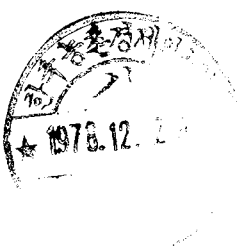
FINAL REPORT
DECEMBER 1978

# EVALUATION STUDY ON FUELWOOD PLANTATION PROJECT UNDER IBRD LOAN



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CONTENTS

# Economic Evaluation of Fuelwood Plantation Project

## Introduction

1. It has not been possible to have self-sufficiency in fuelwood and lumber supplies despite the fact that 67 percent of Korea's land is classified as forest. Although Korea has many laws and measures to protect the forest, it was impossible to enforce the laws due to the political turmoils and weak economic bases. Significant forest denudations have been followed after political disruptions such as the annexation of Korea to Japan, World War II, and Korean War.
Thus, the forest denudations positively associated with the sterility of peopl's emotions, the deprivation of beauties of nature, the aggravation of the outflow of earth and sand from the mountains have brought about significant damages to people's living.

2. One of the most direct reasons of forest devastation was indiscriminative cutting of woods and collection of forest by-produts for fuel except some of the remote mountain forest.

Korea's winter is very cold with three months duration of freezing temperature.

This unfavorate climate condition has led to develop "Ondol" heating system (floor-heating system, the typical heating system of rural areas in Korea) in which flues from the kitchen cooking stoves are led beneath the floors of the living rooms of the house and thence to chymneys on the other side of the house. This under-floor heating system consumes large quantities of fuel.

3. The Korean Government has put massive effort to protect and reforest the mountains since her independence in 1945. Without adequate alternative means of fuel supplies, however, farmers and firewood dealers could not help stop illegal cutting of the forest woods. Recognizing the necessity of alternative ways of fuel supplies the Government started to establish 850 thousand hectars of fuelwood plantations in 1959 with an aim to arrange farm fuels through the establishment of fuel forests, contributing to the prevention of forest demages. The program was accomplished in 1977, totalling 643 thousand hectars planted in terms of area which is less than

as planned by 207 thousand hectars, after many years of trial and errors. Of 643 thousand hectars of the fuelwood establishment, 50 thousnad hectars were carried out in 1976, and 127 thousand hectars in 1977 respectively. Part of the necessary funds for the project was provided by IBRD loaning during 1976 and 1977 years. Shape of forest is visibly improving in recent years.

4. The Government has put a lot effort to reduce the consumption of forest fuel through vigorous policies for improvement of a fuel holes and Ondols in rural areas, and tried to substitute other fuels such as oil and brigutte for the forest fuel in urban areas. But the limited supply of the brigutte and the drastically upward variation of oil price the oil shock in 1976 made it impossible to accomplish the since perfect substitution of the forest fuel in the rural and fishing areas. There'fore, it is expected that the dependency on the forest fuel will be extreme in future.

5. In spite of the importance of the current development of the fuelwood plantation concerning matters with respect to

structural, operational, and institutional aspects there is little information currently available for the evaluation and measurement of the comprehensive situation of the fuelwood plantation of Korea.

Thus, this study was designed to achieve the following objectives.

## Research Objectives and Mehthods

6. Research objectives of the study are as follow.

1) To grasp the general situation of the fuelwood plantation.

2) To analysis trends and patterns of fuel consumption in rural and fishing areas.

3) To evaluate economic impacts of fuelwood plantation projects.

4) To investigate the feasibility of fuelwood plantation projects.

5) To provide policy implications of fuelwood plantation projects.

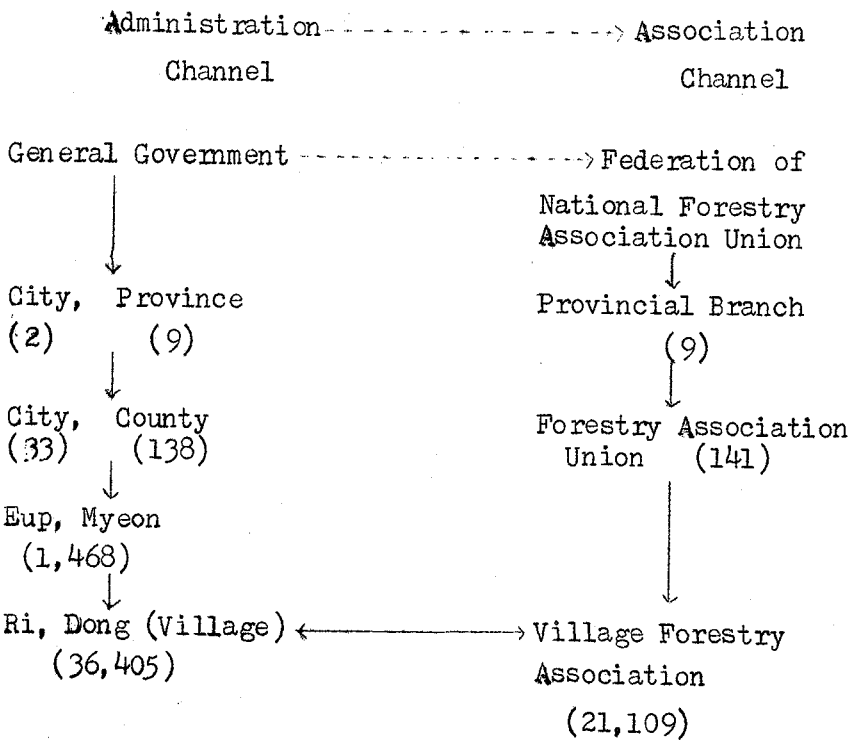
7. To obtain the data necessary to grasp general pictures of fuelwood plantation projects and their performances, 36 sample villages from eight provinces except Cheju province were selected for the 1978 research year. From each village five to seven beneficiary households and 2 nonbeneficiary households if possible were selected, and amounted to 177 benficiary households and 27 nonbeneficiary households. The sample villages which form bases of the study were chosen to reflect geographical characteristics such as mountain, plain, intermediate, and suburban fishing areas. Country Forestry Association Union, Village Forestry Association (VFA) Chiefs, and households were interviewed to fill out the survey forms, About 50 percent of the sample villages have IBRD financed plantations during 1976 and 1977 years. The interviews were carried out in July and August, 1978.

## General Descriptions of Plantation

8. The present status of the Village Forestry Association system as of the end of October, 1977 is that a total members of the VFA are amounted to 2,250,000. There are now 21,109

VEA. and there associations organize 141 City and County Forestry Association Unions, these organizations resemble the administrative organization system and become to have cooperation and connection with administrative system.

Connections between Governmental Administration system and Village Forestry Association



9. If there were no counter-measures arranged for fuel needed by households much demages to would be inevitable through the indiscriminative cutting of woods and collection of forest by-products for fuel. Therefore, as one of measures not only to solve significant fuel problem in rural and fishing area but also to contribute to the prevention of forest, the fuelwood plantation which has been started by the Government from 1959 and ended by the end of 1977 will be a total of 643 thousand hectars planted, averaging 30.5 hectare per Village Forestry Association. of 643 hectar the IBRD loan covered 50 thausand hectare in 1976 and 77 thausand hectars in 1977.

10. For the establishment of fuelwood plantations the City, County and Forest Association Union make survey to find out fuel requirement by the unit of village, and then necessary area for plantation is selected by the FAU and reported to City and County. Finally, City and County decide it as the fuelwood reforestation area after their confirmation. In accordance with the law City or County order forest owner to carry out plantation on the selected area. When the

ordered forest owner does not carry out plantation. Village Forest Association is ordered to carry out proxy execution reforestation with materials of seedlings and fertilizers provided by the Government and also the technical support of the Forest Association union. When the proxy execution is over, the forest owner is ordered to reimburse expences of the plantation. If the forest owner cannot reiburse the expenses a profit sharing contract has been made between VFA and forest owners on the condition to distribute forest products at the ratio of nine to VFA and one to the forest owner. Recognizing the necessity of forest fuels reguireed by villagians the members of VFA are called out and plant under the guidance of reforestation guides with no wages. All fuel forest planted by Village Forestry Association members through their cooperative operation with seedlings and fertilizers provided by the Government.

11. The Village Forestry Associations are supposed to do the following businesses in accordance with the Forest Law and the Charter of the Village Foresty Association.

1) autonomous forest protection, reforestation, and silvicultural management.

2) businesses designated by Forest Law and joint projects according to forest management plan.

3) works entrusted by members of the Village Forestry Association

4) projects for the promotion of common profits of members of Village Forestry Association

5) Other matters regarding to forest

12. The total number of households of in the 36 sample Villages was 4,085. Average number of households per village was 113. Average family number per household was 5.7 person which was very high. Of the total households 3,624 households were farm households and the rest nonfarm households. This comprises the ratio of 89 percent for the farm households and 11 persent for the non-farm households. Relatively high ratio of the farm households indicates that rural households in Korea are heavily dependent upon farming. Members of Village Forestry Association were 3,839 which amount to 93 percent of the total household surveyed. Of the total VFA member households, 916 households were forest land owners and 2,741 households did not possess their own forest land (see Table 1).

A total land area of the sample Villages was 19,789,871 hectare consisting of 4,323 hectare of cultivation land 2,936 hectares of upland, and 10,807 hectare of forest land. An average land area per Village was about 300 hectars (see Table 2 ).

13. Of 10,807 hectares of the forest land the share of fuel-wood plantation was 2,962 hactars which amounts to 27.4 percent of the total forest land of the sample villages. Of the total plantation area 1,877 hectars which amounts to 63.4 percent was established before 1976 and 1,084 hectares which is 36.6 persent was planted since 1973. 611.6 hectars which amounts to 20.6 percent of the total fuelwood plantation was established during 1976 and 1977 with IBRD loans . About 20% percent of the fuelwood plantation area which was established before 1973 was disused and considered to result in a great waste of resources (see Table 3 ).

14. Varieties of the fuelwood species are regidar pine, acasia, alder, acasia-alter mixed forest, and bush clover. The most preferable specie among VFA members was rigidar pine due to its strong adaptabilty to environment and fast growth.

Looking at the fuelwood plantation area established before 1973 by fuelwood species acasia amonnted to 38.4 percent rigidar pine 50.7 percent, alder 6 percent, and other 41.8 percent. Of 190 heatars planted in 1974 acasia amounted to 33 percent, rigidar pine 36 percent alder 17 percent, and bush clover 5 percent. Of 204 hectares established in 1975 acasia was 36 percent, rigitar pine 21 percent, alder 34.7 percent, and bush clover 7.8 percent. Of 290 hectares planted in 1976 acasia amounted to 23.3 percent, rigidar pine 40.4 percent, alder 26.9 percent, bush clover 2.8 percent, and other 6.5 percent. Of 374 hectares planted 1977 acasia amounted to 22.4 percent, rigidar pine 41.8 percent, alder 15.7 percent, bush colver 15.2 percent, and other 4.9 percent . According to the figures the rigidar pine has the largest planted area except 1975. On the basis of the percentage of the plantation area the rankings among fuelwood species are the rigidar pine, alder, acasia, and bush colver (see Table 3).

15. Ninetynine percent of fuelwood plantation in terms of hectars nearby mountains from villages and other along

roads and the edge of streams. The ownership of the site planted by fuelwood species is mostly private owned which amounts to 90 percent. The owners of the plantation site have to render their tenure rights to VFA to establish fuelwood plantation by law if the County office designate the site far fuelwood plantation. The fuelwood plantation is established and managed by VFA with voluntary labor of VFA members. The harvested products will be shared by VFA and the site owners with 9:1 ratio.

16. The servival rates of planted tree ranged from 75 percent to 95 percent and the reforestration of nearby forest is closely visible fuelwood raising status varied widely depending upon soil, light, location, and management of the plantation site. Application of fertilizer, particularly, seems to be very important to raise fuelwood in good condition. Among 36 the sample Villages 30 Villages have applied fertilizers after the establishment of the fuelwood plantations. After the plantation of fuelwood aftercares such as weedings, tendings, fertilizations are carreed out for 2-3 years by the members of VFA, voluntarily, with no wages

paid except fertilizers subsidied the Government. For autonomus fuelwood plantation protection a patrol team is organized by the VFA members. The inturn patrol team consisting of two VFA members makes intensive patrols during the season of fall through the spring of the following year which forest damages are heavily expected. These patrols have served for the prevention of collecting illegally forest products, control of destructive actions against forest facilities, prevention of forest fire, prevention of illegal hunting, etc. There were no villages hired full time patrolmen among the 36 sample villages. All chiefs of the VFA surveyed were serving without pay. It takes generally 4-5 years to harvest fuelwood after planting the seedlings. Weeding is taking place every year until the havest time comes, and the remains are not collected for fuel. They are spreaded and left around the tree for fertilizer.

