

필리핀 벤규트의 고지대 뽕밭현황 및 개선방안

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The State of Mulberry Cultivation and It's Development in
High Land of Benguet Province, Philippines

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Abstract

The Studies were conducted to provide the state of mulberry cultivation and it's development in Banguet province (high land) of Philippines. Philippines initiated the sericulture industry with the technical asistance of Japan in 1974 and established mulberry field and sericultural facilities with technical asistance of Korea in 1990 and 1995.

The required average of 100 to 150^{mm} per month is not available during the dry season from December to March.

Therefore mulching with grass which is available abundantly in the Philippines should be established to conserve moisture, to control soil erosion, surface ran-off and also to increase the humus content in the soil. In chemical properties of mulberry field, the pH value of soil is 4.7, organic matter 1.6%, and available phosphorus 6ppm.

Therefore, all fields should do liming and be applied compost. To improve leaf yield for mulberry planted under partial shade area of pine trees, more pruning of pine tree should be done for good sunshining of mulberry, more liming and compost should be applied to improve acidic soil.

To control the leaf roller, DDVP and KAFIL are able to be used. When spraying insecticides to control mulberry insect pests, care should be taken to consider the residual effects of chemicals on the leaf. Leaf should be fed to silkworms only after the leaves are free of any residual effects.

Key words ; Philippines, Mulberry, Pine, Phosphorus

I . Introduction

The Philippines has been in pursuit of the development of sericulture technology and expansion of farm households of mulberry cultivation from the year 1974 when the industry was given proper attention with the implementation of a package of sericulture development activities. ²⁾

Most of mulberry field in Benguet province (high land) had been planted under pine tree on hill slopes with 30 to 40% without adopting proper soil conservation practices like terracing and provision of contour drains on the inner side of each bench terrace.

The total area under mulberry in Benguet province currently is 34ha, but effective area is only 19ha. This is only 56% of the total area planted in high land. In philippines there are 23 varieties of mulberry. ³⁾ Out of these varieties Batac A accounts for 100% in the distribution of mulberry varieties in all Sericulture Communities of Philippines. Average temperature in high land ranges from 13 to 23°C and annual average temperature of 19.4°C. A monthly average precipitation ranges from 100 to 900^{mm} druing April to November and from 10 to 30^{mm} during dry season.

In this regard, mulberry in Benguet province can enjoy the favourable conditions in nature. Despite of favourable nature, the productivity of mulberry field is very low at the moment

