing facilities, and so on. Harmonization of public and private activities is required in order to fulfil the goals of the Plan. Furthermore, the construction of various facilities accompanying these activities and the support of private activities such as the purchase of agricultural equipment and livestock should be reinforced to encourage active participation on the part of individual farmers, agricultural cooperatives, and private enterprises.

The traditional support method for farmers in Paraguay is financing by parastatal financial institutions. The farm credit plan follows this tradition and provides financing for the totality of private activities. The beneficiaries include private enterprises as well as individual farmers or agricultural cooperatives, principal elements in the Development Plan. However, since the Development Plan principally benefits financially deprived small farmers in an area under harsh natural and economic conditions, credit support should require very special consideration on the part of the government and financial institutions.

2) Providers of agricultural credit

Parastatal organizations such as BNF, CAH, and FG are currently involved in lending to the agricultural sector. In the Integrated Development Plan, however, the scale of beneficial farmers and their products as well as credit items vary considerably and there are no financial institutions that will engage in all of the lending activities. Therefore, the farm credit plan shall establish a higher one-stop organization in the government to deal with the complicated management of lending funds, and through this organization, the resources shall be redistributed among financial institutions according to their lending operation. The plan shall be modelled on FDC (Fondo de Desarrollo Campesino; see Appendix 7.4.4 Agricultural credit plan), which has already started similar lending activities financed by the International Fund for Agricultural Development and other international organizations. Here, on the supposition that an organization provisionally named the "Chaco Region Integrated Agricultural Development Fund" will be established, we examine the conditions for lending to individual business entities to provide a basis for calculating the amount of required fund. The actual calculation of the required fund will be discussed in 9.5 Financing plan.

3) Credit fund

(1) Long-term credit fund

Investments which will benefit from the long-term credit of the Fund are classified into business investment to cover the contribution to farmland and grassland development as well as land purchase on one hand, and farm management investment necessary for the introduction of agricultural equipment and livestock, the construction of facilities etc. on the other.

a) Business investment

In the Integrated Development Plan, individual credit is available for farmland development activities and grassland improvement activities. These activities are conducted under the direct control of the government, but the funds necessary for individual business activities shall be charged to beneficial farmers and therefore financed by long-term credit provided by the Fund. The cost of land acquisition is also included in the calculation of the amount.

b) Farm management investment

As far as farm management investment is concerned, long-term credit is provided to cover the cost of construction of farm management facilities and the purchase of agricultural equipment and livestock, as well as farm management in the period without income for cultivating fruit and other products which will require several years before harvesting. Therefore, the total amount of farm management investment is calculated as the aggregate of the initial and replacement investment in facilities, machinery etc. for each category of farm management according to the farm management plan.

c) Calculation of repayment on long-term credit

The reimbursed amount is equally distributed between principal and interest. Annual repayment rate (R) is calculated as follows.

$$R = \{a (1 + a)^n\} / \{(1 + a)^n - 1\}$$

Here, a = interest rate, and n = repayment period excluding grace period.

(2) Short-term credit

Short-term credit covers not only the production cost required in a single year for individual farms but also the possible shortage of operating capital due to the repayment of the above-mentioned long-term credit. The required amount of credit funds shall be

determined in the light of the annual financial plan of individual farmers adjusted to the progress of business. The required funds should be smaller than the maximum amount of credit, for loans will be repaid with interest in the following year.

(3) Credit in support of distribution and processing

Distribution and processing facilities shall be managed by private enterprises and therefore are not subject to the plan. However, these facilities are indispensable for the accomplishment of objectives set in the farm credit plan, for they shall be established for the purpose of increasing the value added to the agricultural and livestock products produced according to the plan.

Consequently, the funds required for the establishment of distribution and processing facilities should be envisaged in the farm credit plan, but in consideration of the availability of resources for these facilities from general banks, conditions on lending etc. shall be determined with reference to the effective money market rate. This scheme provides only long-term credit for the initial investment in ground arrangement, construction of buildings and facilities, purchase of machinery and equipment etc., and does not cover short-term credit for management costs incurred in a single year.

4) Lending conditions

In view of maintaining financial order, lending conditions should be determined in accordance with the existing conditions in individual financial institutions. However, farm management in the project area will be subject to extremely hard conditions and it is therefore difficult to assume the management of farms in starting new farm management and expanding business scale under the prevalent lending conditions. Therefore, in determining the conditions, the plan considers relaxation measures for some lending activities, such as a prolongation of the grace period, a reduction in the interest rate, and government subsidies. Table 7.4.4.1 shows the lending conditions set for the calculation of interest rates. The figures are presented in U.S. dollars. In consideration of inflation and foreign exchange rates for the five years prior to 1992, the benchmark year for the calculation, the interest rate in the local currency (Guarani) is determined as 12% higher than the calculated rate.

(1) Long-term credit

- (i) The cost of land purchase accompanying new settlement and enlargement of business activities as well as the contribution of individual farmers to the cost of farmland development (construction of infrastructure for farmland development, small irrigation channels and infrastructure for grassland improvement) concerning

management of individual farms, are incurred only at the initial stage of development as business development investment. Therefore, long-term credit covering these costs shall be repaid with an annual interest of 8% over 20 years (including the grace period of three years on principal repayment).

- (ii) Long-term credit covering the construction cost of various farming facilities, the purchase cost of agricultural equipment and livestock as well as the cost for opening orchards, such as the purchase cost of young plants, which are incurred by individual business entities as business-related development investment and require periodical renewals as depreciable assets, shall be repaid with an annual interest of 12% over 10 years.

(2) Short-term credit

The lending conditions on short-term credit are determined so as not to exert a destabilizing effect on the existing banking system. Therefore, short-term credit envisages repayment with an annual interest of 16% over a year.

(3) Credit in support of distribution and processing

The same conditions as in the case of (ii) in (1) Long-term interest are applied, namely 12% annual interest and a 10-year maturity period.

5) Solvency of farmers

Solvency of individual farmers on farm credit shall be separately examined for each category of farm management. Farm management will be conducted continuously and repeatedly and its sustainability cannot be evaluated on the basis of the balance sheet for a single year. Especially for the management of farms unequipped with farm management materials as in the case of settlement, the start-up of farm management will necessarily depend on credit, due to the huge amount of initial investment required and the possible shortage of reserve funds in many cases. Therefore, a capital balance plan shall be prepared in consideration of the annual balance sheet as well as the amount of debt and repayment to determine the solvency of farmers, based on the examination of capital movement from the start-up of farm management to the period in which farm management has stabilized to enable the accumulation of capital. The initial conditions on farm management are set on the assumption of constant price conditions. The following are the basic conditions set for examining the capital balance in each year.

- (i) Farmland and grassland development shall be executed in the initial year of farm management.

- (ii) Investment in agricultural machinery and equipment shall also be executed in the first year of farm management.
- (iii) The cost of introduction of livestock and arrangement for opening orchards shall be determined in accordance with individual introduction plans.
- (iv) The transition to the planned models shall start with business investment, and the fund repayment shall start from the following year.
- (v) The fund requirement in each year shall be calculated from business and farm management investment, income and management costs as well as from living expenditure.
- (vi) The plan for borrowing and repayment shall be determined for the segment of the required funds covered by long-term credit.
- (vii) Possible shortages in annual disposable income remaining after deducting the repayment on the above-mentioned long-term credit shall be covered by short-term credit.
- (viii) The surplus remaining after paying all costs shall be internally retained and allocated for possible shortages in later years.

Application of the plan to individual categories of farm management is shown in figs. 7.4.4.2-7.4.4.15. The continuity of farm management in each category should be assured under the presented lending conditions if accompanied by subsidizing measures by the government for some of the business costs.