17. Fuel production from the fuelwood plantation has been considerablly low compared to what has been expected. The survey reveals that the average amount of fuel harvest out of the fuelwood plantation was 1.71 M/T per hectare (see Table 4).

Expected or planned fuel production was five M/T per hectare. The highest production turned out to be 10 M/T per hectare while the lowest o.1 M/T per hectare. Most of the sample villages produced less than average. But all village shown higher productivity than average have applied organic fertilizers or chemical fertilizers after the establishment of the plantations.

Patterns of Fuel Consumption

18. Average number of the sample VFA households was 6.2 persons per household. Each household has 3 fire holes on average consisting of two for woods and one for buiguette, The survey shows that about 50 percent of the sample VFA households used briguettes. Average number of the sample non-VFA households was 7.6 persons per household which is higher then that of the VFA household by 1.4 persons. Average number of fire holes was 4.5 per non-VFA household. Of 4.5, 2.7 were wood fire holes and 1.8 briqutte fire holes. These figues indicate that the average number of the briqutte fire holes possessed by the VFA households was about two fold higher

than that of the non-VFA households. Consequently the non VFA households found out to consume more briquttes than the VFA households.

19. Average amount of household fuel consumption was 6.89 M/T per annum (See Table 5). Classifing the amount of the fuel consumption by products the fuel consumption is composed of 67 percent of forest products, 19 percent of agricultural by-products, and 14 percent of briquttes. During the period of Spring, Summer, and Fall the sample households frequently used oil stoves, electric cookers which led to consume 144.9 of petroleum and pay much for electricity per annum. The forest products are tree branches and weeds while agricultural by-products are rice straw, barley straw, and mulberry branches. Of the total requirement of the fuel per annum for a household 44 percent is consumed during the winter period and also most of the forest products are used in this period due to intensive demand for heating. Higher petroleum consumption during summer period indirectly evidences that it is mainly used for chooking. In particular, the rapid spread of oil stoves and electric cookers in rural areas has made a great contribution to the saving of forest fuel consumption.

20. There are about 6.2 M/T difference in the fuel consumption between members and nonmembers of VFA. That is, the members use 10.83 M/T and non-members fuel consumption is 4.63 M/T. Since the members of VFA are generally engaged in farming while non-members are shop-keepers, local government civil officers, and wage earners, the difference of 6.2 M/T appears to be used for agricultural activities such as preparing working oxen meal, large amount of cooking for hired laborers. However, non-VFA members used more briquettes than VFA members.

21. There has been significant changes in the fuel consumption patterns in rural area in recent severy years. A survey conducted in 1973 revealed average amount of the fuel consumption in sural areas was 8 M/T per annum for a household. The largest itern of fuel was forest products sharing 80 percent of the annual consumption. It included some of fire-wood and forest litters. Briquettes and agricultural by-products consumption shared only about three percent and 16.4 percent respectively. Another suvey conducted in 1974 disclosed annval amount of the fuel consumption for a household to be 10.7 M/T consisting of 73.8 percent of forest procucts, 20.6

percent of agricultural by-prodcuts, and 5.6 percent of briquettes. The result of this study conducted in 1978 showed significant changes in the fuel consumption pattern compared to the previous two studies. Annual fuel consumption for a household decreased to 6.89 M/T. Of the total amount of annual consumption, the forest products share decreased to 69 percent and briquette composition increased to 14 percent as shown in the following figure.

22. The significant changes may be partly due to the strong enforcement of forest laws which prohibit gathering the forest littlers, the prohibition of entering mountains, and the adoption of fuel saving measures such an improvement of "Ondol" and fireholes. Another, perhaps, more important reason may be the rapid increase in rural wage rate. The rural wage rate increased by 1,961 percent in 1976 compared to the level of 1959, Whereas briquette price increased only by 542 percent during the same period. This indicates that in 1959 with one day wage a farmer can buy 14 briquttes, but in 1976 a farmer can purchase 50 briquettes with a day's wage. The price of forest products may be reasonably converted to wage rate. As the farm wage rate

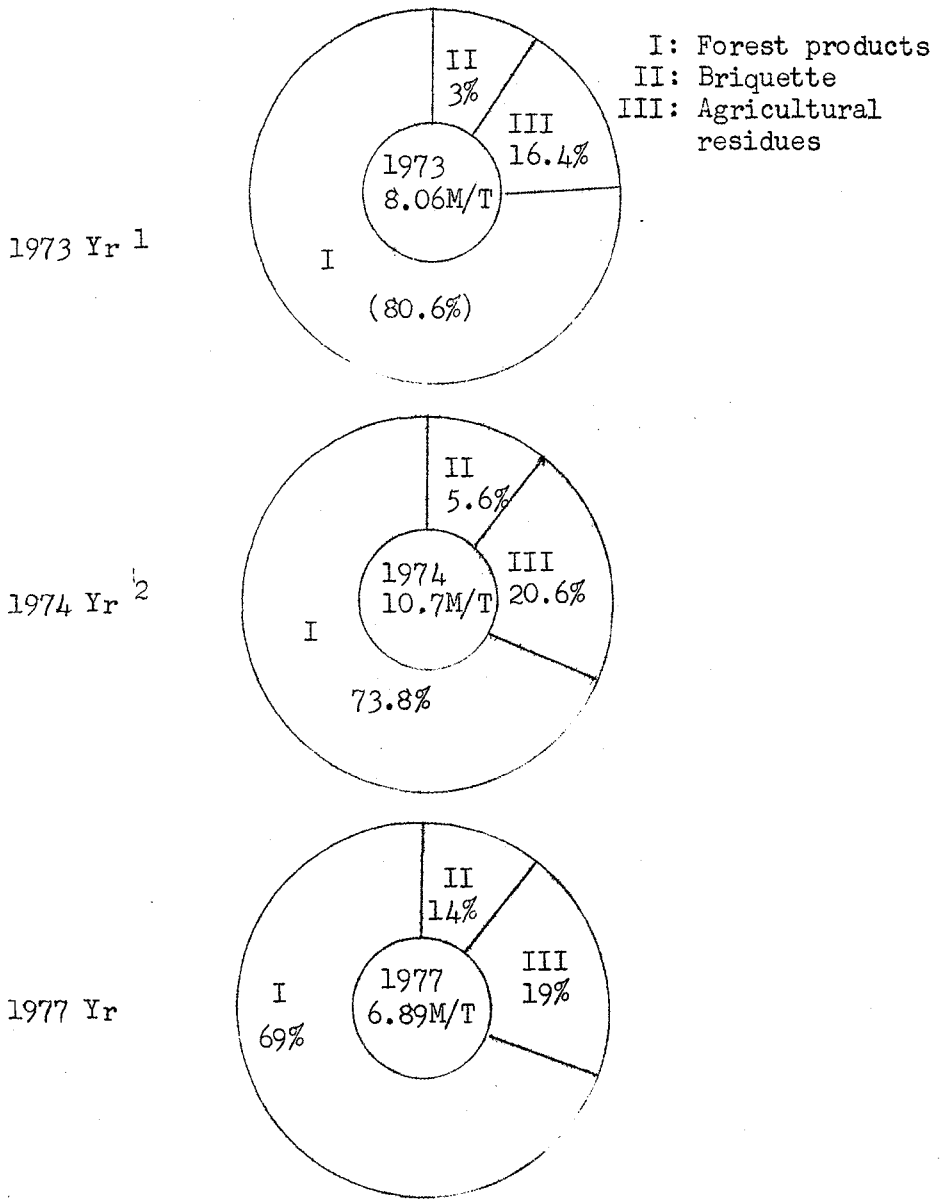
increases rapidly, it is apparent that there has been gradual substitution of briquettes for forest fuel (See Table 6).

Project Benefits

23. The principal benefits of the fuelwood project would be:

1) Production of forest fuel which would replace illegal cutting and gathering of timber and other forest products.
2) labor saving in collecting fuel.
3) creation of permanent timber producing forests as a secondary purpose of the fuelwood plantation projects, and consequent reduction of soil errosion and flood protection.
4) increase in seedling farmer8s income and creation of employment opportunities for the labor intensive seedling farms.
5) beautification of mountains and villages, and institutional building at village level leading to self reliance.

Fuel Consumption Trend




1: Korea Forest Policy Research Institute, Forest Management, 1976, p. 276

2: Cho, E. Hyuck, "Fuel Consumption Survey for Farm Households" Forest Research Institute Research Report, 1974, p. 65.

24. Quantitative measurement of direct benefits, 1) and 2) is attempted. There are no explicit markets for fuelwood in rural area any more. However fuelwood. more specifically trimmed tree branches sometimes are bought and sold among the residents in a village. Price of the fuelwood is around 1,000 won per 60 kg, a loadful of "gike" (A-frame). It is assumed that full yield would reached in eighth year and would equal 5 M/T per hectare. Yeilds would build up 0.5 M/T in fourth year, 1 M/T in fifth year, 2 M/T in sixth year, 4 M/T in seventh year, and 5 M/T per hectare until 20th year thereafter. There will be no production until fourth year. During years 1 to 3, there will be a certain amount of grass and weeds produced but usually it is left on the site for fertilizer and value of this would be merely equal to the opportunity cost of labor maintaining the fuelwood plantation.

25. When there were no fuelwood plantatins, a household had to spent average 41 days per annum to stock up 1 year fuel requirement during mostly winter time. With fuelwood plantation including forest product harvest. Value of time saving may be evaluated as an opportunity costs of labor. Seventy

five percent of annual average wage rate for man and woman in 1977 was 1,500 won/day. Labor saving value per hectare of fuelwood plantation was estimated to be about 16 days when substracting the effect of 45 percent composition rate of briquette and agricultural by-products in fuel consumption. Savings of coal resources and agricultural by-products did not occur in the survey as country to expected.

Project Costs

26. The cost per hectare of plantation extablishment is estimated to be around 112,216 Won. Materials, transport and overhead are evaluated at their financial costs. Supervision costs are valued at 4,233 Won on the basis of the skilled laborer's wage in 1977. Village volunteer labor which comprises 57 percent of total cash valued establishment cost has been valued at 1,500 Won/day which is 75 percent of annual average farm wage rate in 1977. The volunteer labor cost is 63,214 Won per hectare (See Table 7-12 ).

27. The maintenance costs of fuelwood plantation is composed

of weeding brushing for the first 4 years and plantation patrol costs. This is valued at 3,047 won per hectare ( See Table 8). Production cost may be divided into labor cost for harvest and fertilizer costs. Labor cost is estimated at 2,417 Won per hectare and fertilizer cost is 1,303 Won per hectare. Therefore, the total production costs for fuel is 3,786 Won per hectare (See Table 9).

## Project Evaluation

28. The cost and benefit streams are shown in Table 10, 11. The internal rate of return is estimated to be 18.83 percent. The benefit cost ratio is 2.29 and 1.81 when 12 percent and 15 percent discount rates were used respectively,(See Table 10). When the fuel production was valued at opportunity cost of labor, 1,500 Won/day, internal rate of return is estimated to be 19.78 percent, and the benefit cost ratio is 1.84 and 1.46 for 12 percent and 15 percent discount rates respectively. (See table 11). It was assumed that one man can harvest and carry 180 kg/day by A-frame. The transport distance was assumed to be 1 km as shown in Table.

29. Besides the direct benefits of fuelwood component, which are evaluated above, there are several indirect and intangible benefits. Concentration of fuelwood production close to village would ease the pressure on the general forest as a source of fuelwood and would enhance its potential for commercial timber production and value of forest land. Also it would retard erosion and reduce flood damages. Reforestation would enhance aesthetic value of rural areas.

30. The target fuelwood plantation area, 643 thousand hectars, was set under the assumption that a household's annual fuel requirement would be enough with 910 pieces of briquettes. This amount of briquette was converted into calories and then transfered to weight of fuel; 4.2 M/T annual requirement. However, the survey disclosed amount of annual fuel consumption of a household to be about 6.89 M/T and average yield of fuel per hectare to be 1.71 M/T. Even if the average yield is 5 M/T per hectare as planned and nnual fuel eonsumption 4.2 M/T per household, the total yield from fuelwood plantation would meet only 29 percent of total required fuel supply in rural area.

31. Depending upon the relative speeds of rural wage increase and increase in coal production costs due to depletion of coal resources, it will affect significantly energy consumption patterns in rural area. It is urgently needed to take special measures to increase fuelwood productivity such as application of fertilizer and fuelwood breeding researches.

## Conclusion and Recommendations

The fuelwood plantation projet has two important purposes which are to solve rural fuel problem and to accomplish reforestation. Even if fuel harvest from the 643 hectars of fuelwood plantation begins from 1982 as planned, this would meet only 29 percent of total required fuel supply for 2.7 million farm households. According to the First Ten year Forest Development plan the deficit of fuel supply will be solved through the substitution of briquettes, oil and electricity for forest products, an increase in utilization of agricultural by-products, and fuel consumption saving.

