18. TECHNICAL AND FINANCIAL ASPECTS OF CLONALLY PROPAGATED RUBBER PLANTING STOCK FOR RUBBER AGROFORESTRY IN MINDANAO

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Recently there has been a rapid increase in the area of rubber agroforestry established in Mindanao in the Philippines, in response to high international rubber prices and the production deficit in the Philippines. A critical requirement for plantation development is the availability of high quality planting material, and in particular clonal budstock of new varieties including those suited to upland areas. Technical and financial aspects of rubber agroforestry have been investigated, as a precursor to developing a financial model for the establishment of a budwood garden and a nursery for the production of clonal planting material.

INTRODUCTION

Integration of trees into farm lots or the planting of cash crops in between trees (agroforestry) started during the early years of civilization in the Philippines. However, the integration of cash crops into rubber farms or the integration of rubber trees into farms is an uncommon practice. Conventionally, rubber seedlings are established in monocrop plantations with a population of about 555 trees per hectare. Rubber agroforestry is not widely practiced and is rarely documented.

Smallholders became interested in planting rubber trees in the Philippines when the price of rubber cup-lumps reached US $1/kg. The price rose further to $3/kg in 2008, falling back to $2/kg later that year, as reported by Panteleta (2008). Some recipients of the free timber seedlings distributed in 1996 by the World Agroforestry Centre (ICRAF) in Mindanao, even remarked that if the trees given to them during the time were only rubber seedlings then they could have been well-off by now. The high price of rubber and the applicability of this system to accumulate carbon would have made it a viable option for sustainable land management. In 2007, the World Agroforestry Centre (ICRAF) started to promote a rubber agroforestry system, enticing more and more farmers to plant rubber trees.

It was anticipated that constraints would be experienced by smallholders in the availability of land area. Smallholder farmers, who on average own a mere 2 ha of farmland and typically ranging from as low as 0.25 ha up to 5 ha per farm household, could not afford to devote all their land to rubber alone and then with spacings of 3 m by 6 m. These subsistence farmers, who have to rely on their meagre land area for food production, found it difficult to plant rubber as a single crop. Peralta (2009) noted in relation to Kenyan smallholders that replacing food crops with trees is not feasible because they lack funds to purchase food. ICRAF has constantly promoted rubber agroforestry in Mindanao to avoid the much anticipated struggle for food security especially in the uplands. This system provides long-term food security while the production of cash crops addresses their short-term or immediate food requirements.

Rubber and rubber agroforestry plantations are well suited to coastal and upland areas in tropical countries. Kissan Kerala (n.d.) observed that ‘rubber can be grown from sea level up

to an altitude of 500 m in areas with a well distributed annual rainfall of not less than 200 cm and a warm, humid equatorial climate (21–35ºC)'.

According to Sales (2010), the Philippines is the sixth largest rubber producer in the world, with a total plantation area of more than 80,000 ha located in Mindanao, but with only a 40% national self-sufficiency and a rapidly growing demand. Sales also argued that over 20 M families are dependent on rubber cultivation in the Philippines.

According to the National Development Strategic Plan for rubber production in the Philippines, the Philippines aims to plant a total of 1 M ha by 2023 (Department of Labor and Employment 2010). This will result in 500 M trees planted for carbon sequestration, and 500,000 new jobs created.

As reported by the Mindanao Examiner (2006), a program of rapid expansion of the rubber area is being promoted by the Department of Agriculture (DA) regional office in Zamboanga to expand the rubber plantation area on the Zamboanga Peninsula, including the establishment of 10 budwood gardens and nurseries. The industry experienced a setback in 2008 when the market price of rubber fell to PhP80 per kilogram from as high as PhP150/kg three months earlier (Pantaleta 2008).

Sales (2010) observed that both increased area and the use of high-yielding budded clones are seen as the solution to the rubber production deficit in the Philippines, and 109 clones have been evaluated by the University of Southern Mindanao in the molecular marker program[1]. Also, the use of budded seedlings with suitable rootstock proves to be important since they have been found to perform better with regard to growth and yield than unselected seedlings (Cardinal et al. 2007).

Modern concepts of establishing a rubber plantation now take into consideration the earliest possible return on investment by using high yielding clones and adopting techniques that reduce the immaturity period of rubber. Current investigations show that the immaturity of rubber can be reduced by following standard nursery practices. Among such practices are the use of an appropriate soil medium, suitable size of polyethylene bags, and a sound fertilization program during the early growth of the seedlings – both in the ground and in polybags.