Table 7.4.4.1 Conditions set for determining the farm credit plan

| Executing institutions | Classification | | Activities covered by credit | Lending conditions etc. | | Borrowers |
|--|--|------------------|---|-------------------------|----------|---|
| | | | | Interest rate | Maturity | |
| BNF, FG, CAH, agricultural cooperatives and others | Long-term credit | Investment costs | Development of farmland and grass land, land purchase | 8% | 20 (3) | Farmers |
| | | | Purchase of machinery, instruments, and equipment Purchase of livestock, construction of facilities | 12 | 10 | |
| | | | Arrangement for opening orchards | 12 | 10 | |
| | Short-term credit | Management costs | Purchase of seeds, fertilizer, agricultural chemicals, and fuels Allocation to labour cost, maintenance costs, other management costs, and debt repayments | 16 | 1 | |
| BNF, FG and others | Credit in support of distribution and processing | Investment costs | Land arrangement for constructing facilities Construction of facilities Purchase of machinery, instruments, and equipment | 12 | 10 | Agricultural cooperatives and enterprises |

- Note 1: The interest rates presented in the column of lending conditions etc. represent the annual rate and correspond to U.S. dollars.
- 2: Maturity means the number of years required for debt repayment. The grace period for principal payment is presented between parentheses.
- 3: The figures in the table represent conditions set for executing institutions.

CHAPTER 8

INTEGRATED AGRICULTURAL AND LIVESTOCK FARMING DEVELOPMENT PLAN

CHAPTER 8 THE INTEGRATED AGRICULTURAL AND LIVESTOCK FARMING DEVELOPMENT PLAN

8.1 ZONE-BY-ZONE DEVELOPMENT PLANS

In this integrated development plan, areas for the agricultural development plan and for the livestock development plan have been designated according to land use plans, and a certain area of land has been defined as a unit (regional unit).

Each of these units represents a "zone" in this plan. Furthermore, individual programs focussed on cultivation, farming, and post-harvest have been combined for each zone in each of the areas covered by the development plan in consideration of economic efficiency, and are integrated into this zone-by-zone development plan.

Regional features of the development plan in each zone are as follows.

- 1) Three zones - the southern part of the Mennonite settlements, the eastern part of the Mennonite settlements and the northern part of Pozo Colorado - are located in the northern part of the study area, and come under the influence of the economic bloc of the Mennonite settlements to a large extent. Crop farming is feasible in these zones.
- 2) The Asuncion suburban zone is located in the suburbs of Asuncion, Paraguay's capital, and can be regarded as an extension of the eastern region in terms of natural, social, and economic conditions as well as cultivation techniques. The same type of farming as in the northern region (vegetable and fruit farming) is feasible.
- 3) Stock farms (estancia), which raise beef cattle mainly by pasturing the cattle on natural grassland, are presently operated in the areas included in the livestock farming development plan. This plan calls for the introduction of partly improved grassland and the operation of farms dedicated to raising beef cattle mainly on natural grassland, and does not include crop farming. Individual programs for the common software sector including testing and research and diffusion training as well as the common hardware sector including marketing and processing and improvement of social infrastructure, both of which are required to carry out the Development Plan by Zone, are integrated into the Integrated Agricultural and Livestock Farming Development Plan. The latter has been laid out from this study to serve as the Master Plan for the development of the study area of Departamento Presidente Hayes through agricultural and livestock farming.

Table 8.1.1. shows details of the zone-by-zone development plan and individual programs incorporated in the Integrated Plan.

Table 8.1.1 List of Projects by Zone

| Amounts in thousands of US dollars | | | |
|---|---------------------------------|----------------|--------|
| Item | Standard/Dimensions/Description | Quantity | Amount |
| 1. Southern part of the Mennonite settlements | | | |
| 1) Development of farmland/development of grassland/roads/drainage | | | |
| Trunk roads | B=7.0m | 97 km | 8,810 |
| Branch roads | B=6.0m | 162 km | 11,123 |
| Farmland formation | | 26,200 ha | 4,486 |
| Grassland formation | | 15,100 ha | 2,830 |
| Drainage | | 4,200 ha | 6,300 |
| Conservation of farmland (afforestation, observation wells) | | 4,819 ha | 1,790 |
| 2) Cultivation | | | |
| Peanuts + cotton + sorghum + dairy farming | | 100 households | |
| Short-term oil crops + sorghum + small livestock (sheep) | | 100 households | |
| Perennial industrial crops + dairy farming | | 10 households | |
| Cotton + sorghum + fruit trees + dairy farming + small livestock (sheep) | | 20 households | |
| Cotton + sorghum + fruit trees + dairy farming + small livestock (goats) | | 20 households | |
| Cotton + sorghum + fruit trees + dairy farming + small livestock (sheep) (part-time initially) | | 160 households | |
| Cotton + sorghum + fruit trees + dairy farming + small livestock (goats) (part-time initially) | | 160 households | |
| Cotton + small livestock + apiculture | | 70 households | |
| 3) Settlement | | | |
| Medium-scale | No. of farms for settlement | 210 households | |
| Small-scale (full-time) | No. of farms for settlement | 40 households | |
| Small-scale (part-time - full time) | No. of farms for settlement | 320 households | |
| Small-scale (indigenous people) | No. of farms for settlement | 70 households | |
| 4) Social infrastructure | | | |
| Medical facilities | | | |
| • Construction of new clinic | 125 m ² | 1 clinic | 81 |
| • Existing clinic | Supplementary equipment | 1 set | 28 |
| Educational facilities | | | |
| • Construction of new primary schools | 280 m ² | 2 schools | 198 |

| | | | |
|--|--------------------------------|-------------------------|--------|
| • Construction of new secondary school | 280 m ² | 1 school | 99 |
| • Existing schools | Supplementary equipment | 9 schools | 12 |
| Waterworks | Construction of new facilities | 2 sets | 956 |
| Electrification in villages (separate) | | 1 set | 12,990 |
| Communication facilities (separate) | | 1 set | 960 |
| Housing (separate) | | 439 houses | 1,634 |
| 5) Marketing and processing | | | |
| Joint collection and shipment facility/joint grading and packing facility construction project | | | |
| • Joint facility for grading and packing citrus fruit | | 1 facility | 1,100 |
| Milk processing plant construction project | | | |
| • Milk processing plant | | 1 plant | 6,600 |
| Ginning plant construction project | | | |
| • Ginning plant | | 1 plant | 2,600 |
| 6) Agricultural credit | | | |
| Long-term loans | | | |
| • Land acquisition funds (land acquisition funds provided for farmers) | | | 1,596 |
| • Project investment funds (individual share of infrastructure improvement project for agricultural and livestock farming) | | | 6,862 |
| • Farming investment funds (funds for purchase of machinery and livestock and construction of facilities) | | | 19,596 |
| • Marketing and processing facilities funds (funds for construction of marketing and processing facilities) | | | 3,700 |
| Short-term loan (funds for managing farms) | | | 2,892 |
| 7) Agricultural support | | | |
| Strengthening of agricultural and livestock farming organization | | | |
| | | 1 area diffusion office | 180 |
| • Strengthening of farm management diffusion system for local farmers including settlers | | | |
| • Improvement of DEA "regional administration office" and "area diffusion office" | | | |
| Organization of agricultural cooperatives in settlements | | 1 in each settlement | - |
| • Organization for farm management activity in settlements and formation of local society | | | |
| • Establishment of "agricultural cooperative association" for each settlement | | | |
| 2. Eastern part of the Mennonite settlements | | | |
| 1) Development of farmland/development of grassland/roads/drainage | | | |
| Trunk roads | B=7.0m | 211 km | 19,370 |
| Branch roads | B=6.0m | 337 km | 9,332 |
| Farmland formation | | 38,100 ha | 16,175 |