Since the annual average amount of fuel per household which is 4.2 M/T was set under the assumption that a household's

annual fuel requirment would be enough with 910 pieces of briquttes, it considered to be underestimated compared to 6.89 M/T estimated by the study.

Furthermore, the increase of rural wage rate and the relative decrease of briquette price is significantly promoting the substitution of briqutte for other fuel resources in rural areas. But the fuel problem of the rural areas is expected to be more serious due to the limited amount of fuel resources, and the rapid increase of prices of briquette and oil.

Therefore, it is recommended to take the following measures in order to ease the fuel problem of the rural areas with the fuelwood plantations which were already established..

1) The Government should take special measures which are urgently needed to increase fuelwood productivity such as continuous application of fertillizer and fuelwood breeding researches. It is also required to replace acasia with rigidar pine when supplementary plantations take place.

2) As fuelwood forestland is heavily reforestated is required for the Government to permit frequent trimmings and prunnings to Village Forestry Association so as to supplement

the shortage of fuelwood production of fuelwood plantations.

3) Since lack of understanding future benefits of fuelwood plantation makes farmers who are called out for weedings and trimmings of the fuelwood plantations without payment not only lose their interest but also lower the efficiency of labor due to the jummping of rural wage rate a positive enlightening movement on real benefits of the fuelwood plantations should be conducted.

4) As the economic value of forestland gradually increases owners of private forestland of which fuelwood plantations are established are in advantegeous position. Thus, it is urgently needed to supplement present law regarding to fuelwood plantations so as to cope with the negative attitude of the owners of the private forestland at the stage of regular harvest against the distribution rate of forest products.

5) Since the manpower and mobility of infraorganization look dissatisfied to manage all fuelwood plantations, the supplement of the personnel and provision of more motor cycles

to Forestry Association Unions should be achieved. It is also recommended that pick-up trucks being with the County Forestry Department, which were purchased for the fuelwood plantation project, should be returned to the County Forestry Association Union so as to promote mobility.

6) In order to increase the socio-economic efficiency of fuelwood plantations and reforestation projects which have been established by the tremendous amount of financial support so far more positive financial supporting measures should be worked out so that the present Forestry Association Union can accomplish administrative and financial position and establish self-sufficient base.

Table 1. Descriptions of Sample Villages

| Province | County | Village | Total house-holds A | Farm house-holds | Non farm house-holds | Forest-land owner | Non-Forest-land owner | VFA Members | Non-VFA Members B | B/A Pe/B (%) | Briquette using house-holds | C/A (%) | Total Population | Average/ House-Holds |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kyonggi | Pyungtak | Jinyui, Dongchun | 102 | 72 | 30 | 15 | 43 | 58 | 44 | 42.16 | 30 | 29 | 429 | 4 |
| " | " | Kohduck, Dongchun | 111 | 108 | 3 | 4 | 79 | 83 | 28 | 71.17 | 50 | 45 | 605 | 5 |
| " | Yongin | Koosung, Sangha | 39 | 33 | 6 | 4 | 33 | 37 | 2 | 84.62 | 39 | 100 | 170 | 4 |
| " | " | Yongin, Samkuh | 52 | 35 | 17 | 8 | 27 | 35 | 17 | 51.92 | 50 | 96.15 | 253 | 5 |
| Kangwon | Myungju | Koojung, Sanbook | 149 | 144 | 5 | 64 | 73 | 137 | 12 | 48.99 | 14 | 9.39 | 969 | 7 |
| " | " | Mookho, Chokoo | 111 | 89 | 22 | 49 | 32 | 77 | 34 | 28.82 | 13 | 11.71 | 403 | 4 |
| " | Wonsung | Cheejung, Kanhun | 96 | 93 | 3 | 27 | 69 | 96 | - | 65.2 | 3 | 3.12 | 327 | 3 |
| " | " | Sohcho, Sooarm | 100 | 90 | 10 | 27 | 67 | 100 | - | 67 | 60 | 60 | 436 | 4 |
| Chungnam | Gongju | Eein, Sinhung | 100 | 75 | 25 | 35 | 65 | 100 | - | 65 | 10 | 10 | 610 | 6 |
| " | " | Tanchun, Koodong | 73 | 73 | 0 | 21 | - | 73 | - | - | - | - | 456 | 6 |
| " | " | Changkee, Daekyo | 151 | 151 | 0 | 57 | 94 | 151 | - | 62.25 | - | - | 1,028 | 7 |
| " | Kimsan | Chaewon, Daesan | 157 | 143 | 14 | 14 | 143 | 157 | - | 91.08 | 77 | - | 964 | 6 |
| " | " | Chinsan, Wontong | 54 | 49 | 5 | 12 | 42 | 54 | - | 77.77 | 20 | 49.04 | 338 | 6 |
| Chungpuk | Chungwon | Bookil, Wontong | 144 | 130 | 14 | 32 | 110 | 142 | 2 | 80.55 | 12 | 8.33 | 872 | 6 |
| " | " | Namsung, Hunahm | 47 | 43 | 4 | 40 | 7 | 47 | - | 14.89 | 0 | 0 | 317 | 7 |
| " | Chaechun | Kimsung, Kooryong | 144 | 116 | 28 | 68 | 76 | 144 | - | 52.77 | 겸용 32<br>전용농가 30 | 43.05 | 809 | 6 |
| " | " | Kimsung, Pohchun | 63 | 61 | 2 | 28 | 35 | 63 | - | 55.55 | 겸 용 15<br>전 용 5 | 31.75 | 377 | 6 |
| Chonnam | Whasoon | Dong, Daearm | 70 | 62 | 8 | 6 | 64 | 70 | - | 80 | 4 | 5.71 | 375 | 5 |

| Province | County | Village | Total Households A | Farm Households | Non-Farm Households | Forest-land owner | Non-Forest land owner | VFA Members | Non-VFA Members | B/A (%) | Briquette Using Households | C/A (%) | Total Population | Average/ Households |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Chonnam | Whasoon | Dong, Daepo | 72 | 69 | 3 | 6 | 64 | 72 | - | 88.88 | - | - | 530 | 7 |
| " | Youngam | Haksan, Sangyul | 185 | 176 | 9 | 1 | 184 | 185 | - | 99.45 | - | - | 1,118 | 6 |
| " | " | Suhho, Chungryong | 102 | 87 | 15 | 3 | 99 | 102 | - | 97.05 | - | - | 712 | 7 |
| Chonpuk | Moojoo | Moojoo, Ohsan | 58 | 58 | 0 | 9 | 49 | 58 | - | 84.48 | 9 | 15.52 | 424 | 7 |
| " | " | Moojoo, Yongpo | 144 | 144 | 0 | 15 | 129 | 144 | - | 89.58 | 15 | 10.42 | 866 | 6 |
| " | " | Moojoo, Changpak | 83 | 82 | 1 | 5 | 77 | 82 | 1 | 92.77 | 9 | 10.84 | 451 | 6 |
| " | Yimsil | Kwanchon, Suhlchee | 57 | 47 | 10 | 11 | 42 | 57 | - | 73.68 | 4 | 7.01 | 346 | 6 |
| " | " | Kwan Chon, Doin | 291 | 170 | 121 | 13 | 157 | 291 | - | 53.95 | 30 | 10.31 | 1,941 | 7 |
| " | " | Sungsoo, Doin | 76 | 71 | 5 | 19 | 52 | 71 | 5 | 68.42 | 7 | 9.21 | 520 | 7 |
| Kyongnam | Chinyang | Eebanchon, Doin | 135 | 125 | 10 | 11 | 124 | 135 | - | 91.85 | 40 | 29.63 | 742 | 5 |
| " | " | Chinsung, Daesa | 148 | 137 | 11 | 50 | 87 | 137 | 11 | 58.78 | 30 | 20.27 | 1,013 | 7 |
| " | Sanchung | Sanchung, Chatan | 144 | 134 | 10 | 10 | 124 | 144 | - | 86.11 | 20 | 13.89 | 838 | 6 |
| " | " | Ohboo, Naekok | 118 | 116 | 2 | 37 | 70 | 118 | - | 59.32 | 15 | 12.71 | 638 | 5 |
| " | " | Sanchung, Mohkoh | 151 | 143 | 8 | 42 | 103 | 151 | - | 68.21 | 14 | 9.27 | 970 | 6 |
| Kyongpuk | Chilkok | Yoekwan, Nansan | 110 | 90 | 20 | 30 | 60 | 110 | - | 54.54 | 30 | 27.27 | 387 | 4 |
| " | " | Dongmyung, Songsan | 199 | 170 | 29 | 64 | 108 | 172 | 27 | 54.27 | 30 | 15.08 | 1,214 | 6 |
| " | Sangjoo | Naesung, Nungahm | 100 | 94 | 6 | 46 | 48 | 47 | 53 | 48 | 7 | 7 | 539 | 5 |
| " | " | Oenam, Koosuh | 149 | 144 | 5 | 33 | 113 | 139 | 10 | 75.83 | 20 | 13.42 | 864 | 6 |
| Total | | | 4,085 | 3,624 | 461 | 916 | 2,741 | 3,839 | 246 | 2,385.33 | 744 | 714.10 | 23,808 | 206 |
| Average | | | 113.47 | 100.67 | 12.81 | 25.44 | 76.14 | 106.64 | 6.83 | 66.26 | 20.67 | 19.84 | 661.33 | 5.72 |

Table 2. Descriptions of Land Use

(Unit: ha)

| Province | County | Village | Total (A) | Paddy Land | Upland | Forest Land (B) | B/A (%) | Average |
|---|---|---|---|---|---|---|---|---|
| Kyonggi | Pyungtak | Jinyui, Dongchun | 308.31 | 56.9 | 35 | 216.95 | 70.37 | 1.28 |
| " | " | Kohduck, Dongchun | 196.88 | 116.5 | 65.8 | 15.58 | 7.91 | 1.68 |
| " | " | Koosung, Sangha | 130.10 | 9 | 24 | 97.10 | 74.63 | 1 |
| " | " | Yongin, Samkuh | 147.78 | 8 | 5 | 134.78 | 91.20 | 0.37 |
| Kangwon | Myungju | Koojung, Sanbook | 2,189.5 | 334 | 1,320 | 534.52 | 24.41 | 11.49 |
| " | " | Mookho, Chokoo | 882.07 | 310 | 317 | 255.07 | 28.91 | 7.04 |
| " | Wonsung | Cheejung, Kanhun | 406.6 | 74.6 | 45.5 | 296 | 72.79 | 1.29 |
| " | " | Sohcho, Sooarm | 486.2 | 83.4 | 110.8 | 292 | 60.05 | 2.16 |
| Chungnam | Gongju | Eein, Sinhung | 292.04 | 31 | 37 | 224.04 | 76.71 | 0.91 |
| " | " | Tanchun, Koodong | 220.29 | 40.4 | 25 | 154.89 | 70.31 | 0.90 |
| " | " | Changkee, Daekyo | 1,723.27 | 854 | 498 | 372.27 | 21.60 | 8.95 |
| " | Kimsan | Chaewon, Daesan | 251.2 | 57.5 | 55.7 | 138 | 54.93 | 0.79 |
| " | " | Chinsan, Wontong | 157 | 15 | 32 | 110 | 70.06 | 0.96 |
| Chungpuk | Chungwon | Bookil, Wontong | 273.56 | 86 | 87.8 | 96.76 | 35.37 | 1.33 |
| " | " | Namsung, Hunahm | 313 | 34 | 26 | 249 | 79.55 | 1.40 |
| " | Chaechun | Kimsung, Kooryong | 466.54 | 34 | 55 | 377.54 | 80.92 | 0.77 |
| " | " | Kimsung, Pohchun | 422.81 | 11 | 58 | 353.81 | 83.68 | 1.13 |
| Chonnam | Whasoon | Dong, Daearm | 239.61 | 21.5 | 27.8 | 190.31 | 79.42 | 0.80 |
| " | " | Dong, Daepo | 176.58 | 29.5 | 12.1 | 87.84 | 49.74 | 0.60 |
| " | Youngam | Haksan, Sangyul | 993.87 | 88 | 22 | 873.87 | 87.92 | 0.63 |
| " | " | Suhho, Chungryong | 477.89 | 63.8 | 47.8 | 356.29 | 74.55 | 1.28 |
| Chonpuk | Moojoo | Moojoo, Ohsan | 518 | 17 | 32 | 311.9 | 60.21 | 0.84 |
| " | " | Moojoo, Yongpo | 617 | 40 | 55 | 434 | 70.34 | 0.66 |
| " | " | Moojoo, Changpak | 231.54 | 35 | 39 | 149.17 | 64.42 | 0.90 |
| " | Yimsil | Kwanchon, Suhlchee | 272.8 | 23.7 | 32.3 | 216.8 | 79.47 | 1.19 |
| " | " | Kwanchon, Doin | 303.28 | 32 | 70 | 201.28 | 66.36 | 0.60 |
| " | " | Sungsoo, Doin | 286.43 | 43 | 14 | 220.43 | 76.95 | 0.80 |
| Kyongnam | Chinyang | Eebanchon, Doin | 516.58 | 105.43 | 115.50 | 295.65 | 57.23 | 1.77 |
| " | " | Chinsung, Daesa | 656.04 | 117.30 | 57.8 | 480.93 | 73.30 | 1.28 |
| " | Sanchung | Sanchung, Chatan | 462.035 | 66.22 | 61.035 | 326.02 | 70.56 | 0.88 |
| " | " | Ohboo, Naekok | 462.035 | 66.22 | 61.035 | 316.04 | 68.40 | 1.10 |
| " | " | Sanchung, Mohkoh | 709.59 | 118.27 | 38.80 | 518.73 | 73.10 | 1.10 |
| Kyongpuk | Chilkok | Yeokwan, Nansan | 1,155.8912 | 482 | 310 | 363.89 | 31.48 | 8.8 |
| " | " | Dongmyung, Songsan | 798.05 | 97.8 | 38.3 | 655.45 | 82.13 | 0.80 |
| " | Sangjoo | Naesung, Nungahm | 1,622 | 621 | 374 | 627 | 38.66 | 10.59 |
| " | " | Oenam, Koosuh | 423.5 | 102.4 | 48.7 | 263.9 | 62.31 | 1.05 |
| Total | | | 19,789.671 | 4,323.44 | 2,936.90 | 10,807.81 | 2,269.95 | 79.12 |
| Average | | | 549.72 | 120.10 | 81.56 | 300.22 | 63.05 | 2.20 |

