

PRELIMINARY STUDIES ON THE ESTABLISHMENT OF SI-MI-TAUK *GLORIOSA SUPERBAL* AND ITS SOCIO-ECONOMIC POTENTIAL

Khin Win Myint*

ABSTRACT

This research is undertaken by the offer from France Pharmaceutical company offering one metric ton of seeds at 7.US Dollars per kilogram. With this attractive offer a small scale plantation of Si-Mi-Tauk and its minimum requirements for large scale plantation, is carried out. The major objective is to search a new diversion of income generation for the Ministry of Forestry and as well as to promote the socio -economic status of the local communities residing in the area. Si-Mi-Tauk *Gloriosa superba* Linn., is a well known poisonous plant with medicinal value in the traditional ayurvedic systems of medicine both inland and abroad. The plants grow wildly in the central dry zone of Myanmar. According to the survey, it was found that the plants can grow well in any soil condition. Their major requirement is to have direct sunlight. Seeds are valued as a commercial source of colchicine production which is used in the treatment of ganorrhoea, gout and rheumatism and decrease leucocyte mobility.

Si-Mi-Tauk, *Gloriosa superba* Linn., is a well known poisonous plant with medicinal value in the traditional ayurvedic systems of medicine locally and abroad. The plant grows wildly in the dry zone in central Myanmar. According to the survey conducted, it was found that the plant could grow well in any soil condition. Apart grow hat, the major requirement for growth is the direct sunlight. Seeds have commercial value as raw material for colchicines production which is used in the treatment of ganorrhoea, gout, rheumatism and also have effect in decreasing the leucocyte mobility.

A small scale plantation of Si-Mi-Tauk was established with intention to find out the minimum requirement in establishing a large scale plantations.

Note: The research is in fact, carried out in response to attractive after made by France Pharmaceutical Company of US\$ 7 per kg calling tender for 1 metric ton of seed. Another objective is diversion of new source of income for the Ministry and to promote the socio-economic status of local communities in the dry zone area.

* Research Officer, Forest Research Institute

1. INTRODUCTION

Si-Mi-Tauk is well known in Myanmar as a poisonous plant rather than medicinal. It grows abundantly in the dry zone area, in the scrub jungles or along the out skirts of the agricultural fields. On the awareness of its poisonous nature, the plant became a lesser use species, although there are literatures both inland and abroad mentioning their uses.

Scientifically, Si-Mi-Tauk is termed as *Gloriosa superba* Linn. includes in the family Colchicinaceae, differing from the bulbous liliaceae in having a tuber or corm. It is a climbing herb or liana with a height of 2 ft to 10 ft tall. The plants prefer mostly direct sunlight. They climb till they reached to a sufficient amount of light exposure and then after it produce flowers and fruits. Another characteristic of the plant is having leaves with tendril like tips which serve as a mechanical support to climb and grip for a weak stem. Flowers are brightly coloured, changing from yellowish green to red by age. The fruits are ellipsoid, trilobe, dark green when mature. The underground tubers are cylindrically flattened, sometimes pointed at both ends consist of two tubers uniting at rightangles. The outer surface of the tuber is covered by a thin, loose, pale brown epidermis and internally it is dull white and farinaceous. The taste is faintly bitter and with a slightly acrid odour.

In Myanmar traditional medicine the tubers are used in the preparation of medicine for ganorrhoea and sores. The leaves are used for taenicide earache and bacteria infection.

According to the literature on Medicinal plants of India and Pakistan the tubers are used as stomach-ache a tonic, stomachic antiperiodic, paralysis, ganorrhoea, leprosy, colic, intestinal worms and the treatment applied in rheumatism and neuralgic pains.