| | | | |
|---|--------------------------------|----------------|--------|
| Grassland formation | | 24,000 ha | 4,500 |
| Drainage | | 20,500 ha | 31,200 |
| Conservation of farmland (afforestation, observation wells) | | 7,245 ha | 2,690 |
| 2) Cultivation | | | |
| Peanuts + cotton + sorghum + dairy farming | | 100 households | |
| Short-term oil crops + sorghum + dairy farming | | 100 households | |
| Perennial industrial crops + dairy farming | | 20 households | |
| Dairy farming | | 350 households | |
| Cotton + sorghum + fruit trees + dairy farming + small livestock (sheep) | | 40 households | |
| Cotton + sorghum + fruit trees + dairy farming + small livestock (goats) | | 40 households | |
| Cotton + sorghum + fruit trees + dairy farming + small livestock (sheep) (part-time initially) | | 280 households | |
| Cotton + sorghum + fruit trees + dairy farming + small livestock (goats) (part-time initially) | | 280 households | |
| Cotton + small livestock + apiculture | | 150 households | |
| 3) Settlement | | | |
| Medium-scale | No. of farms for settlement | 600 households | |
| Small-scale (full-time) | No. of farms for settlement | 80 households | |
| Small-scale (part-time - full time) | No. of farms for settlement | 560 households | |
| Small-scale (indigenous people) | No. of farms for settlement | 150 households | |
| 4) Social infrastructure | | | |
| Medical facilities | | | |
| • Construction of new clinics | 125 m ² | 3 clinics | 243 |
| • Existing clinic | Supplementary equipment | 1 set | 28 |
| Educational facilities | | | |
| • Construction of new primary school | 280 m ² | 9 schools | 893 |
| • Construction of new secondary school | 280 m ² | 3 schools | 297 |
| • Existing schools | Supplementary equipment | 9 schools | 8 |
| Waterworks | Construction of new facilities | 4 sets | 1,912 |
| Electrification in villages (separate) | | 1 set | 15,260 |
| Communication facilities (separate) | | 1 set | 1,590 |
| Housing (separate) | Construction of new houses | 790 houses | 3,002 |
| 5) Marketing and processing | | | |
| Joint collection and shipment facility /joint grading and packing facility construction project | | | |
| • Joint facilities for grading and packing citrus fruit | | 2 facilities | 2,200 |

| | | | |
|--|--------|-------------------------|--------|
| Milk processing plant construction project | | | |
| • Milk processing plants | | 4 plants | 26,400 |
| Ginning plant construction project | | | |
| • Ginning plant | | 1 plant | 2,600 |
| 6) Agricultural credit | | | |
| Long-term loans | | | |
| • Land acquisition funds (land acquisition funds provided for farmers) | | | 3,587 |
| • Project investment funds (individual share of infrastructure improvement project for agricultural and livestock farming) | | | 9,656 |
| • Farm management investment funds (funds for purchase of machinery and livestock and construction of facilities) | | | 42,799 |
| • Marketing and processing facility funds (funds for construction of marketing and processing facilities) | | | 8,600 |
| Short-term loans (funds for managing farms) | | | 4,775 |
| 7) Agricultural support | | | |
| Strengthening of agricultural and livestock farming diffusion organization | | | |
| | | 1 area diffusion office | 180 |
| • Strengthening of farm management diffusion system for local farmers including settlers | | | |
| • Improvement of DEA "regional administration office" and "area diffusion office" | | | |
| Organization of agricultural cooperatives in settlements | | 1 in each settlement | - |
| • Organization for farm management activity in settlements and formation of local society | | | |
| • Establishment of "agricultural cooperative association" for each settlement | | | |
| 3. Northern part of Pozo Colorado | | | |
| 1) Development of farmland/development of grassland/roads/drainage | | | |
| Trunk roads | B=7.0m | 79 km | 7,070 |
| Branch roads | B=6.0m | 157 km | 4,348 |
| Farmland formation | | 25,400 ha | 10,783 |
| Grassland formation | | 12,000 ha | 2,250 |
| Drainage | | 15,700 ha | 23,700 |
| Conservation of farmland (afforestation, observation wells) | | 4,364 ha | 1,630 |
| 2) Cultivation | | | |
| Peanuts + cotton + sorghum + dairy farming 100 households | | | |
| Short-term oil crops + sorghum + dairy farming 100 households | | | |
| Cotton + sorghum + fruit trees + dairy farming + small livestock (sheep) 20 households | | | |
| Cotton + sorghum + fruit trees + dairy farming + small livestock (goats) 20 households | | | |
| Cotton + sorghum + fruit trees + dairy farming + small livestock (sheep) (part-time initially) 155 households | | | |

| | | | |
|--|--------------------------------|------------|----------------|
| Cotton + sorghum + fruit trees + dairy farming + small livestock (goats) (part-time initially) | | | 155 households |
| Cotton + small livestock + apiculture | | | 80 households |
| 3) Settlement | | | |
| Medium-scale | No. of farms for settlement | | 200 households |
| Small-scale (full-time) | No. of farms for settlement | | 40 households |
| Small-scale (part-time - full time) | No. of farms for settlement | | 310 households |
| Small-scale (indigenous people) | No. of farms for settlement | | 80 households |
| 4) Social infrastructure | | | |
| Medical facilities | | | |
| • Construction of new clinic | 125 m ² | 1 clinic | 81 |
| Educational facilities | | | |
| • Construction of new primary schools | 280 m ² | 4 schools | 387 |
| • Construction of new secondary school | 280 m ² | 1 school | 99 |
| • Existing schools Supplementary equipment | | 1 school | 1 |
| Waterworks | Construction of new facilities | 3 sets | 1,434 |
| Electrification in villages (separate) | | 1 set | 8,940 |
| Communication facilities (separate) | | 1 set | 550 |
| Housing (separate) | Construction of new houses | 530 houses | 2,01 |
| 5) Marketing and processing | | | |
| Joint collection and shipment facility/joint grading and packing facility construction project | | | |
| • Joint facility for grading and packing citrus fruit | | 1 facility | 1,100 |
| Milk processing plant construction project | | | |
| • Milk processing plant | | 1 plant | 6,600 |
| Ginning plant construction project | | | |
| • Ginning plant | | 1 plant | 2,600 |
| 6) Agricultural credit | | | |
| Long-term loans | | | |
| • Land acquisition funds (land acquisition funds provided for farmers) | | | 1,532 |
| • Project investment funds (individual share of infrastructure improvement project for agricultural and livestock farming) | | | 6,650 |
| • Farm management investment funds (funds for purchase of machinery and livestock and construction of facilities) | | | 18,310 |
| • Marketing and processing facilities funds (funds for construction of marketing and processing facilities) | | | 3,700 |
| Short-term loans (funds for managing farms) | | | 2,672 |

| | | | |
|--|-----------------------------|----------------|-------|
| 7) Agricultural support | | | |
| Strengthening of agricultural and livestock farming diffusion organization | | | |
| | 1 area diffusion office | | 180 |
| • Strengthening of farm management diffusion system for local farmers including settlers | | | |
| • Improvement of DEA “regional administration office” and “area diffusion office” | | | |
| Organization of agricultural cooperative in settlements 1 in each settlement | | | - |
| • Organization for farm management activity in settlements and formation of local society | | | |
| • Establishment of “agricultural cooperative association” for each settlement | | | |
| 4. Asuncion suburban zone | | | |
| 1) Development of farmland/development of grassland/roads/drainage for irrigation | | | |
| Trunk roads | B=7.0m | 16 km | 1,550 |
| Branch roads | B=6.0m | 29 km | 803 |
| Farmland formation | | 2,200 ha | 934 |
| Grassland formation | | 300 ha | 60 |
| Drainage (including irrigation facilities) | | 2,200 ha | 2,700 |
| Conservation of farmland (afforestation, observation wells) | | 292 ha | 110 |
| 2) Cultivation | | | |
| Fruit trees + dairy farming | | 90 households | |
| Fruit trees + vegetables | | 100 households | |
| Fruit trees | | 200 households | |
| 3) Settlement | | | |
| Small-scale (full-time) | No. of farms for settlement | 190 households | |
| Small-scale (indigenous people) | No. of farms for settlement | 200 households | |
| 4) Social infrastructure | | | |
| Electrification in villages | | 1 set | 626 |
| Housing | Construction of new houses | 390 houses | 1,482 |
| 5) Marketing and processing | | | |
| Joint collection and shipment facility/joint grading and packing facility construction project | | | |
| Joint facility for grading and packing citrus fruit | | 1 facility | 1,300 |
| 6) Agricultural credit | | | |
| Long-term loans | | | |
| • Land acquisition funds (land acquisition funds provided for farmers) | | | 5,393 |
| • Project investment funds (individual share of infrastructure improvement project for agricultural and livestock farming) | | | 3,246 |