This paper examines the production of new rubber planting material and reports on the financial aspects of a recommended nursery system for producing clonal budstock. Such a nursery system offers the advantages of producing a large quantity of high quality planting materials at the earliest possible time.

The product of this project is mainly budded rubber planting materials. Careful quality control is strictly maintained. A high level of demand is expected, given that rubber growers now understand the importance of high quality planting materials after a recent massive information campaign and training activities on rubber production. Planting stock is assumed to be sold at the nursery location on a cash basis.

[1] As explained by Majik Homes (2010), budding is a process of grafting the bud of a plant into another plant. 'The principle involved in budding is the replacement of the shoot system of a plant with that of another more desirable plant. In this process, a patch of bark of the seedling plant (stock) is replaced by a patch of bark with a dormant bud (bud patch) taken from the clone to be multiplied. The stock is then cut off above the budded portion and the grafted bud develops into a shoot (scion) exhibiting the character.'

TECHNICAL ASPECTS OF BUDDED RUBBER CLONE PRODUCTION

Production of budded rubber clonal planting material is a relatively complex task, and involves various steps, including the preparation of germination beds, establishment of a budwood nursery or garden, transfer of germinated seedlings to polybags, budding, weeding and irrigation. The 5 ha nursery area will be subdivided into a budwood garden, a seedling area and a seedbed area.

Production of Seedlings in Germination Beds

The total area will be prepared by one plowing and two harrowings. The seedbed area (500 m^2) will be further prepared with the construction of 50 seedbeds measuring 1 m x 10 m. The soil will be cultivated and raised at least 15 cm from the ground level incurring a total cost of PhP5000. Fine river sand of at least 10 cm thick requiring about 50 m^3 of sand and costing a total of PhP39,000 will be used as germinating medium. The total cost is estimated to be PhP5000. An overhead shade structure will be installed to protect the germinating seed from direct heat.

The seeds will be sown in the seedbeds, in a single layer touching each other with the prominent mark pointing downward. The seeds will be pressed firmly into the bed until the top of the seeds is level with the surface of the medium. In the absence of rain, seedbeds will be watered twice a day. Seeds germinate 5–7 days after sowing. The seed requirement is approximately 960,000 seeds (a volume of about 480 kerosene cans), based on a germination rate of 80%.

Germinated seeds with an established root system and at an early stage of hypocotyl emergence will be pulled from the germination beds after watering. These will be placed in pails half filled with water for transport to the seedling area for transplanting. Polybags, measuring 15 cm by 30 cm (6 inch by 12 inch) will be filled with garden soil, and arranged in the seedling area in an east-west direction in shallow canals. Seedlings are to be placed in bags with the use of poke holes so that the cotyledons are submerged in the soil at a depth of .25 cm (¼ inch).

Manual weeding of individual polybags and between rows or alleyways will be performed to prevent competition for water and nutrients. Grass cuttings will be placed between rows to assist in weed control.

Sufficient moisture will be provided to ensure the maximum growth of the seedlings. Watering will be done every second day or whenever necessary, especially during prolonged dry periods. A watering system will be installed to facilitate this activity, using a 2 hp electric motor supplemented by a 5 cm diameter water pump with a 5 hp engine.

Budding of rootstock will be undertaken at 4 to 6 months and onwards after planting in polybags. It is expected that the first budding operation will take place in January. Green and brown budding techniques will be used depending on the size of the rootstock. However, if the rootstock has reached the age of 8 months, brown budding is likely to be employed. Payment to budders will be on a piece rate basis at PhP3 per successful bud to include the price of budwood taken from known sources, and is assumed to increase per annum by 10%. By the third year, however, budwood should be available from the 3-year old budwood garden, which will be established at the same time as the nursery. Taking budwood from this budwood garden is expected to reduce the price of budding costs. The price per budding will then be PhP2 but is assumed to increase by 10% per year after the third year.

Budding tape will be opened after 21 days from the budding date. Successfully budded seedlings will be cut back 5–7 days after opening the budding tape. Seedlings will then be transferred to the transplant bed for monitoring of pests and diseases, fertilizer application, irrigation, acclimatization to field conditions and grading until the budded stock have a 2–3 leaf story. At this stage, the plants are ready for disposal.