Poisonous effect of the tuber and seeds are due to the bitter principle superbine and colchicine which are found to be poisonous when given in large doses. The content of colchicine in the seeds is ten times higher than in the tubers. Thus the seeds are valued as a commercial source of colchicine production. Previously, the corms of *Colchicum autumnales* and *Iphgenia* are the sources of colchicine. An increase in demand for colchicine, stimulate the search for an alternative source, leading to *Gloriosa superba*. (PROSEA, 1999)

2. LITERATURE REVIEW

Distribution

Si-Mi-Tauk is commonly known as climbing lily or superb lily is a large climbing herb wide spread in the old world tropics, occurring from tropical and southern Africa from Madagascar to India, Pakistan, and Sri-Lanka ascending to 6000ft. (According to PROSEA 1999). In Myanmar, it is wildy grown in the central dry zone and can grow well in any places it is learnt.

Medicinal and Chemical Properties

In medicine, colchicine is used in the treatment of gout and rheumatism. At present it is the drug of choice for acute gout. It reduces the inflammatory reaction to urate crystal deposited in the joints and decreased leucocyte mobility. (PROCEA-1999)

Chopra, 1956 stated that if the tuber is boiled and eaten, diarrhoea, nausea, vomiting and abdominal pain are often the first signs of poisoning. A burning sensation in the throat, stomach and skin may also be an early sign of intoxication. In patients who have taken an overdose of *Gloriosa superba* tuber, death occurs as a result of respiratory depression and cardiovascular collapse.

Dutt, 1893 report that in order to remove the poison, the tuber is cut into thin slices and soaked in butter-milk to which a little salt is added. In this composition it is soaked by night and dried by day for 4 or 5 days. It is eventually dried well and preserved. By this process its poisonous properties are said to be removed.

Propagation

According to TREE-CD 1973-1999/07 Suparna - MR it was mentioned that the plants raised from seeds take 3-4 years to flower and so the crop is mainly propagated by tubers. as their supply is limited, it is difficult to obtain in large quantities. For propagation purposes tuber should weigh at least 50 g so that they flower in the same season. Undersized tubers fail to flower in the first season and become a waste.

It was also described that various growth promoters are applied to potted plants of *Gloriosa superba* in order to increase tuber size by using growth regulators Cycocel (CCC), Cytozyme and Alar 30 and 60 days after planting, and plant and tuber growth parameters recorded fortnightly. Application of Alar at 4000 p.p.m gave the maximum 11.29 % increase in leaf area. Length of tubers was maximum 6.50cm with 1000p.p.m Cycocel and girth with 2000 p.p.m Alar (2.25 cm) treatments where as the fresh and dry weight of tubers was the highest with the 3000 p.p.m Cycocel treatment.

Plant Resources of South East Asia PROCEA (1999) , mentioned a small scale cultivation tubers of 50-60 g are planted in well tilled soil at a depth of 6 cm in furrows 40-60 cm apart. A closer spacing give a higher percentage of cross - pollination, resulting in improved fruit set. The best seeding medium is 1: 1: 2 mixture of soil, sand and compost.

It was stated that vegetative propagation by tubers is common practice, but not very suitable for the establishment of large plantation. The maximum number of daughter tubers produce by plant is two. Separating the bilobed hypodial tuber produces a higher percentage of flowering plants than leaving the tubers undivided.

Irrigation

It is needed at dry weather during the initial stages of growth. Irrigation applied after flowering may cause the tubers to rot. (CD-ROM) TREE-CD (1973-1999 /07)

Yield

A report from India, 2001 stated that in the surveyed area the average yield is 120 kg per acre. In some places the output is 300 kg per acre. Small scale plantings raised from tubers, yield an average of 250-300kg of seeds per ha. from the second year onwards. In South Africa the seed production is positively correlated with height of the plant and yield an average of 258 seeds per plant for plants.

3. MATERIALS AND METHODS

At present, the crop is raised by tubers because of the problem of seed dormancy which takes 3-4 years to flower. The tubers used in this study are collected mainly from Ma- hlaing township and some from Ye-me- thin area, during May to November. The plants grow wild in the scrub jungles on the outskirts of Ye-me-thin and Ma- hlaing, intermingling with spiny shrubs. They are dug out with difficulty because of the spines. After collection the tubers are carried to FRI, thoroughly cleaned, and kept in a cool, dark and dry place until the next season .