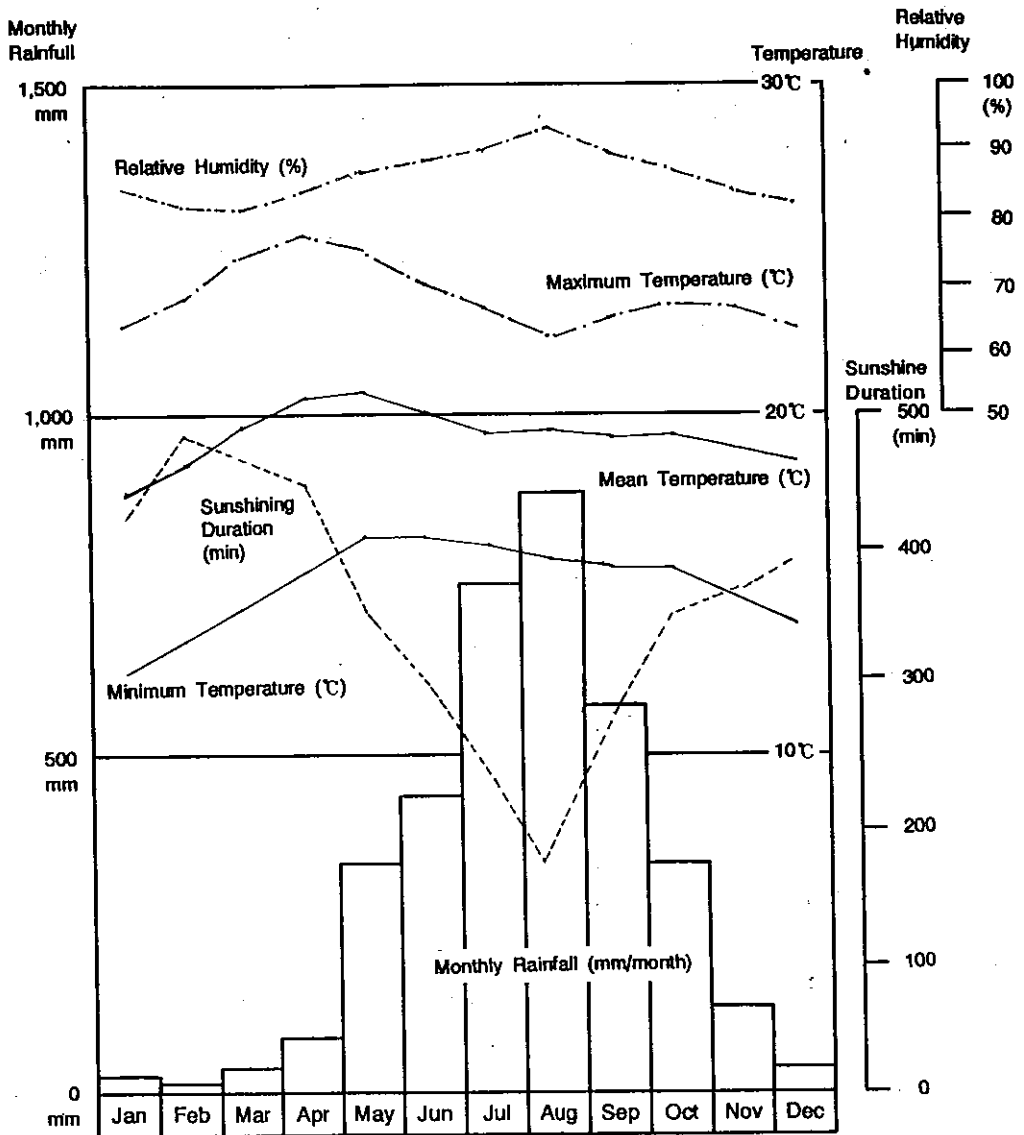
because the technology of mulberry cultivation is still primitive.

Accordingly, some recommendations for high productivity of mulberry field could be provided.

II . State of mulberry cultivation

1. Climatic conditions

The climatic conditions which have a bearing on sericulture activities are related to precipitation, temperature, sunshine and humidity. The monthly average precipitation, temperature, sunshine and humidity in Baguio are shown in Figure 1. From this it may be seen that temperature, sunshine and humidity are not limiting factors for growing of mulberry. Precipitation might be considered as a limiting factor affecting mulberry yield. Precipitation should be considered both in terms of the annual total and its distribution throughout the year. A monthly average precipitation of 100 to 150^{mm} is desirable during the growing season of mulberry. Accordingly, it is seen that the three Sericulture Communities and Municipal Sericultural Center Wangal fall below the desirable monthly minimum range from December to March during the dry season.



Source : Baguio PAGASA Station (Averaged for 1949 - 1987)

Fig. 1. Monthly meteorological characteristics in the Prihct area

Optimum temperature for growth of mulberry is 25°C. In this regard, mulberry in Philippines cannot enjoy the most favourable condition in nature because average temperature ranges from 13 to 23°C and annual average temperature of 19.4°C⁵⁾, but this temperature may not be a limiting factor for growing of mulberry.

2. Mulberry varieties

In the Philippines, there are 23 varieties of mulberry planted at Sericulture Research Development Institute farm. Out of these varieties,

Batac A accounts for 100% in the distribution of mulberry varieties in all Sericulture Communities of high lands. To increase mulberry productivity, variety should be the first consideration followed by natural conditions, and the techniques of mulberry cultivation. In this regard, among 23 existing varieties in the Philippines, Batac A gives the highest yield and suitable quality of leaf. Batac B variety comes next and the other varieties can be considered suitable for maintaining a plasm bank for the purpose of breeding new varieties.