| | | | |
|---|----------------------------|------------------|--------|
| • Farm management investment funds (funds for purchase of machinery and livestock and construction of facilities) | | | 3,801 |
| • Marketing and processing facilities funds (funds for construction of marketing and processing facilities) | | | 600 |
| Short-term loans (funds for managing farms) | 214 | | |
| 7) Agricultural support | | | |
| Strengthening of agricultural and livestock farming diffusion organization | | | |
| | 1 area diffusion office | | 180 |
| • Strengthening of farm management diffusion system for local farmers including settlers | | | |
| • Improvement of DEA "regional administration office" and "area diffusion office" | | | |
| Organization of agricultural cooperative in settlements 1 in each settlement - | | | |
| • Organization for farm management activity in settlements and formation of local society | | | |
| • Establishment of "agricultural cooperative association" for each settlement | | | |
| 5. Area covered by livestock development plan | | | |
| 1) Development of farmland/development of grassland/roads | | | |
| Trunk roads | B=7.0m | 298 km | 26,480 |
| Branch roads | B=6.0m | 375 km | 10,385 |
| Farmland formation (soil for forage crops) | | 85,200 ha | 36,170 |
| Grassland formation | | 427,700 ha | 80,270 |
| 2) Cultivation | | | |
| Full-time beef cattle raisers | | 390 households | |
| Full-time beef cattle raisers | | 100 households | |
| Small livestock (sheep) + apiculture | | 200 households | |
| 3) Settlements | | | |
| Full-time beef cattle farmers (large-scale 1) | | 390 households | |
| Full-time beef cattle farmers (large-scale 2) | | 230 households | |
| Small-scale (indigenous people) | | 1,640 households | |
| 4) Social infrastructure | | | |
| Housing | Construction of new houses | 1,640 houses | 6,232 |
| 5) Agricultural credit | | | |
| Long-term loans | | | |
| • Land acquisition funds (land acquisition funds provided for farmers) | | | 0 |
| • Project investment funds (individual share of infrastructure | | | |
| • improvement project for agricultural and livestock farming) | | | 87,094 |

| | | |
|---|-----------------------------|--------|
| • Farm management investment funds (funds for purchase of machinery and livestock and construction of facilities) | | 9,321 |
| • Short-term loans (funds for managing farms) | | 11,628 |
| 6) Agricultural support | | |
| Organization of agricultural cooperative in settlements 1 in each settlement - | | |
| • Organization for farm management activity in settlements and formation of local society | | |
| • Establishment of "agricultural cooperative association" for each settlement | | |
| 6. Items common to all zones | | |
| 1) Testing and research | | |
| Improvement and expansion of Chaco Livestock Testing Station | 1 station in all zones | 1,610 |
| • Strengthening of basic testing and research sector for local livestock farming development | | |
| • Expansion of equipment and improvement of structural system at existing PRONIEGA Trial Station | | |
| Improvement of breeding stock farms | 1 station in all zones | 1,590 |
| • Supply of breeding stock for promotion of animal improvement and for more efficient farm operation | | |
| • Formation of Chaco region base in supply system for PRODEGA breeding stock supply | | |
| 2) Agricultural support | | |
| Establishment of "Agricultural Training Centre" | 1 centre in all zones | 2,470 |
| • Implementation of training for improvement in technical capability and farm managing ability of settlers | | |
| • Establishment of "Model Farms and Stock Farms" and "Training Centre for Farmers" | | |
| Strengthening of system in diffusion structure (DEA) | | 710 |
| • Organization of agricultural cooperatives in settlements | | |
| Implementation of various projects concerning production activity | | |
| • Improvement of facilities that supply agricultural seeds and seedlings | 1 facility in all zones | 1,610 |
| More efficient farm operation through stable supply of crop seeds, seeds and seedlings | | |
| • Formation of base of SENASE supply system for seeds in the Chaco region | | |
| Establishment of machinery sharing organization | 1 organization in all zones | 13,850 |
| Easing of farmers' investment burden and more efficient farm operation through leasing system for large machines | | |
| 3) Marketing and processing facilities | | |
| Meat processing facilities | 5 facilities | 27,500 |

4) Agricultural credit

Long-term loans

- Funds for marketing and processing facilities (funds for construction of marketing and processing facilities)

6,500

8.2 EVALUATION OF ZONE-BY-ZONE DEVELOPMENT PLAN

In conducting evaluation of the zone-by-zone development plan, a cost benefit analysis must be made according to the following preconditions, and then the investment effect of each development zone must be assessed on the basis of the internal rate of return.

- 1) The calculation of benefits is to be made in the following manner. Spot-sale price (border price - processing and shipping costs) x agricultural and livestock output
- 2) Expenses for roads, farmland development, grassland development, irrigation and drainage, preservation of farmland are to be estimated as project investment costs.
- 3) Expenses for roads, irrigation and drainage facilities are to be estimated as maintenance and administration costs.
- 4) The project investment period is to be determined on the basis of the execution scheme.
- 5) Of the farming expenses, physical expenses including expenses for fertilizers, fodder, and fuel have been estimated as input expenses.
- 6) Transfer items including lease charges, labour costs and taxes, and public imports as well as depreciation costs have been excluded from costs.
- 7) The cost value has been calculated on the basis of the economic prices.
- 8) Estimated profits from present farmland and livestock are to be deducted from benefits.
- 9) The calculation period has been set at 30 years after the launch of farm management.

When the internal rate of return is calculated on the basis of the above preconditions for each development zone, the following results will be obtained.

| | |
|--|-------|
| Southern part of the Mennonite settlements | 35.1% |
| Eastern part of the Mennonite settlements | 33.6% |
| Asuncion suburban zone | 28.8% |
| Northern part of Pozo Colorado | 27.5% |
| Livestock development zone | 15.2% |

(For calculation results, see Tables 8.2.1 - 8.2.5.)

8.3 PRIORITY DEVELOPMENT ZONES

The area to be developed is confirmed in accordance with the land use planning, and is divided into the area covered by the agricultural development plan and the area covered by the livestock development plan. When classified by the type of farming operation, the former represents the combined operation of farming and livestock raising while the latter represents the single operation of beef cattle grazing.

1) Area covered by the agricultural development plan

(1) Suburbs of Asuncion

The area covered by the agricultural development plan is divided into four zones. Three of the four zones are located in the northern part of the study area, which ecologically lies in the region changing into a dry zone from a wet one, while the remaining Asuncion suburban zone lies in the west Chaco region, and is an extension of the eastern part of Paraguay in terms of geological features, agricultural resources, and socio-economic influences that the zone comes under. Thus, the zone is included in the metropolitan economic bloc and is therefore expected to follow a different pattern of socio-economic development from the other three zones in the mid-distant future. For this reason, in discussing the priority order for development, it is not appropriate for those concerned to decide the order of this zone on the basis of the same criteria as the other three zones. Although the Asuncion suburban zone is an administrative district that falls within the jurisdiction of the Chaco region, it is placed under special conditions, smaller in scale than other three zones, and lies closer to the nation's capital and thus may have demonstrable effects of the development. When all of these are taken into account, the zone must be developed prior to the other three zones or at least in parallel with the development of a priority zone of these three.