Early in June, beds of 3ft-10ft are prepared and the bilobe tubers are planted at an interval of about 8 inches apart before the arrival of monsoon. Iron wire fencing is made over the beds, to provide mechanical support allowing the leaf tip tendrils to climb and grip for the upright of the weak stem. The medium of 1: 1:2 (soil, sand and compost) is used. The results of the experimental plots are presented in Table I, II and III.

4. ANALYSIS

(a) Botanic Description

Scientific Name	<i>Gloriosa superba</i> L.
Common Name	Superb Lily; Climbing Lily, Flame Lily
Myanmar Name	Si-mi-tauk
Family	Colchinaceae
Description	A large scandent herb, with underground tubers, 3-10 ft, high, grasping by the tips of the leaves modified into spirals. Stem long, slender, weak, cylindrical, glabrous. Leaves simple, sub-opposite, ovate-lanceolate, tips elongate spiral, parallel venation, bright

green, glabrous. Flowers large, showy solitary or subcorymbose, brightly coloured, petals, yellow-orange-red by age, margins undulate. Fruit 3-celled, capsule 1.5-2.5 in. long, large, green-dark green when mature. Seeds numerous, reddish black at maturity.

Part use

Tuber and seed

Distinguishing Characters of the tubers

Horizontal tuber dichotomously branched or unbranched, flattened or cylindrical, much pointed at both ends, 2-6 in. long about 0.6in. across, a chain of fleshy arched tubers, budding from the convexity above. Externally it is covered by a thin layer of brown cork, circular scars present, paperi-like. Internally the colour is whitish to light yellow. Possess toxicity. Odour slightly acrid, taste faintly bitter, farinaceous.

Distinguishing Characters of the fruits and seeds

Fruits trilobe, oval- elliptic, 1.5- 2.0 in .long, dark green. Seeds globose, about 3-4 mm in diameter, deep red with slight wrinkles. Odourless, tasteless.

(b) Table (1) Experimental Studies on the Plantation of Si-Mi-Tauk (1998)

S.N	Locality	No: of tubers	Observation	Remarks
1.	F.R.I	196 plants (with tubers) 4"-10" tall	Survival plants 31	Seem to have transplanting shock.
2.	F.R.I	Tubers 135	No germination	Undersized tubers fail to germinate in the first season.

Table (2) Experimental Studies on the Plantation of Si-Mi-Tauk (1999- 2000)

S. N	Locality	No. of tubers	Observation	Remarks
1.	Pyinmana Arboretum	500	Survival –18. Growth slow. Stems weak. Late flowering and fruiting.	Shady place. Unfavourable condition for growth.
2.	Meikhtila	500	Survival nil. Tubers rotten	Propagation was made at wet places. Tubers are too young.
3.	F.R.I	500	Survival 218. Caterpillars on the leaves and buds..	Tubers undersize. Destroyed by the defoliators .
4.	Ya-Me-Thin	3000	Removal of experimental plot.	Because of the extension of new high way road project which pass through the plot.

Table (3) Experimental Studies on the Plantation of Si-Mi-Tauk (2001-2002)

S. N	Locality	No: of tubers	Observation	Remarks
1.	Khit-Aye (Tat Kone)	2000	Germination nil. Weeds dense. Heavy rain. Beds underwater. Muddy soil. Tubers rotten	Unfavourable conditions for the survival of plants.
2.	F.R.I (medicinal plants garden)	1000	60% survive. New shoots destroyed by pest.	Undersize tubers 15-20g. Need to use pesticide before the flowering and leafy shoots appear .
3.	Old teak plantation of F.R.I	1200	70% survive. Growth rate fast. Stems stout and flowering occurs at the height of 3-4 ft. Flowering reduce to 66%	66 % success. 80% of the plot having direct sun light, sandy soil, which are favourable for the growth of plants. Flowering shoots destroyed by the pest

Harvesting

The fruits are hand-pick when ripe. Their colour turns from light green to dark green. They are 3- carpelled fruits, about 1.5 to 2.5inches long. On shade drying for about two weeks the fruits turns to yellow and split open longitudinally revealing light yellow to orange red seeds by age. The seeds are removed and dried under shade and sun for about 2-3 times to remove the moisture and to prevent from fungus infections. After that, they are packed in the plastic packets and kept in cool and dry place.