Table 3. Fuelwood Plantation Area by Species and Village

(Unit: ha)

| Province | Count | Village | Before 1973 | | | | | | 1973 | | | | | | 1974 | | | | | | 1975 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Acasia | Alder | Pine | Bush Clover | Other | Subtotal | Acasia | Alder | Pine | Bush Clover | Other | Subtotal | Acasia | Alder | Pine | Bush Clover | Other | Subtotal | Acasia | Alder | Pine | Bush Clover | Other | Subtotal |
| Kyonggi | PyungTak | SinYui, DongChun | 16 | 21 | 1.1 | | | 38.1 | | | | | 10 | | | | | | | | | | | 5 | | 5 |
| 〃 | 〃 | KohDuck, DongChun | | 0.1 | | | | 0.1 | | | | | 7 | | | | | | | | | | | | | |
| 〃 | YongIn | KooSung, SangHa | 4.875 | 4.875 | | | 1.75 | 11.5 | | | | | | | | | | | | | | | | | | |
| 〃 | 〃 | YongIn, SamKuh | | | | | | 13.73 | | | | | | | | | | | | | | | | | | |
| Kangwon | MyungJu | KooJung, Sanbook | | | | | | 25 | | | | | 15 | | | | | | | | 3 | | 1 | | | 4 |
| 〃 | 〃 | MookHo, Chokoo | | | | | | 27.4 | | | | | 18.2 | | 1.5 | | 0.5 | | | 2 | | | 1.5 | 1.6 | | 3.1 |
| 〃 | WonSung | CheeJung, KanHun | 1.05 | | 0.9 | | 1.05 | 3 | | | | | 12 | | | | | | | | | | | | | |
| 〃 | 〃 | SohCho, SooArm | 10.15 | 3.5 | 5.7 | | 6.65 | 26 | | | | | 34 | | | | | | | 18 | 5 | | 6 | | | 11 |
| Chungnam | GongJu | EIn, SinHung | 3 | 15 | 7 | | 5 | 30 | | | | | 62 | | | | | | | | | | | | | |
| 〃 | 〃 | TanChun, KooDong | | | | | | 35 | | | | | 13 | | | | | | | | | | | | | 2 |
| 〃 | 〃 | ChangKee, DaeKyo | 45 | | | | | 45 | | | | | | | | | | | | | | | | | | |
| 〃 | KimSan | Chaewon, Daesan | | | | | | | | | | | 58 | | 9.25 | 9.25 | 8.25 | 3.25 | | 30 | | | | 3 | | 3 |
| 〃 | 〃 | ChinSan, WonTong | | | | | | | | | | | 60 | | 18 | 13.5 | 12.5 | 6 | | 50 | | | | | | |
| Chungpuk | Chungwon | BookIl, WonTong | 6 | 14.8 | | | 2.87 | 23.67 | 3 | 2 | | | 9.5 | 5 | 1.5 | 2 | | | | 3.5 | | | | 2 | | 2 |
| 〃 | 〃 | NamSung, HunAhm | | | | | | 39 | | | | | 16 | | | | | | | | | | | | | |
| 〃 | ChaeChun | KimSung, KooRyong | 11 | 7.8 | 2 | | | 20.8 | | | | | 10 | | | | | | | | | | | | | |
| 〃 | 〃 | KimSung, JohChun | | | | | | | | | | | 30.1 | | 5 | 15 | | | | 20 | 2.5 | 1.25 | 0.35 | | | 4.1 |
| Chonnam | WhaSoon | Dong, DaeArm | | 35 | | | | 35 | | | | | | | | | | | | | | | | | | |

| Province | Count | Village | Before 1973 | | | | | | 1973 | | | | | | 1974 | | | | | | 1975 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Acasia | Alder | Pine | Bush Clover | Other | Subtotal | Acasia | Alder | Pine | Bush Clover | Other | Subtotal | Acasia | Alder | Pine | Bush Clover | Other | Subtotal | Acasia | Alder | Pine | Bush Clover | Other | Subtotal |
| Chonnam | WhaSoon | Dong,DadPo | | 8.1 | | | 20 | 8.1 | | | | | 28.8 | | | | | | | | | | | | | |
| 〃 | YoungAm | HakSan,SangYul | 30 | 50 | 25 | | 4.5 | 125 | | | | | 39 | | | | | | | | 4 | 5.25 | 7.5 | 3.25 | | 20 |
| 〃 | 〃 | SuhHo,ChungRyong | 2.5 | 14.5 | 5 | | | 26.5 | | | | | 11 | | | | | | | | | | | | | |
| Chonpuk | MooJoo | MooJoo,OhSan | | | | | | 91.2 | | | | | 69 | | 3.45 | 7.02 | 1.53 | | | 12 | 7.5 | 4 | 4.5 | | | 16 |
| 〃 | 〃 | MooJoo,YongPo | | | | | | 86.85 | | | | | 53 | | 10.0625 | 20.475 | 4.46 | | | 35 | | | | | | |
| 〃 | 〃 | MooJoo,ChangPak | | | | | | 69.72 | | | | | 36.72 | | | | | | | | | | | | | |
| 〃 | YimSil | KwanChon,SuhlChee | 2.5 | 21 | | | | 23.5 | | | | | 3 | | | | | | | | | | | | | |
| 〃 | 〃 | KwanChon,DoIn | 0.53 | 67.95 | 0.52 | | | 69 | | | | | 6 | | | | | | | | 5 | 0.5 | 0.5 | | | 6 |
| 〃 | 〃 | SungSoo,DoIn | 6.5 | 15.5 | | | | 22 | | | | | 37.5 | | | | | | | | | | | | | |
| Kyongnam | ChinYang | ZeBanChon,DoIn | | | | | | 42.9 | | | | | 39 | | | | | | | | 8.5 | 6 | 3.5 | 1 | | 19 |
| 〃 | 〃 | ChinSung,DaeSa | | | | | | 107.19 | | | | | 74 | | | | | | | | | | | | | |
| 〃 | SanChung | SanChung,ChaTan | 105.5 | 108.8 | 6.5 | | | 220.8 | | | | | 64 | | 9.75 | | 2.5 | | | 13 | 8 | 9.5 | 12.5 | | | 30 |
| 〃 | 〃 | OhBoo,NaeKok | 94.9 | 60 | 0.5 | | | 155.4 | | | | | 80.5 | | 5 | | 2 | | | 7 | 10 | 7.5 | 19.5 | | | 37 |
| 〃 | 〃 | SanChung,MohKoh | | | | | | 151 | | | | | 79 | | | | | | | | 16 | 7.75 | 13.25 | | | 37 |
| Kyongpuk | ChilKok | YeeKwan,NamSan | | | | | | 106.2 | 8 | 5 | 7 | | 20 | 20 | | | | | | | | | | | | |
| 〃 | 〃 | DongMyung,SongSan | | | | | | 49.18 | | | | | 27 | | | | | | | | | | | | | |
| 〃 | SangJoo | NaeSung,NungAhm | | | | | | 82.78 | | | | | 15 | | | | | | | | 3.5 | 0.75 | 0.75 | | | 5 |
| 〃 | 〃 | OeNam,KooSuh | | | | | | 67.12 | | | | | 20 | | | | | | | | | | | | | |
| Total | | | 339.505 | 447.925 | 54.22 | | 41.82 | 1877.74 | 8 | 8 | 9 | | 105.932 | 25 | 63.5125 | 67.995 | 31.7425 | 9.25 | | 190.5 | 74 | 43.5 | 70.85 | 15.85 | | 204.2 |

( Unit : ha )

| Province | Country | Village | 1976 | | | | | | 1977 | | | | | | Total | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Acasia | Alder | Pine | Bush Clover | Other | Subtotal | Acasia | Alder | Pine | Bush Clover | Other | Subtotal | Acasia | Alder | Pine | Bush Clover | Other | Grand total |
| Kyongggi | PyungTak | SinYui,DongChun | | | | | | | 1.75 | 2.5 | 0.75 | | | 5 | 17.75 | 23.5 | 1.85 | 5 | | 48.1 |
| 〃 | 〃 | KohDuck,DongChun | | | | | | | | | | 7 | | 7 | | 0.1 | | 7 | | 7.1 |
| 〃 | YongIn | KooSung,SangHa | | | | | | | | | | | | | 4.875 | 4.875 | | | 1.75 | 13.5 |
| 〃 | 〃 | YongIn,Samkuh | | | | | | | | | | | | | | | | | | 13.73 |
| Kangwon | MyungJu | KooJung,Sanbook | 0.5 | | 3.5 | | | 4 | 3 | | | 4 | | 7 | 6.5 | | 4.5 | 4 | | 40 |
| 〃 | 〃 | MookHo,ChoKoo | 2.5 | 0.5 | 1.5 | | | 4.5 | 0.6 | 1.5 | 1 | 3 | 2.5 | 8.6 | 4.6 | 2 | 4.5 | 4.6 | 2.5 | 45.6 |
| 〃 | WahSung | CheeJung,KanHun | 8.5 | 1.5 | 2 | | | 12 | | | | | | | 9.55 | 1.5 | 2.9 | | 1.05 | 15 |
| 〃 | 〃 | SohCho,SooArm | 3 | 0.5 | 1.5 | | | 5 | | | | | | | 18.15 | 4 | 13.2 | | 6.65 | 60 |
| Chungnam | | EIn,SinHung | 1.5 | 41.25 | 4.75 | | 2.5 | 50 | 2.5 | 7 | 2.5 | | | 12 | 7 | 63.25 | 14.25 | | 7.5 | 92 |
| 〃 | 〃 | TanChun,KooDong | 0.5 | 2 | 1 | | 1.5 | 5 | 1.25 | 3 | 1.25 | | 0.5 | 6 | 2.75 | 6 | 2.25 | | 2 | 48 |
| 〃 | 〃 | ChangKee,DaeKyo | | | | | | | | | | | | | 45 | | | | | 45 |
| 〃 | KimSan | Chaewon,DaeSan | | | | | | | 5 | 15 | 5 | | | 25 | 14.25 | 24.25 | 13.25 | 6.25 | | 58 |
| 〃 | 〃 | ChinSan,WonTong | | | | | | | 2 | 6.5 | 1.5 | | | 10 | 20 | 10 | 14 | 6 | | 60 |
| Chungpuk | ChungWon | BookIl,WonTong | | | | | 4 | 4 | | | | | | | 7.5 | 19.8 | 2 | 2 | 6.87 | 38.17 |
| 〃 | 〃 | NamSung,HunAhm | | | | | | | 2.75 | 10.75 | 2.5 | | | 16 | 2.75 | 10.75 | 2.5 | | | 55 |
| 〃 | ChaeChun | KimSung,KooRyong | | | | | | | 2.5 | 3.5 | 3 | 1 | | 10 | 13.5 | 11.3 | 5 | 1 | | 30.8 |
| 〃 | 〃 | KimSung,OkChun | | | | | | | 2.5 | 1.5 | 1 | 1 | | 6 | 10 | 19.75 | 1.35 | 1 | | 30.1 |
| Chonnam | Whasoon | Dong,DaeArm | | | | | | | | | | | | | | 35 | | | | 35 |