In this case, study and training that are requirements for the settlement of the zone can be different from those for settlers in other three zones. This is because the cultivation of crops required in the farming plan is an extension of the eastern district in the light of natural conditions in this region.

(2) The other three zones

Besides the above-mentioned Asuncion suburban zone, there are three other zones that are covered by the agricultural development plan, namely, the southern part of the Mennonite settlements, the eastern part of the Mennonite settlements and the northern part of Pozo Colorado.

Since the agricultural environments of these three zones are different from each other, and since socio-economic effects of their development will also differ from each other, one must set up certain criteria in order to decide on the priority order for development. Table 8.3.1. shows the "Criteria used to review priority zones in the area covered by the agricultural development plan". This table includes a brief description (item) and the details of each criterion, and specific evaluation criteria for grades.

The conditions of these zones have been rated against each criterion and graded from 3 to 1. The more satisfactory a condition is, or the higher the degree of a condition is, the higher the score is. The results of the grading are shown in Table 8.3.2. The northern zone of Pozo Colorado came out on top, followed by the southern part of the Mennonite settlements and then by the eastern part of the Mennonite settlements.

Incidentally, when discussing the priority of the development of a zone over the development of other zones in a development plan, one must take account of the results of economic analysis.

In the case of this Master Plan, they are shown in the "8.2 Evaluation of zone-by-zone development plans". If the priority order is decided solely on the basis of this result, development will be carried out in the order of the southern part of the Mennonite settlements, the eastern part of the Mennonite settlements and the northern part of Pozo Colorado.

However, the difference in IRR figures indicated by the above economic analysis is very small. In addition, one cannot always find it easy to see the significance of the contents of the analysis. On the other hand, one has to face the reality of Paraguay. Rio Verde, located in the northern part of Pozo Colorado, was officially designated as the capital of Departamento Presidente Hayes a few years ago.

Departamento Presidente Hayes, which the study has covered, is a region where people traditionally make use of natural grassland to raise cattle by pasturing. They do not engage in farming except for those living in the Asuncion suburban zone, especially in Villa Hayes, and those living in the Mennonite settlements. Accordingly, no striking example of the settlement of inhabitants through farming, the resultant formation of villages, and a subsequent increase in population is seen in the region. In the case of this plan that calls for agricultural production in this region through settlement, the fact that Rio Verde, which is located in the northern zone of Pozo Colorado, functions as the capital of Departamento Presidente Hayes takes on great significance as it will serve as

the development foothold in the entire region, not only of this zone.

As to which will be developed first, the eastern part or the southern part of the Mennonite settlements, the figures obtained by the economic analysis point to the southern part. In addition, Campo Aceval settlement, where a domestic settlement project has been carried out, is situated in the southern zone of the Mennonite settlements. Farming in this settlement can hardly be described as satisfactory, and it presently faces such a difficult situation that various measures to prop it up are required urgently.

Although early support must be provided for the settlement independent of the implementation of this plan, it is reasonable to regard the existing settlement as another foothold. As a result of the comprehensive review and evaluation of the above matters, the same priority order in the development of the three zones has been finally decided as suggested above. On top of the list is the northern part of Pozo Colorado, then comes the southern zone of the Mennonite settlements, followed by the eastern part of the Mennonite settlements.

2) Area covered by livestock development plan

The zones in the area covered by the livestock development plan show little difference in natural conditions or cattle raising capacity as far as this plan is concerned. In addition, the details of livestock farming operation are the same in all the zones. Thus, in deciding on a priority zone for development of the zone through livestock farming operation, the distance from principle and trunk roads will serve as the criterion (fig. 8.3.1.).

| Distance from road | Priority order |
|---|----------------------|
| 1) Range of up to 30 km from a principle road when measured at right angles | First priority zone |
| 2) Range of up to 30 km from a trunk road when measured at right angles | Second priority zone |
| 3) Other areas | Third priority zone |

Table 8.3.1 Criteria used to review priority zones in areas covered by the agricultural development plan

| Item | Details | Evaluation | | |
|---|---|--|--|--|
| | | 3 | 2 | 1 |
| Water resources | Farmers are dependent on rain for water, or irrigation water is available for use. | High stability of agricultural production due to availability of irrigation water | – | Relatively low stability of agricultural production due to dependence on rainwater |
| Natural conditions | Soil and meteorological conditions | Satisfactory soil, and relatively a large amount of precipitation | Satisfactory soil and a normal amount of precipitation | Satisfactory soil and a relatively small amount of precipitation |
| Access | Access to a major road | Near | Average | Far |
| Shape of zone | Advantage in forming a settlement | Large | Average | Small |
| Degree of contribution to acceptance of small farms | Proportion of small farmers accepted in settlement (%) (number of small farms/number of all farms settled) | More than 70% | 50%-70% | Less than 50% |
| Effect on other zones | The plan possesses characteristic features that make it serve as a model, and thus is expected to have a far-reaching effect on other zones in and outside the region. Degree of such effect. | The plan possesses characteristic features that make it serve as a model, and thus is expected to have a far-reaching effect on other zones in and outside the region. | Average degree | Adjacent to the Mennonite settlements in the region, thus no great effect can be expected. The land possesses a few characteristic features that make it serve as a model. |
| Social infrastructure | Degree of benefits from development of infrastructure | No benefits from existing infrastructure | Average degree | A great deal of benefits from existing infrastructure |
| Degree of contribution to export | Production value of crops for export per unit zone (thousands of Gs./ha) | More than 100 | 10-100 | less than 10 |
| Creation of employment | Number of workers employed per unit zone (persons/ha) | More than 1 | 1 | Less than 1 |

Table 8.3.2. Selection of Priority Project Zones

| | Southern part of the Mennonite settlements | Eastern part of the Mennonite settlements | Northern part of Pozo Colorado |
|---|--|---|--------------------------------|
| Water resources | 1 | 1 | 1 |
| Natural conditions | 2 | 2 | 2 |
| Access | 1 | 1 | 2 |
| Shape of zone | 1 | 1 | 3 |
| Degree of contribution to acceptance of small farms | 2 | 1 | 2 |
| Effect on other zones | 1 | 1 | 3 |
| Social infrastructure | 2 | 2 | 3 |
| Increase in production of agricultural produce for export | 3 | 2 | 3 |
| Creation of employment | 3 | 3 | 2 |
| Total | 16 | 14 | 21 |
| Order | II | III | I |

Remarks: The zones have been evaluated against each criterion and graded 3, 2 or 1. The more satisfactory a condition is or the higher the degree of a condition is, the higher the score is.

8.4 PRIORITY DEVELOPMENT PROJECTS

The priority development zones have been selected in 8.3, and development will be carried out from zones with higher priority. The purpose of this integrated development plan is to stabilize the livelihoods of people who have settled down in each of these zones by carrying out socio-economic development through promotion of and in keeping with agricultural and livestock production.

Each project is organically linked with one another to achieve this objective while the investment size is decided so that optimal use of resources can be made. Since individual sector projects in each zone to be developed are related to other projects in time sequence, a priority order for each sector must be decided and the procedures for the implementation of each project, the time for fund-raising, etc. must be clarified. However, because this study is aimed at creating a Master Plan for agricultural and livestock farming development in the Lower Chaco region, it covers a plan at this level and reviews only the type and scale of individual sector projects.

The projects that have priority over development projects in each zone include research, study, and training projects as well as projects in the sector of agricultural support. These are basic and are needed to materialize agricultural and livestock production at an early stage; they require much time before they can see their objectives achieved. The implementation of these projects forms the core of the whole plan, followed by development projects for each zone. Therefore, priorities have been established on projects as well as development projects for each zone as follows.