Table 1. Characteristics of mulberry varieties at PTRI-SI, Itrinidad, Benguet

	Variety	Batac A	Batac B	Batac D	Batac F	King
	Species	M.Alba	M.Alba	M.Alba	M.Alba	
B r a n c h	Type	Erect	Erect	Erect	Erect	Erect
	Color	Greenish	Greenish	Greenish	Greenish	Greenish
		Brown	Brown	Brown	Brown	Brown
	Number per tree(cm)	16	11	12	18	7
	Mean length(cm)	108	108	105	100	111
	Total length per tree(cm)	1,720	1,188	1,260	1,880	777
	Internode(cm)	6.0	4.6	6.6	5.0	6.0
L e a f	Shape	Round	Round	Round	Elliptic Round	Round
	Number per tree	288	258	191	360	130
	Length(cm)	18.50	16.50	17.00	17.00	16.50

According to Table 1, Batac A has several merits such as weight of leaves per tree, number of branch per tree, total length per tree, and drought resistance.

3. Planting distance

As a result of conducted for many years in regard to the best planting distance to obtain maximum leaf yields, it has been concluded that maintenance of high plant density per unit area results in increased leaf yield.

Accordingly, the present planting distance has been accepted as suitable for all Sericulture Communities including MSC Wangal. The planting distance has been $(1.5 \times 0.5)m \times 0.5m$. However, the planting distance of $1.0m \times 0.3m$ may be considered as the suitable planting distance to be preferred rather than the planting distance $(1.5 \times 0.5)m \times 0.5m$. This alternating row with wider inter-ridge distance and narrow inter-ridge spacing has not been convenient for mulberry cultivation. There has been a greater incidence of weeds with wider inter-ridge distance than in fields with narrow inter-ridge spacing.

This has been particularly observed after pruning.⁵⁾

4. Location and sites for mulberry cultivation

The three Sericulture Communities : Longlong, Sablan and Sabkil, and MSC Wangal mulberry had been planted on hill slopes with gradient of 30 to 40% without adopting proper soil conservation practices like terracing and provision of contour drains on the inner side of each bench terrace and sod culture to protect the slopes from heavy

erosion during the rainy season. So during heavy rains, the top soils of mulberry field have been subjected to surface run-off causing heavy soil erosion, resulting in loss of essential soil nutrients especially calcium, potassium and magnesium which has increased soil acidity and poor growth of mulberry.⁷⁾

5. Soil of mulberry field

It has been observed that the location selected for establishing mulberry fields for the three Sericulture Communities : Longlong, Sablan and Sabkil as well as MSC Wangal have been on sloping and undulating land on hillsides. Physical and chemical properties would not be conducive to good mulberry growth under these circumstances.

In this connection, the soil of MSC Wangal as well as the three Sericulture Communities were analyzed by the KOICA Consultant 1996. According to Table 2, in chemical properties, the pH value of soil ranges from 4.3 to 4.9, on the average 4.7. This pH value is considered too low when compared with the optimum pH value of 6.8.

Table 2. Soil analysis in highland.

Field Identity	pH	O.M(%)	Available Phosphorus(ppm)	Potassium(ppm)
MSC Wangal	4.7	1.0	5	100
Sablan	4.7	2.0	3	172
Longlong	4.6	1.5	7	219
Sabkil	4.7	1.7	6	143
Mean	1.6	1.6	5.2	158

The content of organic matter in the soil ranges from 1.0 to 2.5%, on the average 1.7%. This amount of organic matter is also considered low when compared with the optimum of 3%. But very little organic matter has been applied to the mulberry field at Sabkil and Longlong since it was established, however, 1.5 to 1.7% of organic matter is surprisingly high.

The content of available phosphorus in the soil range from 3 to 9ppm. This content of available phosphorus is far below when compared with the optimum content of 200ppm. Potassium is considered adequate for mulberry growth.⁴⁾

6. Training, pruning and harvesting

In the MSC Wangal and in the three Sericulture Communities, the present training system of mulberry is semilow cut where pruning is at a height of 30 to 40cm from the ground level.

In the three Sericulture Communities excluding MSC Wangal, it was observed the extension workers lacked the basic principles of pruning. The pruning done was the haphazard chopping of branches at a predetermined height. The result of this was the disproportionate damage caused to the bushes physiologically.

Before every pruning, the leaves are picked individually from the trees.