| Province | County | Village | 1976 | | | | | | 1977 | | | | | | Total | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Acasia | Alder | Pine | Bush Clover | Other | Subtotal | Acasia | Alder | Pine | Bush Clover | Other | Subtotal | Acasia | Alder | Pine | Bush Clover | Other | Grand total |
| Chonnam | WhaSoon | Dang,DaePo | 1.75 | 9.5 | 2.25 | 2.3 | | 15.8 | | 11 | 2 | | | 13 | 1.75 | 28.6 | 4.25 | 2.3 | | 36.9 |
| 〃 | YoungAm | HakSan,SangYul | | | | | | | | 1 | 2 | 10 | 6 | 19 | 34 | 56.25 | 34.5 | 13.25 | 26 | 164 |
| 〃 | 〃 | SuhHo,ChungRyong | | | | | | | 5 | 4 | 2 | | | 11 | 7.5 | 18.5 | 7 | | 4.5 | 37.5 |
| Chonpuk | MooJoo | MooJoo,OhSan | 7.25 | 13.05 | 8.7 | | | 29 | | 7.85 | 2.15 | 2 | | 12 | 18.2 | 31.92 | 16.88 | 2 | | 160.2 |
| 〃 | 〃 | MooJoo,YongPo | | | | | | | 4.68 | 7.88 | 3.44 | | 2 | 18 | 14.74 | 28.35 | 7.9 | | 2 | 139.85 |
| 〃 | 〃 | MooJoo,ChangPak | 4.75 | 8.55 | 5.52 | | | 18.82 | | 13.3 | 4.6 | | | 17.9 | 4.75 | 21.85 | 10.12 | | | 106.44 |
| 〃 | YimSil | KwanChon,SuhlChee | | | | | | | | 3 | | | | 3 | 2.5 | 24 | | | | 26.5 |
| 〃 | 〃 | KwanChon,DoIn | | | | | | | | | | | | | 5.53 | 68.45 | 1.02 | | | 75 |
| 〃 | 〃 | SungSoo,DoIn | | | | | | | 29.75 | 7.75 | | | | 37.5 | 36.25 | 23.25 | | | | 59.5 |
| Kyongnam | ChinYang | EeBanChon,DoIn | | | | | | | 2 | 5 | 8 | 5 | | 20 | 10.5 | 11 | 11.5 | 6 | | 81.9 |
| 〃 | 〃 | ChinSung,DaeSa | 11.5 | 18.5 | 12 | 2 | | 44 | 4 | 12 | 4 | 10 | | 30 | 15.5 | 30.5 | 16 | 12 | | 181.19 |
| 〃 | SamChung | SanChiag,ChaTan | | 5.5 | 13.5 | | 2 | 21 | | | | | | | 123.25 | 124.55 | 35 | | 2 | 284.8 |
| 〃 | 〃 | OhBoo,NaeKok | 3 | 4 | 4 | 1 | 2 | 14 | 4.5 | 15 | | 3 | | 22.5 | 117.4 | 86.5 | 26 | 4 | 2 | 235.9 |
| 〃 | 〃 | SanChung,MohKoh | 8 | 1 | 7 | | 5 | 21 | | 5 | 2.5 | 6 | 7.5 | 21 | 24 | 13.75 | 22.75 | 6 | 12.5 | 230 |
| Kyongpuk | ChilKok | YeeKwan,NamSan | | | | | | | 6 | 5.25 | 5.75 | 3 | | 20 | 14 | 10.25 | 22.75 | 3 | | 146.2 |
| 〃 | 〃 | DongMyung,SongSan | 8 | 6 | 8 | 3 | | 25 | | | | 2 | | 2 | 8 | 6 | 8 | 5 | | 76.18 |
| 〃 | SangJoo | NaeSung,NungAhm | | | | | | | 2.75 | 4.75 | 2.5 | | | 10 | 6.25 | 5.5 | 3.25 | | | 97.78 |
| 〃 | 〃 | OeNam,KooSuh | 6.75 | 5.25 | 3 | | | 15 | 1.25 | 2.5 | 1.25 | | | 5 | 8 | 7.75 | 4.25 | | | 87.12 |
| Total | | | 67.5 | 117.1 | 78.22 | 8.3 | 17 | 237.12 | 83.78 | 156.53 | 58.69 | 57 | 18.5 | 374.5 | 636.295 | 877.595 | 302.72 | 90.4 | 77.32 | 2962.06 |

Table 4. Fuelwood Production

| Region | | | Plantation Year | Area (ha) | 1 Species | Harvest Year | Yrs to take | 1st Yr (M/T) | 2nd Yr (M/T) | 3rd Yr (M/T) | Total (M/T) | No. of Seedlings |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Province | County | Village | | | | | | | | | | |
| Kyonggi | Pyungtak | Jinyui | 1967 | 40.2 | A.R.O | 1973이전 | 6 | 23.7t | 56 t | 76 t | 155.7 | 152,400 |
| " | " | Dongchun | 1965 | 5 | B | 1976 | 1 | 10 | | | 10 | 50,500 |
| " | " | Kohduck | 1973 | 6.85 | R | 1973이전 | | 1 | | | 1 | 400 |
| " | " | Dongchong | 1977 | 7 | B | 1977 | | | 14 | | 14 | 70,000 |
| " | Yongin | Koosung | 1960 | 11.5 | A.R | 1973 | 13 | 26 | 30.7 | 32.7 | 89.4 | 46,000 |
| " | " | Yongin | 1967 | 12.23 | A.R | 1973 | 6 | 30 | 30 | 16.6 | 76.6 | 42,850 |
| Kangwon | Myungju | Koojung | 1967 | 25 | A.R | 1976 | 9 | 10 | 10 | 12 | 32 | 100,000 |
| " | " | Mookho | 66,67년 | 27.4 | A.R | 1973 | 7 | 52 | 21.6 | 26.3 | 99.9 | 142,200 |
| " | Wonsung | Jijung | 63~72 | 3 | A.R.O | 1976 | | 35 | 36 | | 71 | 12,000 |
| " | " | Sohcho | 63~72 | 26 | A.R.O | 1970 | | 152 | 134 | 143 | 429 | 104,000 |
| Chungnam | Gongju | Tanchun | 1967 | 35 | A.R.O | 1974 | 7 | 1.5 | 1.5 | 1.5 | 4.5 | 140,000 |
| " | Kukdong | Kukdong | 1977 | 6 | A.R.O | 1977 | | 2.6 | 27.3 | | 29.9 | 24,000 |
| " | Kongju | Jangkee | 66,67 | 45 | A | 1975 | | 15.6 | | | 15.6 | 90,000 |
| " | Kumsan | Taesan | 1975 | 3 | B | 1975 | | 15 | 60 | | 71 | 30,000 |
| " | " | " | 1976 | | | 1976 | | 15 | 2 | | 17 | |
| " | " | " | 1977 | 25 | A.R.O | 1977 | | 100 | 600 | 2 | 702 | 100,000 |
| " | " | Jinsan | 1974 | 50 | A.R.O.B | 1975 | 1 | 2 | 70 | 2 | 74 | |
| " | Koechon | Koechon | 1977 | 10 | A.R.O | 1977 | | 50 | 2 | | 52 | |
| Chonpuk | Chungwon | Bookil | 59,61 | 5 | A.R | 1976 | | 30 | | | 30 | 83,200 |
| " | Wontong | Wontong | 1975 | 2 | B | 1975 | | 4 | | | 4 | 40,000 |
| " | " | " | 1976 | 4 | B | 1976 | | 8 | 34 | | 42 | 40,000 |
| " | Chungwon | Namsong | 73이전 | 39 | A.R.O | 1970 | | 120 | 152 | | 272 | 62,000 |
| " | Jaecheon | Kumsung | 1967 | 20.8 | A.R.O | 1973 | 6 | 7 | 7 | 6 | 20 | 83,200 |
| " | " | " | 1974 | 20 | R.O | 1974 | | 24 | 8 | 4 | 36 | 80,000 |
| Chonnam | Hwasun | Hwasun | 1961 | 35 | R | 1970 | 9 | 150 | 63 | 25.75 | 238.75 | 140,000 |
| " | " | " | 1962 | 8.10 | R | 1970 | 8 | 124 | 15 | | 139 | 24,300 |
| " | Yungdan | Haksan | 1967 | 125 | A.R.O | 1972 | 5 | 60 | 68 | 42 | 173 | 500,000 |
| " | " | Sheoho | 59,67 | 26.5 | A.R.O | 1972 | | 20 | 22 | | 42 | 98,000 |
| Chonpuk | Osan | Yulsok | 1976 | 29 | A.R.O | 1976 | | | 58 | | 58 | 116,000 |
| " | " | " | 1977 | 12 | R.O.B | 1977 | | | 16 | | 16 | 6,000 |
| " | Muju | Muju | 65,66 | 86.85 | | | | 55 | 84 | 30 | 169 | 347,000 |
| " | " | " | 64,67 | 69.72 | | 1970 | | 85 | 48 | 36 | 169 | |
| " | " | Jangbaik | 1976 | 18.82 | A.R.O | | | 40 | | | 40 | |
| " | Imsil | Gwanchon | 1972 | 23.5 | A.R | 1974 | 2 | 151 | 213.7 | 242 | 606.7 | 72,000 |
| " | " | " | 67,72 | 69 | A.R.O | 1971 | | 60.9 | 129.5 | | 190.4 | 276,000 |
| " | Doin | Huchon | 1967 | 22 | A.R | 1971 | 4 | 17 | 50 | 65.6 | 132.6 | 88,000 |
| Kyongnam | Jinyang | Eebansung | 1962 | 42.9 | A.R.O | 1972 | 10 | 35.1 | 39.35 | 40.9 | 115.35 | 110,500 |
| " | " | Jinsung | 66,64,65 | 107.19 | A.R.O | 1972 | | 223 | 250 | 228 | 701 | 428,000 |
| " | Sancheong | Sancheong | 60,64,67 68,69,71 | 220.8 | A.R.O | 1972 | | 7.1 | 153 | 264 | 424.1 | 524,000 |
| " | " | Obu | 60,64,67 68,69,71 | 155.4 | A.R.O | 1972 | | 66.6 | 262 | 196 | 524.6 | 636,000 |
| " | " | Sancheong | 62,64,67 68,69,71 | 151 | A.R.O | 1972 | | 33.5 | 146 | 174 | 353.5 | 604,000 |
| Kyongbuk | Chilgok | Dongmyung | 59~72 | 49.18 | A.R.O | 1973 | | 42.12 | 37 | 27.34 | 106.46 | 196,780 |
| " | Sangju | Naeshue | 66,64 65,69 | 82.178 | A.R.O | 1971 | | 164 | 328 | 410 | 902 | 331,120 |
| " | " | Oeinam | 64,66 | 67.12 | A.R.O | 1971 | | 335 | 410 | 70 | 915 | 248,480 |
| Total | | | | 1,830.238 | | | | 2,403.72 | 4,228.65 | 2,173.69 | 8,809.06 | |
| Average | | | | | | | | 1.34 | 2.42 | 1.36 | 5.12 | |

1: A: Acasia R: Rigida Pine, O: Older, B: Bush Clover

Table 5. Amount of Fuel Consumption per Household by Season[1]

(Unit: Tons)

| Kinds \ Season | Spring | Summer | Autumn | Winter | Total Annual |
|---|---|---|---|---|---|
| Forest Products | 0.80 | 0.60 | 1.1 | 2.11 | 4.61(61%) |
| Agricultural Residues | 0.30 | 0.20 | 0.4 | 0.4 | 1.30(19%) |
| Briquette | 0.15 | 0.21 | 0.16 | 0.46 | 0.98(14%) |
| Total | 1.25(18%) | 1.0(14%) | 1.66(24%) | 2.96(44%) | 6.89(100%) |

[1] Spring 2 months (3,4), Summer 4 months (5,6,7,8), Fall 2 months (9,10), Winter 4 months (11,12,1,2)

Table 6. Trends of Rural Wage Rate and Briquette Price: 1959-1976

| Year | Farm Wage Rate (A)[1](Won/Man/Day) | Briquette Price (B)[2](Won/Piece) | Relative Wage Rate(A/B) |
|---|---|---|---|
| 1959 | 97 | 7 | 13.9 |
| 1960 | 96 | 7 | 13.7 |
| 1961 | 106 | 7 | 15.1 |
| 1962 | 115 | 7 | 16.4 |
| 1963 | 148 | 7.80 | 19 |
| 1964 | 199 | 8.30 | 24 |
| 1965 | 221 | 10 | 22.1 |
| 1966 | 256 | 13 | 19.7 |
| 1967 | 307 | 16 | 19.2 |
| 1968 | 381 | 16 | 23.8 |
| 1969 | 463 | 16 | 23.8 |
| 1970 | 579 | 18 | 32.2 |
| 1971 | 659 | 19 | 34.7 |
| 1972 | 803 | 21 | 38.2 |
| 1973 | 886 | 22 | 40.3 |
| 1974 | 1,141 | 28 | 40.8 |
| 1975 | 1,467 | 34 | 43.2 |
| 1976 | 1,903 | 38 | 50.1 |

1 Wage rate for adult man, NCAF, The List of Farm Prices 1959-1974, 1975, P.208, and NCAF, NCAF Monthly Report, Sept., 1977. P.12

2 19 hole briquette, NCAF, The List of Farm Prices 1959-1974, 1975. and Korea Chamber of Commerce, The List of Pieces, 1976, P. 233.