- 1) Technical control projects for agricultural and livestock production such as research
- 2) Projects for preparation of various data useful for diversification of agricultural products
- 3) Projects for diffusion of agricultural and livestock farming techniques such as study and training
- 4) Projects in the sector of agricultural support

The above priority projects 1, 2, 3, and 4 (see Table 8.4.1) together with pilot projects, which are discussed in the next section, will be carried out prior to the implementation of the development project for each zone. Because of its nature, a pilot project must be implemented as a small-scale guidance project for the zone-by-zone development plan that involves construction of the production base hardware sector, on the condition that the above priority projects be carried out to improve the fundamental farm management software sector. Thus, it will be implemented in correlation with the priority projects.

- 5) Development project for the northern part of Pozo Colorado and the Asuncion suburban zone
 - 6) Development project for the southern part of the Mennonite settlements
 - 7) Development project for the eastern part of the Mennonite settlements
-
- 5) Development project for A zone in areas covered by the livestock development plan
 - 6) Development project for B zone in areas covered by the livestock development plan
 - 7) Development project for C zone in areas covered by the livestock development plan

(Note: a development project represents a combination of individual sector projects in each zone excluding projects 1, 2, 3, and 4.)

Table 8.4.1 Priority Projects

| Name of priority projects | Details of priority projects |
|--|---|
| (1) Technology management projects for agricultural and livestock production, such as testing and research | Projects for expansion and improvement of the Chaco Livestock Testing Station Projects for construction of stock breeding farms |
| (2) Projects for preparation of various data useful for the diversification of agricultural products | Projects for developing farm products including marketing of newly introduced products such as jojoba and macadamia nuts |
| (3) Projects for diffusion of agricultural and livestock technology such as through study and training | Projects for establishing training centres for farmers |
| (4) Projects in the agricultural support sector | Projects for establishment of shared agricultural machinery organization Projects for construction of seedling supply facilities |

8.5 PILOT PROJECTS

The project which will play a pivotal role in this integrated development plan is the settlement project. Priorities have been established for three zones in the settlement project, the exception being the Asuncion suburban zone. On top of the priority list is the northern part of Pozo Colorado, followed by the southern part of the Mennonite settlements, and then by the eastern part of the Mennonite settlements. The number of farm households for settlement in these zones will total 2,330 farms (excluding indigenous people). A total of 424 farms, engaged in farming, are presently settled in these three zones. Therefore, about 1900 farms are additionally required to settle in the zones.

Because a settlement project mainly concerns people and calls for them to live in groups and engage in agriculture and livestock raising, essentially it is not easy to run such a project systematically in line with a certain goal. In this project, which starts with the acquisition of land for settlement, all sorts of arrangements and preparations that are wide in variety ranging from the preparation of land to settlement must be made completely smoothly and without a hitch. A detailed plan, careful preparations, and rich experience will be required to achieve this. For this reason, it is necessary and extremely meaningful to carry out a pilot settlement project based on this integrated development plan.

Accordingly, the implementation of a guidance project for settlement (a pilot project) is required prior to the implementation of a full-scale settlement project, and such a pilot project takes on considerable significance. A farming plan can be checked in terms of more practical land use, various farming entities and diverse types of farming through comprehensive implementation of projects for agricultural support, consolidation of the foundation for agricultural and livestock farming, improvement of villages (development of social infrastructure), settlement and farming. In addition, techniques can be developed and accumulated, systems can be reviewed, and model villages can be demonstrated through this pilot project. The following conditions can be considered as the requirements for a zone to be selected for the implementation of a pilot project.

- 1) Land must be owned by settlers or the state so that there will be no land problems.
- 2) There must be many existing farms which are familiar with the natural conditions of the Chaco region.
- 3) Farmers must have farming experience with cotton, peanuts, and dairy products.

At the time of the presentation of the final draft report (DF/R) and the seminar on the transfer of skills, "The Concept of Concrete Pilot Projects" was proposed by the Paraguayan government and discussed. The details of the proposal are shown at the back of this report as a reference. The details are as per the following five items.

- (i) A pilot project for the integrated development of Campo Aceval district (part of the southern Mennonite settlements)
- (ii) A pilot project for settlement targetted at small-scale farming in piecemeal farming areas in the eastern region and the Chaco region
- (iii) A pilot project for settlement in the Villa Hayes district (part of the suburbs of Asuncion)
- (iv) A pilot project to promote farm produce processing in the Villa Hayes district
- (v) A pilot project for support for the indigenous inhabitants in the Lower Chaco region

These five are based on this Master Plan, and can be highly evaluated as a strategy that the Paraguayan government mapped out by itself in order to materialize the plan. For this reason, they must reviewed and organized, whereafter studies of the present status and decisions on the plan must be made at an early stage. Thus, it is hoped that efforts to work out the conditions required in order to materialize the plan will be actively promoted.

CHAPTER 9

PROJECT EXECUTION SCHEME

CHAPTER 9 PROJECT IMPLEMENTATION PLAN

9.1 PROJECT IMPLEMENTATION SYSTEM

In establishing the system for the implementation of this project, one must know in detail how the Ministry of Agriculture and Livestock, which is in charge of agricultural and livestock farming development, came to set up the present organization, and functions under the present system as well as the characteristics of the Chaco region where this project will be carried out, so that a realistic system can be conceived. The main role of the Ministry of Agriculture and Livestock in the state administration is to take administrative measures to develop and support agriculture, livestock farming, and forestry, to establish standards and requirements as a means to this, and to carry out projects for survey and research of agricultural resources, agricultural financing and agricultural cooperative systems, training in and diffusion of agricultural techniques, land problems and settlement, technical cooperation, etc.

The Ministry of Agriculture and Livestock was separated from the Ministry of Agriculture, Livestock, Commerce and Industry in 1950. But technical and financial cooperation for agricultural and livestock farming development had been promoted mainly through the Inter-American Agricultural and Livestock Farming Technical Cooperation Service (STICA), and institutional organs had been established as required under the name of programs or projects to take the responsibility of receiving such cooperation. STICA was dissolved in 1967. Since then, new organizations have been created as needed to meet the requirements for wage cooperation from USAID and the Inter-American Development Bank. With the socio-economic development and growth at home and abroad, necessary divisions have been added to the Ministry of Agriculture and Livestock as external organs, and small-scale reorganization has been made to date. On the other hand, in 1961 a planning division was required to be set up within the government institutions - a requirement that had to be met in order to put the U.S.-advocated "Alliance for Progress" into effect in Inter-American countries. As a result, a planning division was set up in the Planning Agency and in each of the Ministries. Since then, the organizational system of the Ministry of Agriculture and Livestock has been reformed to cope with the changes in agriculture, livestock raising, and forestry and the development of values on a global scale. However, some divisions which are not incorporated into a "program" have not yet been reorganized to the point where the Ministry of Agriculture and Livestock can be made into one unified system.

Being the administrative office in charge of the Paraguay Chaco Region, the Defense Ministry has conducted all administrative operations in the Chaco region for geopolitical reasons since the Chaco War.

Since it was organized in March 1977, the Commission for Development in Northwestern Region of Chaco has served as a coordinator for various project implementation organs on the side of Paraguay as the organization responsible for a series of resources studies and planning projects for the development in Chaco which have been planned as a U.N. program or by the Organization of American States. In December 1992, the committee was reorganized to take charge of the whole Paraguay Chaco region. At the same time its function was expanded from a mere coordinator to a similar role to that of the Development Agency - an organization with capacity to carry out projects. The committee is made up of the Secretary of Defense, the Secretary of Finance, the Secretary of Agriculture and Livestock Farming, the Secretary of Public Communications, the Director General of the Planning Agency and the Governor of the Central Bank.