When individual leaves are picked from the trees, the tender leaves are fed to the young silkworm (1st to 2nd instar) and more mature leaves are fed to the

middle silkworms (3rd to 4th instar). Branch cutting with leaves is done and fed to 5th instar silkworms. When branches are cut, they are cut at 30cm height from the fist for the convenience of the workers with the result that the remaining branches left after cutting has to be pruned once again. This increased costs and this practice should be stopped. When harvesting branches for branch feeding, the entire branch at the correct pruning level should be cut without leaving another portion of branch to be removed is another unnecessary pruning operation.

7. Application of fertilizer

At present, chemical fertilizer is applied in the ratio of 46kgs-nitrogen, 18 kgs-phosphate, 18kgs-potassium per hectare. These amounts are not sufficient as the number of prunings per year is three or four times. In comparison with the amount of fertilizer in temperate countries such as Korea and Japan, where N-300kgs, P205-120kgs, K20-150kgs per hectare is applied with only one or two prunings a year.⁶⁾

Very little organic matter has been applied to the three Sericulture Communities except MSC Wangal where organic matter has been applied only 7,000kgs of compost per hectare. It is surprising that application of organic matter has been neglected in all communities as well as MSC Wangal where this is available in plenty at no cost. This reflects on the management of

highland sericulture.

The present low yield of mulberry leaves is mainly due to the poor soil conditions in the field owing to lack of organic matter and continuous application of chemical fertilizer. In addition to the above, the lack of chemical fertilizer also provides low yields of leaves. There is one more constraint to the decrease of leaf yield that is the low pH value, phosphorus and calcium content in the soil.

8. Maintenance of mulberry field

It has been observed that no standard practice has been followed in the Philippines in the following aspects of mulberry cultivation and maintenance of sloping fields: First planting, soil improvement, ploughing, weed control, water control,

mulching, disease and pest control.

It is regrettable to note that some of these practices are not carried out at all. There are signs of heavy erosion in the field of the farms at Longlong, Sablan, and MSC Wangal. This is mainly due to the failure to adopt proper soil washed away especially in fields on slopes of about 30 to 40 gradient. In most instances, no contour drains have been possible at the bottom edge of each bench terrace and no sodding has been on the slopes between plant rows.

As seen in Table 3, the former Chief Technical Advisor of FAO-UNDP Project reported in 1994 to have established 34 has of cultivated mulberry fields but 56% is only considered effective where mulberry harvesting is being done. The balance of 44% of fields has been neglected.^{2,3)}

Table 3. Project(Phase I) Accomplishment and present areacultivated(ha)

Site	Selected	Place	Area of field accomplished (A)	Present area cultivated(B)	(B/A) ×100
	M.S.C.	Wangal & Puguis La Trinidad	5.0	5.0	
High land	S.C	Sablan Benguet	8.5	5.0	
		Sabkil, Ambuklao	9.60	4.0	
		Itogon, Benguet			
		Longlong La Trinidad	10.75	5.0	
		Total	33.85	19.0	56%

To increase cocoon production from existing mulberry fields, work should be initiated both to increase productivity per unit area and to extend the effective area of the fields simultaneously.

Most of mulberry are under the shade of pine tree. Mulberry is a pro-lime (Ca²⁺) plant and pine is a pro-acid plant. Accordingly how they are compatible in the same soil and how they are to co-exist

each other? Actually soil pH was 4.7 in Sabkil, 4.6 in Longlong, 4.5 in Benguet state university field planted under partial shade of pine. Soil pH 4.5 to 4.7 are quite suitable conditions for growing of pine while that is too bad conditions for

mulberry growth. The labour costs involved in maintenance of mulberry fields in the Philippines are very high compared to costs in Korea. Here it is 4 times higher, action must be taken to reduce labour inputs. (See Table 4)

Table 4. Labour required for management of farm in MSC wangal, La Trinidad (ha/yr)

WORK	No. of labour required			
	Philippines	Ratio(%)	Korea	Ratio(%)
Weeding	104	30	40	47
Pruning	90	26	18	21
Fertilizing	110	32	18	21
Ploughing	-	-	4	5
Control of Disease and insect Pests	45	12	5	6
Total	349	100	85	100

The high labour cost is due to that the field operations are not mechanized and fields are cultivated by hands. But more important one is the distributing ratio by the work that weeding generally account for about 50% of total labour cost required.⁶⁾

At present only two times weeding is operated per year. It has therefore been observed that the same length of mulberry stems and weeds have been growing in the fields because timely weed control has been lost.