Propagation by seeds

Seeds collected from the previous year are used. They are planted in 10 flower pots containing 10 seeds in each. It was observed that the first shoot appears within 2- 3 months producing 2-3 nodes with 2 opposite leaves at each node. Growth rate was very slow and height of the plants do not exceed more than 4 inches and gradually dried out. This was tested for many times and the results found to be the same. Therefore, the crop is raised by tubers because of the seed dormancy which takes 3 to 4 years to flower.

(c) Soil analysis of the experimental plots

S. N	Description	pH	Total N%	Average P%	Texture			Remarks
					Sand %	Silt %	Clay %	
1.	Old Teak Plantation area	6.17	0.0319	0.000039	90	3	3	Sandy soil
2.	Ya-Me-Thin area	6.02	0.0425	0.000055	74	9	15	Sandy loam
3.	Khit-Aye(Tak-kone)	6.02	0.0352	0000064	90	4	3	Sandy
4.	F.R.I(Medicinal plants garden)	5.82	0.582	0.000321	82	10	6	Loamy sand
5.	Ma-Hlaing (Kone-le)	8.50	0.0190	0.00037	76	13	4	Sandy loam

5. OBSERVATIONS

- (a) *G. superba* occurs in very diverse habitats but favour dried places.
- (b) Naturally they are found growing near the scrubs types of plant where they can lean to grow upright.
- (c) Under full light exposure and high rainfall for about 2-3 times provide a fast growth rate of plants and producing flowers at the height of 1.5 to 2.0ft within a month.
- (d) Unfavourable to shade and excess of water
- (e) Vegetative growth prolongs till it reaches to a sufficient amount of light for flowering. .Therefore in some shady places the height of the plant is more than 10 ft.
- (f) Under the partial shade, growth rate is found to be slow. Flowering occurs within 9-10 weeks, producing 10-25 flowers per plant.
- (g) Fruiting follows soon after pollination and its maturity reaches within 8 weeks. Each fruit consists of 30- 50 seeds.
- (h) Harvesting can be made within 4- 6 months from the time of appearance of the first shoot.
- (i) Daughter tubers cannot produce a new plant in the same year. Tubers used in this study are 15 to 40g. Although it is underweight 20 - 40% of the tubers produce successful plants.
- (j) Lily caterpillar (*Polytela gloriosae*) and green caterpillar (*Pulsia chalcites*) are found to be the major defoliators
- (k) Life cycle is found to be completed within 5-6 months.

6. CALCULATION ON THE MINIMUM NUMBER REQUIREMENTS OF TUBERS, SPACES AND THE ESTIMATE COST TO BUY TUBERS TO PRODUCE ONE METRIC TON OF SEEDS.

Based on the record of experimental studies, the minimum requirements are calculated as follows.

1. A single tuber give rise to a single plant.
2. A single plant can produce 10 –25 fruits.
3. Each fruit consists of 30-50 seeds.
4. Therefore a single plant can produce 300- (500-750) -1250seeds.
5. The following calculation is based on the minimum amount of 300 seeds.

With the aid of the top loading balance it reveals that
 100 seeds weighed 2.5 grams
 300seeds.....= 7.5 grams obtain from a single plant / tuber

1000 gram = 1 kg

$$7.5 = \frac{7.5}{1000} \text{ kg}$$

$\frac{7.5 \text{ kg}}{1000}$ kg of seeds obtained from a single tuber

For 1000kg = 133333 tubers

If the tubers are planted at the spacing of 2ft x 1ft, there will be 21780 tubers needed for one acre

therefore for 133333 tubers 6.122 acre is needed for plantation

estimate cost for buying tubers = 133333 x 3 kyats = 399999

In conclusion the basic requirements to get 1 metric ton of seeds is found to be as follows:

- (1) 6.122 acre is needed for plantation
- (2) 133333 tubers have to be used
- (3) Estimate cost for buying tubers will be 399999 kyats

Out put

1. The minimum amount of seeds produce from a single plant / tuber is 300-500 seeds.
2. From 21780 tubers / per acre it can obtain 6534000 seeds (or) 163.35 kg within 1 lifecycle(i-e 6 months)
3. As the yield is linked with the initial condition of the tuber, weather, water, pest and disease, quality of pollination and man power the minimum out put is found to be 996.74 kg.