Table 7-1. Investment Costs of Fuelwood Plantation (1977)

(Unit: Won)

| Province | County | Village | Fuel-wood Area | Seedings | | Pertilizer | | Labor Costs | | Transportation | | Supervision | | Other | | Total | Invest-ment Cost/ha |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Total | ha | Total | ha | Total | ha | Total | ha | Total | ha | Total | ha | | |
| Kyonggi | Pyongtak | Dongchun | 5 | 176,906 | 35,381 | 11,655 | 2,331 | 280,320 | 56,064 | 7,460 | 1,492 | 17,845 | 3,569 | 17,715 | 3,543 | 511,901 | 102,380 |
| Kwangwon | Myungju | Sanbook | 7 | 256,824 | 36,689 | 27,509 | 3,930 | 610,248 | 87,178 | 19,392 | 2,770 | 38,843 | 5,549 | 46,532 | 6,647 | 999,348 | 142,764 |
| " | " | Chokoo | 8.6 | 319,549 | 37,157 | 27,720 | 3,223 | 695,501 | 80,872 | 19,542 | 2,272 | 41,088 | 4,778 | 46,959 | 5,460 | 1,150,359 | 133,763 |
| Chungnam | Kongju | Sinhung | 12 | 437,986 | 36,499 | 25,392 | 2,116 | 672,768 | 56,064 | 17,904 | 1,492 | 42,828 | 3,569 | 43,220 | 3,602 | 1,240,098 | 103,342 |
| " | " | Kookdong | 6 | 219,190 | 36,532 | 12,697 | 2,116 | 336,384 | 56,064 | 8,952 | 1,492 | 21,414 | 3,569 | 21,600 | 3,600 | 620,237 | 103,373 |
| " | Kimsan | Daesan | 25 | 916,260 | 36,650 | 52,924 | 2,117 | 1,401,600 | 56,064 | 30,150 | 1,206 | 89,225 | 3,569 | 90,000 | 3,600 | 2,580,159 | 103,206 |
| " | " | Kyochon | 10 | 357,454 | 35,745 | 21,151 | 2,115 | 560,540 | 56,064 | 12,060 | 1,206 | 35,690 | 3,569 | 36,000 | 3,600 | 1,022,995 | 102,300 |
| Chungpuk | Chungwon | Hunam | 16 | 574,829 | 35,927 | 33,855 | 2,116 | 897,024 | 56,064 | 23,897 | 1,494 | 57,104 | 3,569 | 57,600 | 3,600 | 1,644,309 | 102,769 |
| " | Chaechun | Kooryong | 10 | 390,764 | 39,076 | 24,321 | 2,432 | 615,090 | 61,509 | 17,157 | 1,716 | 39,155 | 3,916 | 41,333 | 4,133 | 1,127,820 | 122,782 |
| " | " | Pohchun | 6 | 220,500 | 36,750 | 15,862 | 2,644 | 390,834 | 65,139 | 11,189 | 1,865 | 24,879 | 4,147 | 26,933 | 4,489 | 690,197 | 115,033 |
| Chonnam | Hwasoon | Daepoh | 13 | 466,380 | 35,875 | 27,541 | 2,119 | 728,832 | 56,064 | 19,396 | 1,492 | 46,397 | 3,569 | 46,799 | 3,600 | 1,335,345 | 102,719 |
| " | Youngam | Sangyhul | 19 | 763,896 | 40,205 | 71,959 | 3,787 | 1,609,716 | 84,722 | 50,718 | 2,669 | 102,461 | 5,393 | 121,730 | 6,407 | 2,720,480 | 143,183 |
| " | " | Chungryong | 11 | 418,248 | 38,023 | 23,260 | 2,115 | 616,704 | 56,064 | 16,412 | 1,492 | 39,259 | 3,569 | 39,600 | 3,573 | 1,153,483 | 104,862 |
| Chanpuk | Mooju | Ohsan | 12 | 455,855 | 37,988 | 31,740 | 2,645 | 781,668 | 65,139 | 22,378 | 1,865 | 49,758 | 4,147 | 53,866 | 4,489 | 1,395,265 | 116,272 |
| " | " | Yongpoh | 18 | 669,041 | 37,169 | 44,437 | 2,469 | 1,118,052 | 62,114 | 31,330 | 1,741 | 71,172 | 3,954 | 17,866 | 993 | 1,951,898 | 108,439 |
| " | " | Changpak | 17.9 | 635,927 | 35,527 | 35,972 | 2,010 | 953,088 | 53,245 | 25,364 | 1,417 | 60,673 | 3,390 | 61,200 | 3,419 | 1,772,224 | 99,007 |
| " | Yimsil | Sulhchee | 3 | 56,916 | 18,972 | 6,347 | 2,116 | 168,193 | 56,064 | 4,476 | 1,492 | 10,707 | 3,569 | 10,800 | 3,600 | 260,439 | 86,813 |
| " | " | Hoochon | 37.5 | 1,397,125 | 37,257 | 79,351 | 2,116 | 2,102,400 | 56,064 | 55,950 | 1,492 | 133,838 | 3,569 | 135,000 | 3,600 | 3,903,664 | 104,098 |
| Kyungnam | Chinyang | Daechon | 20 | 825,022 | 41,251 | 58,191 | 2,910 | 1,393,530 | 69,677 | 40,985 | 2,049 | 88,705 | 4,435 | 102,750 | 5,138 | 2,509,183 | 125,459 |
| " | " | Daesa | 30 | 1,103,764 | 36,792 | 95,220 | 3,174 | 2,226,420 | 74,214 | 66,008 | 2,200 | 141,720 | 4,724 | 139,414 | 4,647 | 3,772,546 | 125,752 |
| " | Sanchung | Nahkok | 22.5 | 765,306 | 34,014 | 57,151 | 2,540 | 1,424,790 | 63,324 | 40,281 | 1,790 | 90,697 | 4,031 | 11,667 | 519 | 2,389,892 | 106,217 |
| " | " | Mohko | 21 | 805,480 | 38,356 | 63,495 | 3,024 | 1,300,764 | 61,941 | 44,754 | 2,131 | 82,803 | 3,943 | 12,667 | 603 | 2,309,963 | 109,998 |
| Kyungpuk | Chilkok | Naksan | 20 | 782,029 | 39,102 | 51,820 | 2,591 | 1,284,630 | 64,232 | 24,938 | 1,247 | 81,775 | 4,089 | 12,600 | 630 | 2,237,792 | 111,890 |
| " | " | Songsan | 2 | 81,386 | 40,693 | 10,562 | 5,281 | 221,028 | 110,514 | 5,088 | 2,544 | 14,068 | 7,034 | 700 | 350 | 333,282 | 166,641 |
| " | Sangju | Nungam | 10 | 373,733 | 37,373 | 21,159 | 2,116 | 560,640 | 56,064 | 14,920 | 1,492 | 35,690 | 3,569 | 36,000 | 3,600 | 1,042,142 | 104,214 |
| " | " | Koosuh | 5 | 187,170 | 37,434 | 10,579 | 2,116 | 280,320 | 56,064 | 7,460 | 1,492 | 97,845 | 19,569 | 18,000 | 3,600 | 601,374 | 120,275 |
| Total | | | 367.5 | 13,657,540 | | 952,436 | 941,870 | 68,266 | 23,231,184 | 1,676,588 | 638,161 | 45,610 | 1,555,639 | 122,356 | 1,248,251 | 91,050 | 41,626,875 | 1,957,540 |
| Average | | | | | | 37,163 | | 2,563 | | 63,214 | | 1,736 | | 4,233 | | 3,397 | | 112,216 |

Table 7-2. Investment Costs of Fuelwood Plantation (1976)

(Unit: Won)

| Province | County | Village | Fuel-wood Area | Seedings | | Pertilizer | | Labor Costs | | Transportation | | Supervision | | Other | | Total | Invest-ment Cost/ha |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Total | ha | Total | ha | Total | ha | Total | ha | Total | ha | Total | ha | | |
| Kangwon | Myungju | Chokuh | 5 | 145,702 | 32,378 | 9,558 | 2,124 | 214,542 | 47,676 | 6,052 | 1,345 | 9,535 | 2,119 | | | 385,389 | 85,642 |
| " | Wonsung | Kanhun | 12 | 356,784 | 29,732 | 14,568 | 1,214 | 589,368 | 49,114 | 16,140 | 1,345 | 38,652 | 3,221 | | | 1,015,512 | 84,626 |
| " | " | Sooam | 5 | 158,940 | 31,788 | 6,070 | 1,214 | 245,570 | 49,114 | | | 16,105 | 3,221 | | | 426,685 | 85,337 |
| Chungnam | Kongju | Shinhung | 50 | 1,255,189 | 25,104 | 106,200 | 2,124 | 2,823,200 | 56,464 | 69,000 | 1,380 | 161,050 | 3,221 | | | 4,414,639 | 88,293 |
| " | " | Kookdong | 5 | 154,550 | 30,910 | 10,620 | 2,124 | 280,905 | 56,181 | 6,900 | 1,380 | 16,105 | 3,221 | | | 280,905 | 56,181 |
| Chungpuk | Chungwon | Wontong | 4 | 139,960 | 34,990 | 21,867 | 5,467 | 457,920 | 114,480 | 7,096 | 1,774 | 10,135 | 2,534 | | | 636,978 | 159,245 |
| Channam | Whasoon | Daepoh | 16 | 449,984 | 28,480 | 41,011 | 2,596 | 1,029,140 | 65,135 | 18,407 | 1,165 | 59,727 | 3,780 | | | 1,598,269 | 101,156 |
| Chonpuk | Mooju | Yuhlsok | 29 | 937,767 | 32,337 | 61,596 | 2,124 | 1,629,249 | 56,181 | 39,962 | 1,378 | 93,409 | 3,221 | | | 2,761,983 | 95,241 |
| " | " | Changpak | 19 | 614,399 | 32,646 | 40,373 | 2,145 | 1,067,439 | 56,718 | 26,182 | 1,391 | 61,199 | 3,252 | | | 1,809,592 | 96,153 |
| Kyongnam | Chinyang | Daesah | 44 | 1,327,790 | 30,177 | 57,058 | 1,297 | 1,883,296 | 42,802 | 63,216 | 1,437 | 123,516 | 2,807 | | | 3,454,876 | 78,520 |
| " | Sanchung | Chatan | 21 | 843,988 | 40,190 | 44,602 | 2,124 | 1,296,380 | 61,732 | 28,973 | 1,380 | 56,336 | 2,683 | 51,576 | 2,456 | 2,321,855 | 110,565 |
| " | " | Mokoh | 21 | 710,012 | 33,810 | 44,603 | 2,124 | 1,206,280 | 57,442 | 28,973 | 1,380 | 55,965 | 2,665 | | | 2,045,833 | 97,421 |
| Kyongpuk | Chilkok | Songsan | 25 | | | 60,046 | 2,402 | 1,068,616 | 42,745 | 32,548 | 1,302 | 69,753 | 2,790 | | | 1,230,963 | 49,239 |
| " | Sangju | Koosuh | 15 | 398,439 | 26,563 | 31,859 | 2,124 | 512,510 | 40,834 | 18,213 | 1,214 | 39,975 | 2,665 | | | 1,100,996 | 73,400 |
| Total | | | 236 | 7,493,504 | 409,105 | 550,031 | 31,202 | 14,404,415 | 796,619 | 381,662 | 17,870 | 811,462 | 41,400 | | | 23,484,475 | 1,261,016 |
| Average | | | | | 31,752 | | 2,330 | | 61,035 | | 1,532 | | 3,438 | | | | 100,087 |