The most opportune control of the weeds is just timely when weeds are at an early stage. If it is lost, weeding cost may be required almost two times. The present low yield of mulberry leaves is due to the poor weeding in the field.

9. Disease and insect pests of mulberry

No proper study has been made in the Philippines on the incidence, identification and control of disease and insect pests. No concentrated effort has therefore been attempted on effective control.

Of the two diseases identified, bacterial blight appears to cause slightest damage in the three Sericulture Communities as well as MSC Wangal. Rust disease is now a very common sight in the Philippines in all farms to see heavy infection of this mulberry disease, particularly during the rainy season. No action appears to have been taken to counter the effect of this disease in reducing mulberry productivity, especially mulberry quality.

Of the two insect pests identified, snails appear to cause the slightest

damage. But leaf roller is very common in the Philippines in all community fields and MSC Wangal to see heavy damage of this insect pest. So far, no chemical and ecological control method have not been taken to counter the effect of this disease.

10. Low phosphorus content

The three Sericulture Communities as well as MSC Wangal fields have too low phosphorous content and too low pH value. Too low phosphorus content has probably been caused by too low pH value (pH 4.5) owing to fixation with Al and Fe. The leaves produced in the soil of low phosphorus have a poor balance of amino acid. Arginine content is 200times higher than that in normal leaves.⁴⁾ This abnormality causes larval stage to extend several days longer and weight of larva to be gained is lower than normal.

11. Improvement of mulberry yield for plants planted under partial shade

As all agriculture and forestry scientist know, mulberry is a pro-lime plant and pine tree is a pro-acid plant.¹⁾ Actually

soil pH was 4.7 in Sabkil, 4.6 in Longlong, 4.5 in BSU field planted under partial shade of pine tree. Soil pH 4.5 to 4.7 are quite suitable conditions for growing of pine tree. But this is too bad conditions for growing of mulberry. The optimum pH for mulberry is 6.8.

Therefore, the project also decided to set up the trials on the improvement of mulberry yield for plants planted under partial shade which has two treatments : the sunshining field and the shading field. Survey items are leaf yield, leaf analysis and leaf feeding on silkworms.

The project conducted an experiment of mulberry yield under partial shade and leaf feeding on silkworms (See Table 5). According to Table 5, it will be seen that the sunshining field gives more mulberry leaf and more cocoon production than the shading field. The sunshining field generally gives heavier single cocoon weight, heavier single pupal weight and less number of silkworms infected than the shading field. But the shading field gives higher cocoon shell ratio than the sunshining field.

Table 5. Leaf yeild and cocoon production between sunshining and shading fields

Treatment	Leaf yield per 10trees (index)	Laval duration Total (days)	Disease infestation	Cocooning (%) sound pupa	Ave. single cocoon Wt. (grams)	Cocoon shell ratio (%)	Ave. single pupal Wt. (grams)	Total prod'n (grams)
Flat BSU Sunshining	3,890gms (100)	24.9	1.1	99.29	1.63	19.7	1.31	2,115
Shaded BSU Shading	2,325gms (60)	24.9	1.1	99.16	1.59	21.17	1.26	1,945

BSU : Benguet State University

This conclusion is however premature as the observation has been made recording only one silkworm rearing test. For a definite conclusion, it will be necessary to at least continue the experiment for another 2 years to cover dry and rainy seasons.

The project also surveyed light intensity. During the clean day it was 26,000lux in the sunshining field, 5,000lux in the shading field at 10:20 a.m.. During the cloudy day, it was 4,000lux in the sunshining field, 1,700lux in the shading field at 4:00 p.m..⁶⁾ This light intensity has affected leaf yield and leaf quality produced in the experiment field, causing lower leaf yield and lower cocoon production in the shading field than sunshining field.