7. DISCUSSION AND CONCLUSION

Field collection and experimental plantation is carried out annually starting from 1998 June and ending in 2002 December. Four years of in-situ and ex-situ studies, reveals that the major factor required for a successful plantation is to provide a high intensity light exposure to the plants. It is clearly observed that the development of the vegetative shoot is fast under full sun light and need a high rain fall about two to three times, producing flowers within 4-6 weeks. Where as the plants which are under partial shade give rise to weak and elongated stems which

continue climbing till they reach to a height where a direct sun light is available after which they produce flowers and fruits. Therefore the plants have a wide variation and height development. In some places the plants climb even more than 10 ft. Another favourable factor of the plant is that it can grow well in any soil condition.

According to PROCEA(1999), it was stated that in order to produce a high percentage of flowering and fruiting, firstly the cultivation area must have high intensity of light exposure, bilobe tubers should be divided and each tubers should weigh at least 50 g . It was also mentioned that under sized tubers fail to flower in the first season. In this study, light exposure can only be provided partially as the nursery sites are not in the open field with the exception of the cultivation site made at the eastern part of FRI. Tubers are not divided as they are under weight varying from 10 to 30 g . During the 4 year period of collection, tubers of 50 g are not procurable. This is one of the drawback adversely affecting the flowering capacity in the first season.

Spacing of the tubers is another major factor influencing the pollination of the flowers. In this research the spacing of the tuber is 2 ft x 1 ft. Therefore the area enclose 21780 tubers per acre. If the spacing is closer it gives a higher percentage of cross pollination, resulting in successful fruits but the disadvantages is that 2 kinds of pest, lily caterpillar and green caterpillar are found to be infected from one plant to another and ruined the whole plot. If the plants are set up far apart, manual pollination should be made. This work needs high man power input, so as to attain successful fertilization for each flower within the limited period of sunshine in the early morning. (Report on the cultivation of *Glorisa superba* 2000.)

The propagation by tubers is not suitable for the establishment of large scale plantation, because it is difficult to obtain them in the required quantities. Consequently propagation by seeds become a necessary option in order to solve this problem. Four possible options are available. They are

- (1) To increase the size of tuber by using various growth promoters.
- (2) To find out suitable means for vegetative propagation.
- (3) To improve the germination of seeds by using various pre-sowing treatment and growth regulators.
- (4) By means of tissue culture

Based on the calculation, the minimum requirement of space needed for plantation is 6.122 acre. To produce one metric ton of seeds 133333 tubers are required and the estimate cost for buying tubers is about 399999 kyats. The expected out put is 996.74 kg. As the demand for colchicine is increasing, this research can culminate in a feasible and financially beneficial enterprise if enough input and expertise are applied.

8. SOCIO- ECONOMIC STATUS OF THE LOCAL COMMUNITY RESIDING IN THE SURVEY AREA

Village name	Khin- Tha
House hold	80
Population	454
Area	30-40 acre
Occupation	Taung- ya
Education Level	Primary to middle about 150, matriculation 4, University 3,graduate 3,
Economy	Paddy
Main crops	Tamarind, chilli- minor crops beans and sunflower
Seasonal crops	Chilli, beans
Energy	Nil
Land tenure	Owner farmers few, hired farmer and landless more
Utilization of fuel wood	Side branches and twigs of trees
Sources of water	Stream, few pond and Thit- sone Dam
Livestock	Nil
Government Organigation	Nil
Social well fare associations	Nil
Information on medicinal plants	Aloes, Than manaing – kyauk manaing, Phaloo taung hmwe, Ma- gyi, Tamar.
Total identified and collected specimens of medicinal plants	As mentioned above.
shops selling medicinal plants	Nil
House hold cultivation medicinal plant	Nil
Remark	Economy medium to poor

9. REFERENCES

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