Table 9. Fuelwood Production Costs

(Unit: Won)

| Provence | County | Village | Fuelwood Area (ha) | Fertilizer | | Labor | | Other | | Total | Production Cost/ ha |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Total | ha | Total | ha | Total | ha | | |
| Kunggi | Pyong Tak | Dong Chon | 48 | 29,407 | 611 | 97,488 | 2,031 | 1,750 | 36 | 128,645 | 2,678 |
| " | Yong In | Soo Won | 14 | 11,763 | 871 | 62,650 | 4,475 | 472 | 35 | 74,885 | 5,381 |
| " | " | Sam Kuh | 14 | 23,525 | 1,713 | 47,250 | 3,375 | 944 | 69 | 71,719 | 5,157 |
| Kangwon | Myung Ju | San Puk | 40 | 17,643 | 441 | 16,200 | 4,050 | 708 | 18 | 34,551 | 4,509 |
| " | " | Cho Ku | 46 | 41,757 | 916 | 69,736 | 1,516 | 1,675 | 37 | 113,168 | 2,469 |
| " | Wonsung | Kan Hun | 15 | 35,287 | 2,353 | 51,300 | 3,420 | 1,416 | 94 | 88,003 | 5,867 |
| " | " | Soo Am | 60 | 48,000 | 800 | 270,000 | 4,500 | 1,888 | 32 | 319,888 | 5,332 |
| Chungnam | Kongju | Sui Hung | 92 | 262,703 | 2,856 | 167,992 | 1,826 | 15,850 | 172 | 446,545 | 4,854 |
| " | Kimsang | Dae San | 58 | 321,837 | 5,549 | 371,954 | 6,413 | 9,750 | 168 | 703,541 | 12,130 |
| " | " | Kyo Chon | 60 | 546,396 | 9,107 | 82,500 | 1,375 | 6,250 | 104 | 635,146 | 10,586 |
| Chungpuk | Chungwon | Won Tong | 38 | 49,991 | 1,310 | 142,994 | 3,763 | 2,006 | 53 | 194,991 | 5,126 |
| " | " | Hun Am | 55 | 94,101 | 1,711 | 141,735 | 2,577 | 3,776 | 69 | 239,612 | 4,357 |
| " | Chaechun | Koo Ryong | 31 | 41,169 | 134 | 130,200 | 4,200 | 1,652 | 54 | 173,021 | 4,388 |
| " | " | Poh Chun | 30 | 23,765 | 790 | 140,400 | 4,680 | 944 | 31 | 165,109 | 5,501 |
| Chonnam | Whasoon | Dae Poh | 37 | 68,400 | 1,854 | 123,876 | 3,348 | 3,068 | 83 | 195,344 | 5,285 |
| " | Yongam | Sang Yul | 164 | 52,932 | 323 | 549,072 | 3,348 | 2,124 | 13 | 604,128 | 3,684 |
| " | " | Chung Ryong | 38 | 64,695 | 1,725 | 21,242 | 559 | 2,596 | 69 | 88,533 | 2,353 |
| Chunpuk | Mooju | Yuhl Sok | 160 | 158,340 | 988 | 698,880 | 4,368 | 12,698 | 79 | 869,918 | 5,435 |
| " | " | Chang Pak | 126 | 75,439 | 597 | 83,790 | 665 | 28,301 | 224 | 187,440 | 1,486 |
| " | Yinsil | Suhl chi | 27 | 18,000 | 679 | 13,500 | 500 | 708 | 27 | 32,208 | 1,206 |
| " | " | Kwanchon | 75 | 21,456 | 286 | 62,475 | 833 | 870 | 12 | 84,801 | 1,131 |
| " | " | Hoochon | 60 | 285,000 | 4,790 | 82,500 | 1,375 | 11,210 | 188 | 378,710 | 6,353 |
| Kyongnam | Chinyang | Daechon | 82 | 90,0000 | 1,104 | 136,448 | 1,664 | 3,540 | 43 | 229,988 | 2,811 |
| " | " | Daesah | 181 | 120,000 | 662 | 740,833 | 4,093 | 4,720 | 26 | 865,553 | 4,781 |
| " | Sanchung | Nahkok | 236 | 114,000 | 483 | 449,344 | 1,904 | 14,193 | 60 | 577,537 | 2,447 |
| " | " | Mohko | 230 | 72,000 | 313 | 179,860 | ,782 | 8,964 | 39 | 260,824 | 1,134 |
| Kyongpuk | Chilkok | Naksan | 146 | 194,038 | 1,327 | 329,960 | 2,260 | 7,788 | 53 | 531,786 | 3,640 |
| " | " | Songsan | 76 | 131,040 | 1,720 | 229,444 | 3,019 | 4,536 | 60 | 365,020 | 4,799 |
| " | Sangju | Nungam | 98 | 58,813 | 602 | 131,908 | 1,346 | 2,360 | 24 | 193,081 | 1,972 |
| " | " | Koosuh | 87 | 88,219 | 1,013 | 233,943 | 2,689 | 3,540 | 41 | 325,702 | 3,743 |
| Total | | | 2,424 | 3,159,716 | 47,626 | 5,859,474 | 77,577 | 160,297 | 2,013 | 9,179,487 | 127,216 |
| Average | | | 81 | 105,324 | 1,303 | | 2,417 | 5,343 | 66 | | 3,786 |

Table 8. Maintenance Costs of Fuelwood Plantation

(Unit: Won)

| Province | County | Village | Fuel-wood Area (ha) | Patrol and other | | Labor for Weeding, Trmming | | Total | Maintenance Cost/ha |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Total | ha | Total | ha | | |
| Kyonggi | Pyongtak | Dongchon | 48 | 33,700 | 700 | 53,360 | 1,109 | 87,060 | 1,809 |
| " | Yongin | Soowon | 14 | 13,480 | 1,000 | 21,344 | 1,581 | 34,824 | 2,581 |
| " | " | Sankuh | 14 | 26,960 | 1,960 | 42,688 | 3,109 | 69,648 | 5,069 |
| Kangwon | Myungju | Sanpuk | 40 | 20,220 | 510 | 32,016 | 800 | 52,236 | 1,310 |
| " | " | Chotoo | 46 | 47,850 | 1,050 | 75,771 | 1,662 | 123,621 | 2,712 |
| " | Wonsung | Kanhun | 15 | 40,440 | 2,700 | 64,032 | 4,269 | 104,472 | 6,969 |
| " | " | Sooam | 60 | 53,920 | 920 | 85,376 | 1,423 | 139,296 | 2,323 |
| Chungnam | Kongju | Sinhung | 92 | 257,000 | 2,790 | 403,350 | 4,384 | 660,350 | 7,174 |
| " | Kimsan | Daesan | 58 | 156,900 | 2,710 | 242,010 | 4,173 | 398,910 | 6,883 |
| " | " | Kyoshon | 60 | 261,500 | 4,360 | 403,350 | 6,723 | 664,850 | 11,083 |
| Chungpuk | Chungwon | Wontong | 38 | 57,290 | 1,500 | 90,712 | 2,377 | 148,002 | 3,877 |
| " | " | Hunam | 55 | 107,840 | 1,960 | 26,752 | 486 | 134,592 | 2,446 |
| " | Chaechun | Kooryong | 31 | 47,280 | 1,540 | 74,704 | 2,426 | 121,984 | 3,966 |
| " | " | Pohchun | 30 | 26,960 | 900 | 42,688 | 1,418 | 69,648 | 2,318 |
| Chonnam | Whasoon | Daepoh | 37 | 87,620 | 2,380 | 124,800 | 3,382 | 212,420 | 5,762 |
| " | Yongam | Sangyuhl | 164 | 60,660 | 370 | 96,048 | 586 | 156,708 | 956 |
| " | " | Chungryong | 38 | 74,140 | 1,980 | 117,392 | 3,131 | 191,532 | 5,111 |
| Chonpuk | Mooju | Yhulsok | 160 | 149,060 | 930 | 233,943 | 1,460 | 383,003 | 2,390 |
| " | " | Changpak | 126 | 97,660 | 770 | 153,273 | 1,212 | 250,933 | 1,982 |
| " | Yimsil | Suhlchee | 27 | 20,520 | 760 | 32,016 | 1,208 | 52,536 | 1,968 |
| " | " | Kwanchon | 75 | 21,554 | 140 | 16,134 | 215 | 26,594 | 355 |
| " | " | Hoochon | 60 | 320,150 | 5,380 | 506,920 | 8,520 | 827,080 | 13,900 |
| Kyangnam | Chinyang | Daechon | 82 | 101,100 | 1,240 | 160,080 | 1,964 | 261,180 | 3,204 |
| " | " | Daesah | 181 | 134,800 | 740 | 213,440 | 1,178 | 348,240 | 1,918 |
| " | Sonchung | Nahkok | 236 | 128,060 | 540 | 202,768 | 860 | 330,828 | 1,400 |
| " | " | Mohkoh | 230 | 280,880 | 350 | 128,064 | 557 | 208,944 | 907 |
| Kyongpuk | Chilkok | Naksan | 146 | 222,400 | 1,520 | 352,176 | 2,409 | 574,576 | 3,929 |
| " | " | Songsan | 76 | 123,360 | 1,620 | 193,608 | 2,542 | 316,968 | 4,162 |
| " | Sangju | Nungam | 98 | 67,400 | 690 | 106,720 | 1,091 | 174,120 | 1,781 |
| " | " | Koosuh | 87 | 101,100 | 1,160 | 160,080 | 1,838 | 261,180 | 2,998 |
| Total | | | 2,424 | 3,141,504 | 45,140 | 4,455,615 | 68,091 | 7,386,025 | 113,231 |
| Average | | | | | 1,296 | | 1,838 | | 3,047 |

Table 10. Economic Evaluation of Fuelwood Plantation Project/ha (Planted 4,000 Saedling per ha)

(Unit: Won)