III. Recommendations

1. Climatic conditions

The Philippines enjoys ample precipitation, temperature, sunshine and humidity and these factors do not limit the growing of mulberry successfully. The annual precipitation is quite suitable but the question is the distribution of this annual total. It is found that precipitation is not evenly distributed throughout the year. The required average of 100 to 150mm per month is not available to the three Sericulture Communities as well as in MSC Wangal during the dry season from December to March.

The three Sericulture Communities have steep slope mulberry field and there are no water resource so that irrigation network is not able to construct with low cost. But the irrigation facilities at MSC Wangal should be developed and permanent irrigation network should be constructed to enable a regular irrigation cycle.

At present, the three Sericulture Communities as well as MSC Wangal farms have managed to overcome this obstacle by adopting dry farming techniques like mulching and control a grass cover to prevent excessive surface drainage and conserve moisture in the soil. A grass cover not only conserves moisture but also controls soil erosion, surface run-off and also increases the humus content of the soil. This is particularly required in fields on sloping hill sides which are at gradient over 15%. A sod culture helps in weed control saving in maintenance costs.

2. Mulberry varieties

Up to this date, the variety considered best in the Philippines for quality and quantity of leaf is Batac A which has been adapted to the country conditions. Reference to Table 1, it will be possible to observe that Batac A has its merits but it is doubtful whether it would be ideally suitable for high yielding due to the long internode distance and nonideal type of leaf.

The immediate and urgent need therefore, is to survey the different

characteristics of imported varieties such as Kanva 2 and S 54. Once new varieties are imported and propagated in the Philippines, it is very necessary to collect certain data relating to these varieties by carrying out certain operations and experiments. SRDI-DMMMSU should also maintain a plasm bank for research purposes at the lowland and the highland by establishing a stock plantation with all varieties both foreign and local suitable isolated in separate plots. This will enable research workers to study the different characteristics for future breeding work.

3. Planting distance

The density of planting has a direct relationship with the yield of mulberry leaves and the proper spacing of plants is therefore very important. Generally, to obtain a high yield, it is important to maximize number of branches by wider spacing of trees. A suitable density has

to depend on the soil, climate, pruning method, maintained method and use mechanized instruments. The spacing and density shown in Table 6 is recommended for the Philippines conditions. Within the ranges indicated in Table 6, a choice has to be made on the basis of other factors. For example, where the soil conditions are poor, the density has to be increased in order to obtain equivalent yields of leaves per area and supplemented by regular irrigation. Where the field operations are mechanized, then the following standards for inter-ridge distance are to be used: for example, a two-wheeled tractor will require 1.8m of inter-ridge distance and a small-sized rotary machinery will require 1.5m at least. For hand weeding, the present planting distance of 1.0m×0.3m or 0.4m is quite reasonable for easy maintenance of fields.

Table 6. Proposed standard density for mulberry plantation

Type of Pruning	Inter-ridge distance(m)	Inter-tree distance(m)	No. of trees (ha)	Remarks
30-40cm height	1.8	0.3	18,520	Two-wheeled Tractor
	1.5	0.3	22,220	Small-sized rotary
	1.0	0.3-0.4	33,330	Handweeding

4. Pruning and harvesting

The very urgent and immediate need is to educate the workers in the correct art of clean pruning. It is only after

perfecting the art of pruning that questions like height of pruning, number of pruning, etc. can be looked into. The recommended height of pruning at 30 to

40cm has been proven both theoretically and practically to give an increase in yield of 50% over present yields throughout the tropical countries. Bottom pruning causes stress and is against mulberry physiology.

The inter-rearing system recommended by the former Silkworm Rearing Consultant and Moriculture Consultant with 3 months to 4 months pruning cycle is expected to give maximum yields and make available suitable leaves for young age and adult age silkworms during the 3 to 4 months period. This is presently being practiced. It can be agreed on condition that the pruning height should be at 30 to 40cms and heavier doses of fertilizer should be applied. Irrigation should be resorted to during the dry seasons.