In careful consideration of the present status of the Ministry of Agriculture and Livestock and the Commission for Integrated Development in Chaco, a practical project implementation system has been studied for the purpose of developing agricultural and live- stock farming in the Lower Chaco region.

Since this project concerns agricultural and livestock farming development, the main organization that will carry out the project is the Ministry of Agriculture and Livestock. Organizations which are involved in this project include STP (in charge of planning), MOPC (in charge of public facilities), IBR (in charge of settlement), INDI (which takes care of the indigenous people), and BC, FG, BNF, and FDC as financial institutions. In addition, M.H. is indispensable for the project in the light of budgetary measures to promote the project.

Since the purpose of this project is to achieve well-balanced overall development, ANDE, ANTELCO, MSPBS, MIC, and MEC need to join the project as organizations which make improvements in the surrounding zones while maintaining a closer connection as the project progresses. All internal and external divisions and bureaus of the Ministry of Agriculture and Livestock, the main institution responsible for the implementation of the project, will be involved.

The present organization of the Presidents' Office includes a Council for Rural Development (CDR), where government institutions responsible for projects in their own sectors meet to make coordination so that tasks in each of their sectors can be carried out.

However, this system proves to be effective only when each government institution has a means and method of implementing projects as in the case of the eastern region of Paraguay. Because such a system has not yet been established in the Chaco region, in order to demonstrate the

capability for coordination it is necessary to have a means that enables optimum-scale investment and operation in line with the goal of a project by adopting a method such as the Planning Programming Budgetary System. In order for the CDR system to work as the implementation system for this project, it is necessary to have sophisticated administrative institutions in the Chaco region such as those in the eastern region of the country.

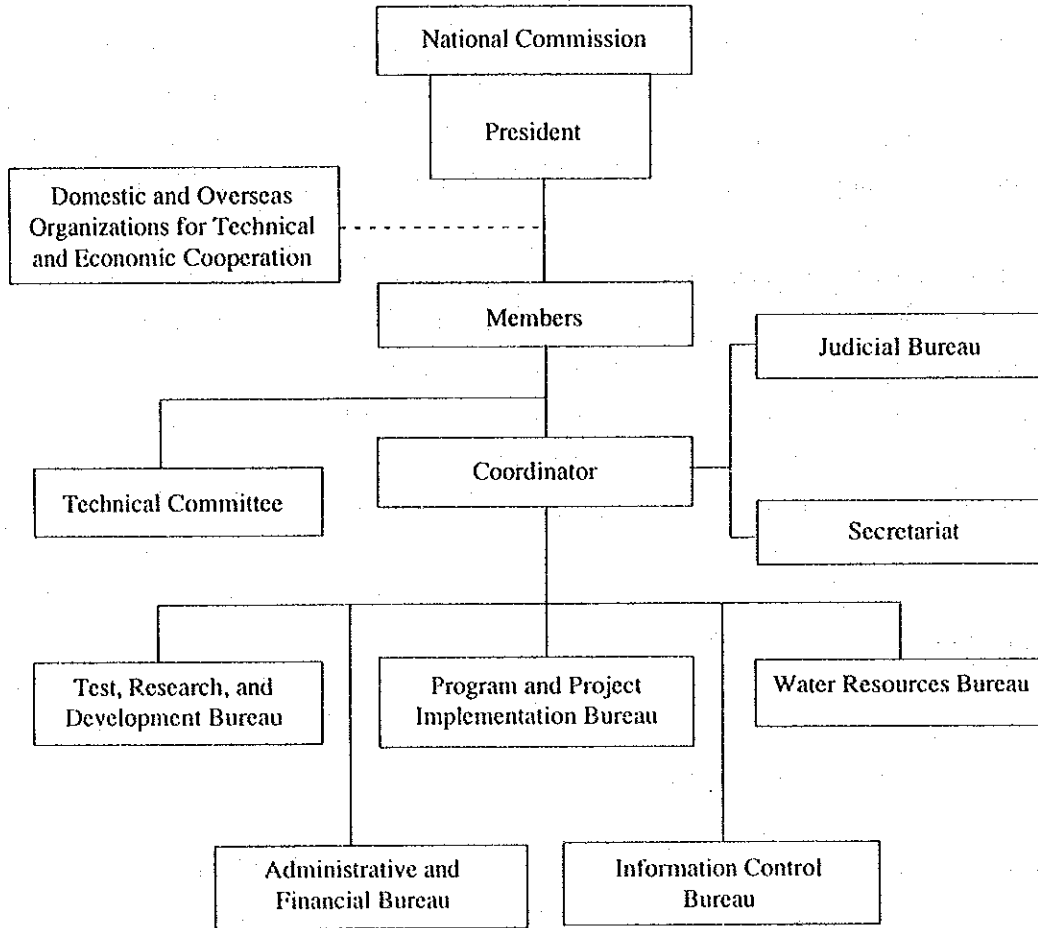
The law concerning the establishment of the "Commission for Development in Northwestern Part of Paraguay Chaco" promulgated on March 9, 1977 was revised on December 21, 1992 to create the more specific "Committee for Integrated Development in Paraguay Chaco", which has become the present project system for development in Chaco. The organization chart and the functions of this commission are shown in fig. 9.1.1. The commission is unique as far as its functions are concerned. Although the organization is called a "commission", it practically takes on the character of a "self-governing corporation" since it is endowed with the capacity to work out budgetary measures and to carry out projects. It also has a technical committee which assists the executive president of the commission. Annual budgets for the implementation of projects are obtained through representatives of all government institutions which form the commission, and the commission is required to coordinate the implementation of its projects.

Since such a project system has been established during the study of this project and the Lower Chaco region is part of the region under the control of this commission, and since the CDR system adopted in the eastern region as described above is one method but cannot be applied to the Chaco region at present, this project should be carried out under the system of the "Commission for Integrated Development for Paraguay Chaco".

When the project progresses in the Chaco region, and it has been confirmed that the government's departments and agencies that form the technical committee of the Chaco Commission come to have the same functions and performance as in the eastern region and thus are capable of performing operations, the task of the Chaco Commission is over, and the Chaco region will be incorporated into the general administration structure of the government.

Figure 9.1.1. Project Implementation System

Organization Chart of the National Commission for Integrated Development
in Paraguay Chaco region



9.2 EXECUTION PLAN

The implementation period of this project will be 20 years. The overall implementation design will be made during the first two years. The overall implementation design is aimed at settling on adjustments for each project, construction programming budget, and execution scheme for various support projects. In the entire program, the research facility provision project and the agricultural support facility provision project are to be put into practice prior to other projects. Thus, in order to prepare for the launch of the settlement project, the former is to be implemented during the period from the second year to the fifth year, and the latter should be carried out from the third year to the sixth year.

As described in Chapter 8, the project can be carried out independently in the Asuncion suburban zone as an extension of the eastern region; farms have shifted from the cultivation of sugarcane, the major farm product in this region, and have already started to cultivate vegetables, though small in quantity, as a signal for the diversification of farm products. Under such circumstances, it is necessary to carry out the project as soon as possible.

The agricultural foundation consolidation project is to be implemented in the zones one after another for a period of 15 years from the sixth year to 20th year, in accordance with established priorities. That is to say, the project is to be carried out simultaneously in the three zones - Asuncion suburban zone, the northern zone of Pozo Colorado and the first priority zone in the areas covered by the livestock development plan - from the sixth year. The project is to be implemented in other zones according to the implementation process shown in fig. 9.2.1. The implementation period is five years for the northern part of Pozo Colorado, two years for the Asuncion suburban zone, five years for the southern part of the Mennonite settlements and six years for the eastern part of the Mennonite settlements. The entire area covered by the livestock development plan is to be divided into three zones. The consolidation of the foundation in the first priority zone is to be completed in seven years, the second priority zone in seven years, and the third priority zone in three years. The social infrastructure improvement project is to be carried out two years before the launch of the settlement project in order to satisfy the minimum requirements for life environment at the time of settlement.