| Year | Total Project Costs | | | | Discount Rate | | | Present Value | | | Total Benefits | | | Present Value | | | Cash Flow | Present Value | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Capital Cost | OM Cost | | Total | 12 % | 15 % | 20 % | 12 % | 15 % | 20 % | | | Total | 12 % | 15 % | 20 % | | 12 % | 15 % | 20 % |
| 1977 | 112,216 | 3,047 | - | 115,263 | - | - | - | 115,263 | 115,263 | 115,263 | - | - | - | - | - | - | -115,263 | 115,263 | -115,263 | -115,263 |
| 1978 | - | 〃 | - | 3,047 | 0.893 | 0.870 | 0.833 | 2,720,971 | 2,650,89 | 2,538.151 | - | - | - | - | - | - | -3,047 | -2,720.971 | -2,650.890 | -2,538.151 |
| 1979 | - | 〃 | - | 3,047 | 0.797 | 0.756 | 0.694 | 2,428.459 | 2,303.532 | 2,114.618 | - | - | - | - | - | - | -3,047 | -2,428.459 | -2,303.532 | -2,114.618 |
| 1980 | - | 〃 | - | 3,047 | 0.712 | 0.658 | 0.579 | 2,169.464 | 2,004.926 | 1,764.213 | - | - | - | - | - | - | -3,047 | -2,169.464 | -2,004.926 | -1,764.213 |
| 1981 | - | 1,296 | 3,786 | 5,082 | 0.636 | 0.572 | 0.482 | 3,232.152 | 2,906.904 | 2,449.524 | 5,978 | 24,000 | 29,978 | 19,066.008 | 17,147.416 | 14,449.396 | 24,896 | 15,833,856 | 14,240.512 | 11,999.872 |
| 1982 | - | 〃 | 〃 | 〃 | 0.567 | 0.497 | 0.402 | 2,881.494 | 2,525.754 | 2,042.964 | 11,955 | 〃 | 35,955 | 20,386.485 | 17,869.635 | 14,453.910 | 30,873 | 17,504.991 | 15,343.881 | 12,410,946 |
| 1983 | - | 〃 | 〃 | 〃 | 0.507 | 0.432 | 0.335 | 2,576,574 | 2,195.424 | 1,702.47 | 23,913 | 〃 | 47,913 | 24,291.891 | 20,698.416 | 16,050.855 | 42,831 | 21,715.317 | 18,502.992 | 14,348.385 |
| 1984 | - | 〃 | 〃 | 〃 | 0.452 | 0.376 | 0.279 | 2,297.064 | 1,910.832 | 1,417.878 | 47,826 | 〃 | 71,826 | 32,465.352 | 27,006.576 | 20,039.454 | 66,744 | 30,168,288 | 25,095.744 | 18,621,576 |
| 1985 | - | 〃 | 〃 | 〃 | 0.404 | 0.327 | 0.233 | 2,053.128 | 1,661.814 | 1,184.106 | 59,780 | 〃 | 83,780 | 33,847.120 | 27,396.060 | 19,520.740 | 78,698 | 31,793.992 | 25,734.246 | 18,336.634 |
| 1986 | - | 〃 | 〃 | 〃 | 0.361 | 0.284 | 0.194 | 1,834,602 | 1,443.238 | 935.908 | 〃 | 〃 | 〃 | 30.244,580 | 23,793.520 | 16,253.320 | 〃 | 28,409.978 | 22,350.732 | 15,267.412 |
| 1987 | - | 〃 | 〃 | 〃 | 0.322 | 0.247 | 0.162 | 1,636.404 | 1,255.254 | 823.284 | 〃 | 〃 | 〃 | 26,977.160 | 20,693.660 | 13,572.360 | 〃 | 25,340.756 | 19,438.406 | 12,749.076 |
| 1988 | - | 〃 | 〃 | 〃 | 0.287 | 0.215 | 0.135 | 1,458.534 | 1,092.63 | 686.07 | 〃 | 〃 | 〃 | 24,044.860 | 18,012.700 | 11,310.300 | 〃 | 22,566.326 | 16,920.070 | 10,624.230 |
| 1989 | - | 〃 | 〃 | 〃 | 0.257 | 0.187 | 0.112 | 1,306.074 | 950.334 | 569.184 | 〃 | 〃 | 〃 | 21,531.460 | 15,666.860 | 9,383.360 | 〃 | 20,225.386 | 14,716.526 | 8,814.176 |
| 1990 | - | 〃 | 〃 | 〃 | 0.229 | 0.163 | 0.093 | 1,163.778 | 828.366 | 472.626 | 〃 | 〃 | 〃 | 19,185.620 | 13,656.140 | 7,791.540 | 〃 | 18,021.842 | 12,827.774 | 7,318.914 |
| 1991 | - | 〃 | 〃 | 〃 | 0.205 | 0.141 | 0.078 | 1,041.81 | 716.562 | 396.396 | 〃 | 〃 | 〃 | 17,174.900 | 11,812.980 | 6,534.840 | 〃 | 16,133.090 | 11,096.418 | 6,138.444 |
| 1992 | - | 〃 | 〃 | 〃 | 0.183 | 0.123 | 0.065 | 930.006 | 625.086 | 330.33 | 〃 | 〃 | 〃 | 15,331.740 | 10,304.940 | 5,445.700 | 〃 | 14,401.734 | 9,679.854 | 5,115.370 |
| 1993 | - | 〃 | 〃 | 〃 | 0.163 | 0.107 | 0.054 | 828.366 | 453.774 | 274.428 | 〃 | 〃 | 〃 | 13,656.140 | 8,964.460 | 4,524.120 | 〃 | 12,827.774 | 8,420.686 | 4,249.692 |
| 1994 | - | 〃 | 〃 | 〃 | 0.146 | 0.093 | 0.045 | 741.972 | 472.626 | 228.69 | 〃 | 〃 | 〃 | 12,231.880 | 7,791.540 | 3,770.100 | 〃 | 11,489.908 | 7,318.914 | 3,541.410 |
| 1995 | - | 〃 | 〃 | 〃 | 0.130 | 0.081 | 0.038 | 660.66 | 411.642 | 193.116 | 〃 | 〃 | 〃 | 10,891.400 | 6,786.180 | 3,183.640 | 〃 | 10,230.740 | 6,374.538 | 2,990.524 |
| 1996 | - | 〃 | 〃 | 〃 | 0.116 | 0.070 | 0.031 | 589.512 | 355.74 | 157.542 | 〃 | 〃 | 〃 | 9,718.480 | 5,864.600 | 2,597.180 | 〃 | 9,128.968 | 5,508.860 | 2,439,638 |
| 1997 | - | 〃 | 〃 | 〃 | 0.104 | 0.061 | 0.026 | 528,528 | 310.002 | 132.132 | 〃 | 〃 | 〃 | 8,713.120 | 5,110.580 | 2,178.280 | 〃 | 8,184.592 | 4,800.578 | 2,046.148 |
| 計 | 112,216 | 34,220 | 64,363 | 210,798 | | | | 148,342.552 | 142,698.38 | 135,726.63 | | 408,000 | 1,274,812 | 339,749.190 | 258,576.260 | 171,059.090 | 1,064,014 | 191,415.600 | 116,147.830 | 35,332.440 |

B/C Ratio ( 12 % ) $= \frac{339,749}{148,342} = 2.29$ NWP ( 12 % ) $= 339,749 - 148,342 = 191,407$ (원)

〃 ( 15 % ) $= \frac{258,576}{142,698} = 1.81$ 〃 ( 15 % ) $= 258,576 - 142,698 = 115,878$ (원)

〃 ( 20 % ) $= \frac{171,059}{135,726} = 1.26$ 〃 ( 20 % ) $= 171,059 - 135,726 = 35,333$ (원)

IRR $= 15 + 5 \left(\frac{116,147}{116,147 + 35,332}\right) = 15 + 5 \ (0.766)$

$= 18.83$ %

Table 11. Economic Evaluation of Fuelwood Plantation Project/ha (Planted 4,000 seedling per ha)

(Unit: Won)

| Year | Total Project Cost | | | | Discount Rate | | | Present Value | | | Total Benefits | | | Present Value | | | Cash Flow | Present Value | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Total | 12% | 15% | 20% | 12% | 15% | 20% | | | Total | 12% | 15% | 20% | | 12% | 15% | 20% |
| 1977 | 112,216 | 3,047 | - | 115,263 | - | - | - | 115,263 | 115,263 | 115,263 | - | - | - | - | - | - | -115,263 | -115,263 | -115,263 | -115,263 |
| 1978 | - | 〃 | - | 3,047 | 0.893 | 0.870 | 0.833 | 2,720.971 | 2,650.89 | 2,538.151 | - | - | - | - | - | - | - 3,047 | - 2,720.971 | - 2,650.890 | - 2,538.151 |
| 1979 | - | 〃 | - | 3,047 | 0.797 | 0.756 | 0.694 | 2,428.459 | 2,303.532 | 2,114.618 | - | - | - | - | - | - | - 3,047 | - 2,428.459 | - 2,303.532 | - 2,114.618 |
| 1980 | - | 〃 | - | 3,047 | 0.712 | 0.658 | 0.579 | 2,169.464 | 2,004.926 | 1,764.213 | - | - | - | - | - | - | - 3,047 | - 2,169.646 | - 2,004.926 | - 1,764.213 |
| 1981 | - | 1,296 | 3,786 | 5,082 | 0.636 | 0.572 | 0.482 | 3,232.152 | 2,906.904 | 2,449.524 | 4,166 | 24,000 | 28,166 | 17,913.576 | 16,110.952 | 13,576.012 | 23,084 | 14,681.424 | 13,204.048 | 11,126.488 |
| 1982 | - | 〃 | 〃 | 〃 | 0.567 | 0.497 | 0.402 | 2,881.494 | 2,525.754 | 2,042.964 | 8,333 | 〃 | 32,333 | 18,332.811 | 16,069.501 | 12,997.866 | 27,251 | 15,451.317 | 13,543.747 | 10,952.902 |
| 1983 | - | 〃 | 〃 | 〃 | 0.507 | 0.432 | 0.335 | 2,576.574 | 2,195.424 | 1,702.47 | 16,666 | 〃 | 40,666 | 20,617.662 | 17,567.712 | 13,623.110 | 35,584 | 18,041.088 | 15,372.288 | 11,920.640 |
| 1984 | - | 〃 | 〃 | 〃 | 0.452 | 0.376 | 0.279 | 2,297.064 | 1,910.832 | 1,417.878 | 33,333 | 〃 | 57,333 | 25,914.516 | 21,557.208 | 15,995.907 | 52,251 | 23,617.452 | 19,646.376 | 14,578.029 |
| 1985 | - | 〃 | 〃 | 〃 | 0.404 | 0.327 | 0.233 | 2,053.128 | 1,661.814 | 1,184.106 | 41,166 | 〃 | 65,166 | 26,327.064 | 21,309.282 | 15,183.678 | 60,084 | 24,273.936 | 19,647,468 | 13,999.572 |
| 1986 | - | 〃 | 〃 | 〃 | 0.361 | 0.284 | 0.194 | 1,834.602 | 1,443.288 | 985.908 | 〃 | 〃 | 〃 | 23,524.926 | 18,507.144 | 12,642.204 | 〃 | 21,690.324 | 17,063.856 | 11,656.296 |
| 1987 | - | 〃 | 〃 | 〃 | 0.322 | 0.247 | 0.162 | 1,636.404 | 1,255.254 | 823.284 | 〃 | 〃 | 〃 | 20,983.452 | 16,096.002 | 10,556.892 | 〃 | 19,347.048 | 14,840.748 | 9,733.608 |
| 1988 | - | 〃 | 〃 | 〃 | 0.287 | 0.215 | 0.135 | 1,458.534 | 1,092.63 | 686.07 | 〃 | 〃 | 〃 | 18,702.642 | 14,010.690 | 8,797.410 | 〃 | 17,244.108 | 12,918.060 | 8,111.340 |
| 1989 | - | 〃 | 〃 | 〃 | 0.257 | 0.187 | 0.112 | 1,306.074 | 950.334 | 569.184 | 〃 | 〃 | 〃 | 16,747.662 | 12,186 042 | 7,298.592 | 〃 | 15,441.588 | 11,235.708 | 6,729.408 |
| 1990 | - | 〃 | 〃 | 〃 | 0.229 | 0.163 | 0.093 | 1,163.778 | 828.366 | 472.626 | 〃 | 〃 | 〃 | 14,923.014 | 10,622.058 | 6,060.438 | 〃 | 13,759.236 | 9,793.692 | 5,587.812 |
| 1991 | - | 〃 | 〃 | 〃 | 0.205 | 0.141 | 0.078 | 1,041.81 | 716.562 | 396.396 | 〃 | 〃 | 〃 | 13,359.030 | 9,188.406 | 5,082.948 | 〃 | 12,317.220 | 8,471.844 | 4,686.552 |
| 1992 | - | 〃 | 〃 | 〃 | 0.183 | 0.123 | 0.065 | 930.006 | 625.086 | 330.33 | 〃 | 〃 | 〃 | 11,925.378 | 8,015.418 | 4,235.790 | 〃 | 10,995.372 | 7,390.332 | 3,905.460 |
| 1993 | - | 〃 | 〃 | 〃 | 0.163 | 0.107 | 0.054 | 828.366 | 453.774 | 274.428 | 〃 | 〃 | 〃 | 10,622.058 | 6,972.762 | 3,518.964 | 〃 | 9,793.692 | 6,428.988 | 3,244.536 |
| 1994 | - | 〃 | 〃 | 〃 | 0.146 | 0.093 | 0.045 | 741.972 | 472.626 | 228.69 | 〃 | 〃 | 〃 | 9,514.236 | 6,060.438 | 2,932.470 | 〃 | 8,772.264 | 5,587.812 | 2,703.780 |
| 1995 | - | 〃 | 〃 | 〃 | 0.130 | 0.081 | 0.038 | 660.66 | 411.642 | 193.116 | 〃 | 〃 | 〃 | 8,471.580 | 5,278.446 | 2,476.308 | 〃 | 7,810.920 | 4,866.804 | 2,281.192 |
| 1996 | - | 〃 | 〃 | 〃 | 0.116 | 0.070 | 0.031 | 589.512 | 355.74 | 157.542 | 〃 | 〃 | 〃 | 7,559.256 | 4,561.620 | 2,020.146 | 〃 | 6,969.744 | 4,205.880 | 1,862.604 |
| 1997 | - | 〃 | 〃 | 〃 | 0.104 | 0.061 | 0.026 | 528.528 | 310.002 | 132.132 | 〃 | 〃 | 〃 | 6,777.264 | 3,975.126 | 1,694.316 | 〃 | 6,248.736 | 3,665.124 | 1,562.184 |
| 計 | 112,216 | 34,220 | 64,363 | 210,798 | | | | 148,342.552 | 142,698.38 | 135,726.63 | 597,656 | 408,000 | 1,005,656 | 272,216.070 | 208,088.790 | 138,693.000 | 794,858 | 123,873.540 | 65,660.400 | 2,962.410 |

B/C Ratio(12%) $= \frac{272,216}{148,342} = 1.84$ NWP (12%) = 272,216 − 148,342 = 123,874(원)

〃 (15%) $= \frac{208,088}{142,698} = 1.46$ 〃 (15%) = 208,088 − 142,698 = 65,390(원)

〃 (20%) $= \frac{138,693}{135,726} = 1.02$ 〃 (20%) = 138,693 − 135,726 = 2,967(원)

$IRR = 15 + 5\left(\frac{65,660}{65,660 + 2,962}\right) = 15 + 5\ (0.956)$

$= 19.78\%$