The present practice of harvesting is by picking individual leaves for feeding the young silkworms. Branch harvesting is resorted to when feeding adult worms. During branch harvesting, the branches are cut at a height of 30cms or more above fist level. Thereafter, these bushes are pruned to fist level on a later date. This should be stopped as quite an amount of plant nutrition is lost by this practice. The bush continues to absorb nutrition from the soil after the branch harvesting and activates the buds left on the stems. This is an absolute waste of plant nutrition. The harvesting of branches should be carried out simultaneously with the pruning and thereby combine both these operations to

one operation. In this way, waste of valuable plant nutrition can be saved to give higher yield of leaves. If both these operation of harvesting and pruning is not possible, the bushes remained are not pruned to the fist level on a later date particularly during the rainy season because the bushes remained give more leaves than that pruned to the fist level on later date.

The project conducted a pruning experiment with Batac A variety at the MSC Wangal. According to this experiment, the high-cut pruning of 30cms above the fist level has grown 2.60cms of shoot per day but bottom pruning grown 2.32cms of shoot per day.⁷⁾

5. Application of fertilizer

The physical conditions of the soil with respect to all Communities as well as MSC Wangal are not conducive to mulberry cultivation. Most of soil texture are clay to heavy clay which is not suitable for the growth of mulberry.

The chemical conditions of the soil in all farms are not suitable for the growth of mulberry. All the above fields need heavy doses of organic matter as much as 15 tons per hectare. Liming should be done according to Table 7.

The present application amount of fertilizer is N-46kgs:P205-18kgs:K20-18 kgs per hectare but this amount is not sufficient considering the number of pruning.

Table 7. Soil pH and lime application(kgs/ha)

Depth Applied pH	10 cm Depth	20 cm Depth	30 cm Depth
4.0	1,000	2,000	3,000
4.5	500 - 800	1,100 - 1,700	1,600 - 2,100
5.0	300 - 600	600 - 1,100	1,000 - 1,600
5.5	200 - 300	400 - 600	700 - 1,000
6.0	100 - 250	250 - 400	300 - 700
6.5	a little	a little	a little

The following recommendations should be applied for the fields subject to 2 or 3 prunings per year for 800 to 1,000kgs of cocoon production per hectare: N:250 to 300kgs, P205:120kgs, K20:120kgs, Compost:15tons.

If possible, the above should be supplemented with an application of 15 tons of organic matter at least once in two years failing once a year.

The present practice of spot application of fertilizer is commonly followed in all Sericulture Communities. This method is suitable for young mulberry trees and mulberry planted on sloping land like Longlong, Sablan and Sabkil and some partial field in MSC Wangal to economize on the use of fertilizer. In the case of flat field, broadcasting of fertilizer is advocated. This enables an even distribution to enable all parts of the branch to absorb the fertilizer. This practice should enable the harvesting of more leaf per unit area than obtainable today.

6. Maintenance of mulberry field

As mentioned earlier the MSC Wangal and the three Sericulture Communities farms do not follow regular and systematic routine in the maintenance and upkeep of mulberry fields. There is no single method followed in planting, soil improvement, ploughing, weeding, mulching, control of disease and insect pests in the Philippines.

In order to meet this need, the following recommendations should be carried out in all farms.

For planting, ridge should be as far as possible on contour where land is undulating. The direction of plants on the inter-ridge should be in the direction of the wind. The depth of planting trench should be 40cms wide and 40cms deep. During excavation of the trench, the top soil and sub soil should be dug out and heaped up separately. The present practice of digging out the trench and putting soil in one heap should be stopped. At least 15tons of organic matter and 2tons of lime along with 100kgs of phosphorus should be applied per hectare before actual planting of

saplings is carried out as basic fertilizer. Shovel should be used to take out saplings from the nurseries to ensure saplings with good root systems. All saplings should be planted at a depth of 10cms.

For improvement and condition of soils, the following operations are recommended: When supplying organic matter to the soil, this should be placed at the center of the inter-ridge. It should then be covered with soil. When liming the soil, the lime should not be mixed with organic matter.

For ploughing and weeding, the following operations are recommended: Where the inter-ridge space is 1.5m to 2.0m, rotary machinery or two-wheeled tractors would be used for ploughing and weeding. In case of inter-ridge spacing less than 1.0m, hand weeding must be resorted to. Weeding costs can be reduced by the spraying of weedicide.

For mulching of soil, the following recommendations should be followed: During the drought the fields at all farms should be covered with 10cms layer of wild grass to control evaporation and weeds.