The entire implementation process is shown in fig. 9.2.1.

Fig. 9.2.1 Execution Scheme for Integrated Agricultural and Livestock Development Plan in the Lower Chaco Region

| Entire execution scheme | Unit | Requirements | Annual schedule of the Project | | | | | | | | | | | | | | | | | | | |
|---|---------|--------------|--------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| | | | 1st | 2nd | 3rd | 4th | 5th | 6th | 7th | 8th | 9th | 10th | 11th | 12th | 13th | 14th | 15th | 16th | 17th | 18th | 19th | 20th |
| 1) Entire execution scheme | | | ←-----→ | | | | | | | | | | | | | | | | | | | |
| 2) Implementation of projects | | | ←-----→ | | | | | | | | | | | | | | | | | | | |
| 1) Research | | | ←-----→ | | | | | | | | | | | | | | | | | | | |
| -Chaco Livestock Experimental Station | place | 1 | ←-----→ | ←-----→ | | | | | | | | | | | | | | | | | | |
| -Breeding stock farms | place | 1 | ←-----→ | ←-----→ | | | | | | | | | | | | | | | | | | |
| 2) Support for agri. & livestock farming | | | ←-----→ | | | | | | | | | | | | | | | | | | | |
| -Training centre for farmers | place | 1 | ←-----→ | ←-----→ | | | | | | | | | | | | | | | | | | |
| -BEA regional administration office | place | 1 | ←-----→ | ←-----→ | | | | | | | | | | | | | | | | | | |
| -DEA area diffusion office | place | 4 | ←-----→ | ←-----→ | | | | | | | | | | | | | | | | | | |
| -Agricultural machinery joint-use organization | place | 1 | ←-----→ | ←-----→ | | | | | | | | | | | | | | | | | | |
| -SEMASE seed and seedling supply facility | place | 1 | ←-----→ | ←-----→ | | | | | | | | | | | | | | | | | | |
| 3) Agri. infrastructure improvement | | | ←-----→ | | | | | | | | | | | | | | | | | | | |
| -Roads (trunk roads) | km. | 701 | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ |
| -Preparation of farmland (including branch roads) | ha. | 177, 100 | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ |
| -Preparation of grassland | ha. | 478, 100 | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ |
| -Drainage (including irrigation facilities) | ha. | 42, 800 | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ |
| -Preservation of farmland (afforestation and observation wells) | ha. | 16, 720 | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ |
| 4) Social infrastructure improvement | | | ←-----→ | | | | | | | | | | | | | | | | | | | |
| -Clinics | set | 7 | ←-----→ | ←-----→ | | | | | | | | | | | | | | | | | | |
| -Educational facilities | schools | 37 | ←-----→ | ←-----→ | | | | | | | | | | | | | | | | | | |
| -Communication facilities | set | 3 | ←-----→ | ←-----→ | | | | | | | | | | | | | | | | | | |
| -Electrification | set | 4 | ←-----→ | ←-----→ | | | | | | | | | | | | | | | | | | |
| -Waterworks | set | 9 | ←-----→ | ←-----→ | | | | | | | | | | | | | | | | | | |
| -Housing | houses | 3, 780 | ←-----→ | ←-----→ | | | | | | | | | | | | | | | | | | |
| 5) Marketing and processing facilities | | | ←-----→ | | | | | | | | | | | | | | | | | | | |
| -Ginning plant | place | 3 | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ |
| -Joint facilities for grading and packing citrus fruit | place | 4 | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ |
| -Plant for milk and milk products | place | 6 | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ |
| -Meat processing plant | place | 5 | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ |
| -Joint collection and shipment facility for vegetable and fruit | place | 1 | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ | ←-----→ |

Legend

- ←-----→ Applicable to all zones
- ←-----→ North of Pozo Colorado
- ←-----→ Suburbs of Asuncion
- ←-----→ South of the Mennonite settlements
- ←-----→ East of the Mennonite settlements
- ←-----→ First priority Livestock development zone
- ←-----→ Second priority Livestock development zone
- ←-----→ Third priority Livestock development zone

9.3 MAINTENANCE AND ADMINISTRATION PLAN

A maintenance and administration plan for public facilities included in the basic facility development plan is laid out in this section.

1) Roads

In this plan roads are classified as principal roads, trunk roads, branch roads, and roads for cultivation. Since principal roads are major national highways, they are not covered by this plan. The maintenance of these roads continues to be carried out under the present maintenance and administration system of the Ministry of Public Works and will not be part of this project.

Since roads for cultivation will be constructed on farm lots and thus managed by individual farms, a maintenance and administration plan for such roads will not be reviewed here. In this section, a maintenance and administration plan for trunk roads and branch roads will be decided.

The plan calls for the provision of some 701 km of trunk roads. The length of trunk roads to be constructed is about the same as that of the existing trunk roads to be repaired. Some 1,060 km of branch roads will be newly laid. As for the road structure, the trunk roads will be paved with asphalt while the branch roads will be covered with gravel.

The Maintenance and Administration Division of the Public Works Ministry's Municipal Road Bureau (DIRECCION DE CAMINOS VECINALES) is currently in charge of the administration of local roads in Paraguay.

The Maintenance and Administration Division has five work offices across the country. The Chaco region comes under the control of the office in Pozo Colorado, which consists of two engineers and 82 staff members including operators. The following equipment and machines are provided for the office to maintain and repair roads, but they are not adequate either in quality or quantity.

| | | | |
|-----------------|---|--------------------------|---|
| • Bulldozers | 3 | • Cutters | 3 |
| • Motor graders | 7 | • Tank trucks | 2 |
| • Dump trucks | 7 | • Water lorries | 2 |
| • Backhoes | 3 | • Heavy machine carriers | 1 |
| • Scrapers | 4 | | |

The core organization responsible for road administration must follow the existing Paraguayan system. Milk and vegetables, which are to be collected and shipped daily, account for a significant portion of the agricultural production plan. Therefore, the maintenance and administration of roads take on added importance. This plan calls for further strengthening of the work office in Pozo Colorado.

(1) Implementation system

The core administrative organization will be the Maintenance and Administration Division of the Public Works Ministry's Municipal Road Bureau (DIRECCION DE CAMINOS VECINALES), and its work office in Pozo Colorado will be used. The frequency of inspection and repair of earth roads (branch roads) will be in accordance with the standard of the present administration system in the Chaco region, which is three times a year.

As for paved roads (trunk roads), their state of repair will not be specifically reviewed on the assumption that they are not in need of repairs for the time being. It appears that the administration of paved roads usually concerns repairs of accessories to roads, mowing and the like. Accordingly, inspection and repair will be performed once a year.

The main items to be inspected and repaired are as follows.

- 1) Correction of uneven road surfaces (periodical repair)
- 2) Inspection and improvement of waterways
- 3) Maintenance and administration of bridges
- 4) Mowing in lots for accessories to roads

(2) Provision of machines for road maintenance and repair

One set of machines for earth road maintenance and another set for paved road maintenance, and one set of supporting machines and equipment are to be secured. Earth road maintenance machines mainly consist of a motor grader and a dump truck, which are used in a combination of machines and equipment designed for the maintenance of surrounding zones. The costs of the machines and equipment amount to about US\$1,500,000, details of which are shown in Table 9.3.1.

Machines and equipment used to maintain and repair accessories to roads are counted as paved road maintenance machines. The costs of the machines and equipment total about US\$300,000, details of which are shown in Table 9.3.2. Bulldozers and backhoes will be provided as supporting machines and equipment. The costs of the machines and equipment amount to US\$400,000, details of which are shown in Table 9.3.3.