Establishment of a Budwood Nursery or Garden

The use of asexually propagated planting materials through budding rubber is a common practice. Budded rubber seedlings, depending on the clones selected, are said to have superior growth, produce 2 to 3 times as much latex and also produce suitable bark thickness for tapping. With this outcome in mind, the project will concentrate on the production of budded seedlings and to ensure a continuous output for sale to smallholders.

A 1 ha budwood garden is to be established within the ICRAF nursery area as a ready source of scions to support its budding operations. As land preparation, the area will be plowed once using a farm tractor to loosen the soil and to control weeds. One week later, it will be harrowed twice to break up the clods, render good soil tilth and facilitate ease in laying out. Five recommended clones will be established – namely USM 1, PB 330, PB 260, RRIM 600 and RRIM 712 – with 1800 seedlings for each clone in five blocks, oriented in an east-west direction, each measuring 18 m x 100 m and with 2 m alleyways in between blocks. Each block will be laid out with 1 m space between rows and 1 m between hills.

Holes measuring 25–30 cm in diameter and 40–45 cm deep will be dug based on the desired location as marked by pegs in the laid-out area. Hole diggers will be used together with crowbars and shovels. Holing will be done a day before the actual field planting. This activity will require 164 man-days on the assumption that 55 holes will be accomplished each day by one worker.

Procurement and Hauling of Planting Materials

The planting requirement of the 1 ha budwood garden is 9000 seedlings. However, 10,000 budded seedlings will be procured from accredited[2] rubber nurseries selling high quality planting materials and that offer the lowest price. The excess from the seedling requirements will be utilized for re-planting activities. A total of 2000 seedlings of each of the 5 recommended clones will be purchased. The seedlings will be delivered by the nursery operator at least 3 days before the scheduled planting to facilitate acclimatization of the seedlings before planting.

Outplanting and Watering of the Budded Seedstock

Planting will be done during the rainy season, i.e. from June to November. The planting materials purchased will be uniform in size (with 2nd leaf story) thus no further sorting will be necessary. At the time of planting, 20 grams of complete fertilizer (14-14-14) will be applied as a basal application, and covered with soil to prevent direct contact with the roots of the seedlings. The planting materials will be carefully placed in the hole with the plastic bag to be cut vertically from the bottom up and removed. Spaces between the holes and the seedlings will be backfilled with the soil removed during holing. The back-filled soil will be lightly compacted to ensure there are no hollow spaces in between the seedlings roots and the soil but with care taken during compacting to allow air circulation between the soil particles. Newly established seedlings will be watered whenever they show signs of moisture

[2] Accredited nurseries are nurseries that have undergone the process of accreditation. Accredited nurseries are regarded to be selling quality materials with the correct line of clone being propagated.

stress, especially during the first year of the budwood garden. Replanting of missing hills will be done immediately gaps are observed. Mortalities are assumed to be about a 1000 seedlings or about 11% of the total seedling requirement.

Fertilizer Application, Weeding, Pruning and Pest and Disease Control

At planting time, 20 grams of the complete fertilizer will be applied as a basal dressing. In the second and succeeding years, individual trees will be fertilized with 250 grams in split application. This will be placed between hills and rows using the drill hole method. Weeds in the budwood garden will be controlled by hand weeding or using a grass cutter. The frequency of weeding will depend on the extent of the weed population.

Any sprouts emerging from the rootstocks, apart from the budded shoots, will be promptly removed, and dead branches pruned. The budwood garden will be monitored as often as possible to identify the presence of common pest and diseases. When indications of pest and disease infestations are observed, spraying of the recommended insecticides or fungicides will be employed. Clean culture or sanitation will also be employed to minimize such infestations.

Harvesting of Budwood

Harvesting of the first batch of budwood and bud sticks is expected to commence 12 to 18 months after planting. However, the clones will be allowed to grow for at least 2 more years before harvesting.

Budwood will be harvested using contract harvesters and by cutting the stems which have expanded, healthy and mature terminal whorl or new sprouted terminal shoots in a candle-like stage using a pruning saw at a height of 25–30 cm from the union shoots. Attention will be paid to correct the developmental stage and harvesting of the buds.

Marketing Clonal Seedlings

To facilitate the marketing of the product, the management will enter into a marketing contract with the provincial government of Cotabato in Southern Mindanao where extensive government plantings are conducted. The management will also enter into a contract with the local government units and other government and private agencies as its main market outlet. Walk-in clients will also be served including prospective growers in the Visayas and Luzon areas. The possibility of associating with farmer’s organizations including the United Rubber Producers Association (URPA) in Misamis Oriental and establishing contracts with focal persons in rubber production will also be explored.