For control of diseases and pests, the operations recommended are: A survey should be carried out into the incidence of pests and diseases and correct identification established. One identification has been made, choose the correct pesticide and fungicide and spray at regular intervals.

7. Control of mulberry disease and insect pests

During the three-month duty of the Consultant, he was able to identify 2 diseases and 2 insect pests affecting mulberry fields in the Philippines. Identification was made by physical observation and microscopic examinations. The insect pest that causes heavy damage to mulberry fields has been identified as the leaf roller. This infestation is common in all fields and districts in the Philippines. In MSC Wangal for example, almost 70% of the mulberry fields has been infested.

To control the leaf roller, the project tested three kinds of insecticides which were available locally, two insecticides and one, from Korea (See Table 8). Of the insecticides tested, DDVP has proved most effective. It has given a death count of 99%. This is followed by KAFIL which accounted for 63 deaths. This conclusion is, however, premature because the observation has been made after recording only 24 hours treatment. For a definite conclusion, it will be necessary to count the dead insects after 72 hours of treatment.

Table 8. Effect of recommended insecticides on leaf roller

Insecticides	24 hrs after treatment death count as a %age		Mean
DDVP(Korea)	98.13	100.00	99.06
DECIS	* 5.60	** 92.59	49.09
KAFIL	* 31.00	** 95.69	63.35
Control	0	0	0

Note : * mark : low concentration of insecticide

* * mark : high concentration of insecticide

Nevertheless, DDVP is quite effective to control leaf roller but this is not available locally at present so that KAFIL is to be used to control leaf roller with high concentration of chemicals.

When spraying insecticides to control mulberry insect pests, care should be taken to consider the residual effects of the chemicals on the leaf. Leaf should be fed to silkworms only after the leaves are free of any residual effects.

摘 要

필리핀의 잠사업은 그 역사가 매우 짧다. 1974년 일본의 잠업기술을 도입하면서부터 양잠에 관심을 갖기 시작하였다. 그후 1990년 한국의 잠업기술자의 도움을 받아 뽕밭을 조성하고 잠실을 지어 양잠을 본격적으로 시작하게 되었다. 따라서 이 나라의 잠업역사가 짧은 것 만큼 뽕나무 재배기술도 몹시 낙후되어 있는 실정이다. 필리핀 고지대의 뽕밭의 현황 및 그 개선책을 요약하면 다음과 같다.

강우량, 기온, 일조시간 및 습도 등은 뽕나무가 자라는데 큰 무리가 없어 보인다. 다만

12월부터 3월까지의 건기에는 뽕밭에 관수를 하거나 뽕밭 주위에 무진장으로 자생하고 있는 풀을 베어서 뽕밭에 피복하여 토양수분을 보존한다.

대부분의 뽕밭이 급경사지에 조성되었는데 등고선에 따라 계단을 만들거나 승수로의 설치등이 되어 있지 않기 때문에 강우시에는 토양의 침식 및 유실이 심하였다. 따라서 계단 사면에는 초생재배를 실시하고 계단면에는 유기물을 피복하여 토양의 유실을 방지해야 할 것이다.

토양의 pH 4.7, 유기물함량 1.6%, 유효인산함량은 6ppm이었다. 즉 유기물 함량이 낮은 강산성토양이며 유효인산함량이 극히 낮은 토양이었다. 석회와 유기물을 다량 사용하여 토양을 개량하고 인산비료를 증시해야 한다. 소나무 밑에서 재배하고 있는 뽕밭에서는 햇빛이 잘 쬐일 수 있도록 소나무의 결가지를 전정해주고 석회를 증시한다. 현재의 ha당 시비량 질소-46kg, 인산-18kg, 칼리-18kg은 너무 적은 양이므로 ha당 질소-250kg, 인산-120kg, 칼리-120kg을 사용한다.

전체 뽕밭의 70%에 해당하는 뽕나무가 뽕나무 잎말이 나방피해를 받고 있는 실정인바 DDVP 및 KAFIL 등의 약제 방제를 실시한다. 우기에 많이 발생하는 적삼병은 이병된 뽕잎과 새순은 조기 제거하고 Topsin-M을 살포한다.

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