Selling of the product will start one year after seed sowing or six months after budding. This will take place during the month of August of the following year. The same production scheme will be repeated in the second year up to the fifth year of the project’s implementation.

FINANCIAL ANALYSIS OF A CLONAL NURSERY INVESTMENT

A financial analysis is being developed for a 5 ha nursery assumed to be established for the production of clonal rubber planting materials. The nursery is a single-proprietorship enterprise where the owner provides the capital. The owner manages the nursery operations but hires a bookkeeper to assist in the financial management. The bookkeeper records all the incoming and outgoing transactions of the project, and acts as the officer- in-charge in the absence of the manager. The owner also hires skilled utility workers to undertake all the routine tasks necessary in the implementation of the project, including irrigation, potting,

application of fertilizer and pesticides and weeding except budding. Contractual skilled propagators locally known as budders perform all the activities of asexual propagation at a per piece compensation.

Technical Aspects of Nursery Design and Operation

In the first year of implementation of the project, most of the undertakings will be the pre-production activities, including: procurement of a 5 ha lot; construction of a work shed, office building/bodega; installation of a water system and fence; procurement of materials, tools and equipment, purchase of seeds, seed germination and vegetative propagation (i.e. budding) activities. The establishment of the budwood garden will also take place at this stage.

In the second year of operation, selling of the first batch of production will take place which marks the end of the first production cycle. The same production activities will be undertaken in succeeding years of operation except for the third year when budwoods will be taken from the establishment budwood garden. Since it will be already established, the budwood garden would only need maintenance activities such as weeding, pruning and applying pesticide and fertilizer.

A total of 800,000 budded seedlings per year will be targeted, and of recommended clones of PB 330, PB 260, RRIM 600 and USM 1. Polybag containers will be used and seeds coming from RRIM selections 623, 605, 901, 712; PB selections 5/51, 217 and 235 and the clone GT 1 will be used as rootstock. Seeds will be procured from Bukidnon and Zamboanga provinces at Php300 per can. About 480 cans will be procured with an estimated total of 960,000 seeds. The seed materials will cost a total of PhP144,000.

Performance Criteria, Planning Horizon and Discount Rate

The financial analysis will be a current price analysis, with a real discount rate (net of inflation) of 15% per year. The net present value, internal rate of return and payback period (allowing for discounting) will be derived. This analysis is still in progress.

Some preliminary financial estimates have been made. The project requires an initial investment of PhP4.43 M for expenses during the first year cycle of operation. The proponent of the project has to put up an investment of PhP5 M which will finance the project during its unproductive stage, i.e. the first year. Expenses for Year 2 to 5 will be taken from the income generated by the project.

Project operating costs will include costs of labour, fuel, potting medium and fertilizer. Seedling production is labour intensive because it requires continuous manpower to maintain the seedling stocks, establishment and maintenance of the budwood garden and other routine jobs. Budding jobs however, will be on a per piece compensation basis and the cost of supervision and bookkeeping services will be provided in the form of a salary.

The project is expected to first generate income during the second year of implementation, when budded rubber seedlings are ready for marketing. A net production of 800,000 budded seedlings is projected with a success rate of 75% in the first production year and an increment of 5% per year in the succeeding years. The success rate is set at 75% considering that seedling propagators will still be honing their skills during the initial phase. Subsequent increase during the succeeding years will be attributed to the increase in experience of the nursery operators in rubber production. It is assumed that annual net production will further decrease by 2.5% due to adverse environmental conditions resulting in seedling mortality. Sales are assumed to show a decrease of 2.5% as a result of promotional market strategy whereby seedlings will be given to customers for free. The

annual projected gross income is PhP19,600,000 representing the sale of 560,000 seedlings at a price of 35 pesos each. In total, the projected gross income of the project for the five year cycle is about PhP86 M, assuming the price of the budded seedlings remains the same throughout the four succeeding years.

CONCLUDING COMMENTS

The project will generate employment among residents in the locality and will provide the necessary income for their families. The project will also generate revenue for the government upon payment of its tax obligations. Further, the project will benefit the environment because it deals with industrial crops, specifically rubber as its product. Rubber is an agro-reforestation tree material. It promotes an environment-friendly farming system (including being a major carbon sequestrator). With the readily available plant materials that the project will produce, it can be expected that there will be more areas planted to rubber trees. Overall, initial estimates indicate that the project is financially viable, and the social and environmental benefits are substantial.

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