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Studies on nutrient enhancement of Glory lily (*Gloriosa superba* L.), Rind

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Abstract
The experiment was conducted to study the nutrient enhancement of major and minor nutrients in Glory lilly rind at Department of Nematology, Tamil Nadu Agricultural University, Coimbatore, during 2016. The results revealed that major nutrients like N, P, K and minor nutrients *viz.*, calcium, magnesium, iron, copper and manganese in the rind of *Gloriosa superba* was increased substantially when the rind incorporated with farm yard manure. Further, significant increase has been noticed in their nutrient content if the rind is decomposed with Farm Yard Manure. (Major nutrients *viz.*, N-0.50%, P-0.14% and K-0.98% and minor nutrients *viz.*, Ca-0.09%, Mg-0.03%, Fe-2680µg/g, Cu-21.3 µg g^{-1}, Zn- 35.6µg g^{-1}, Mn- 459.7 µg g^{-1}) Fortification of *G. superba* rind with Farm Yard Manure resulted in enhanced quantities of major nutrients *viz.*, N- 0.67%, P-0.19% and K- 1.22% and minor nutrients *viz.*, Ca- 0.11%, Mg- 0.05%, Fe- 3854µg g^{-1}, Cu- 49.7 µg g^{-1}, Zn- 50.51µg g^{-1}, Mn- 520.10 µg $g^{-1}$and can be applied as soil amendments for the control of plant parasitic nematodes. Significant increase in nutrient content of rind by decomposition with farm yard manure enhanced the value addition of *G. superba.*

Keywords: *Gloriosa superba*, Rind, Fortification, Farm Yard Manure, Decomposition

Introduction
Glory lily (*Gloriosa superba* L.) is recognized as state flower of Tamil Nadu. The name *Gloriosa* is said to be derived from the word 'glorious' meaning handsome and *superba* from the word 'superb' meaning splendid or majestic kind. In Tamil Nadu, it holds a monopoly in the production with an annual production of 600-700 tonnes and productivity of 1.04 tonnes/ha grown in an area of 6,000 acres [1]. It is a semi-woody herbaceous branched climber reaching approximately 5 meter height, with a brilliant wavy-edged yellow and red flowers, which is one of the endangered species among the medicinal plants. It is extensively scattered in the tropical and sub-tropical parts of India. It is adapted to different soil texture and climatic variations. The plant grows well in sandy-loam soil in the mixed deciduous forest in sunny ecosystem. Being native of India, specifically southern India, it is known as glory lily and climbing lily in English. In world market, glory lily is considered as rich source of colchicines and gloriosine. The flower has analgesic, anti inflammatory, anti microbial, larvicidal, antipoxviral, antithrombotic, antitumor, enzyme inhibition potential and used in the treatment of snake bite, skin disease and respiratory disorders [2].Different parts of plant have wide variety of uses especially in traditional system of medicine.

Materials and methods
Collection of plant parts of *G. superba*
The plant parts *viz.*, rind, rhizomes, flowers, leaves and seeds of *G. superba* were collected from the farmer field at Dharapuram, Tirupur District, Tamil Nadu.

Fortification of rind
The rind was fortified with Farm Yard Manure (FYM) and buried into soil for 12 days. The chemical properties were analysed for rind alone, rind + FYM and fortified rind + FYM.

Estimation of total nitrogen [3]
Digestion
One g of sample was weighed and transferred accurately into a dry Kjeldahl flask and 30 ml of conc. H_2S0_4 containing 1 g of salicylic acid was added. The contents were mixed well and allowed to stand for at least half an hour with frequent shaking. About 5 g of crystalline sodium thiosulphate ($Na_2S_20_3$ $5H_20$) was added shaked well and digested over a low flame until frothing ceased. Then 10 g of K_2SO_4 and 1 g of $CuSO_4.5$ H_20 was added and heated strongly until the liquid in the flask turned green.

Distillation
Twenty ml of 2% boric acid was taken in a 250 mL beaker and few drops of double indicator was added and kept under the delivery end of the distillation unit. Care was taken that the tip of the delivery tube was immersed in the standard acid contained in the beaker to avoid loss of evolving ammonia. To this, 40 per cent NaOH was added to the distillation flask until it became alkaline and checked with red litmus paper. When the distillation started uniform boiling is ensured. The distillation was continued until the distillate ran free of ammonia (red litmus paper test). When the distillate ran free of ammonia, delivery tube was detached rinsed with distilled water and back titrated against N/10 H_2SO_4 the rinsing was collected in the ice tumbler. The quantity of N/10 H_2SO_4 was noted down. Using this value, the N content was calculated.

Estimation of total phosphorous [4]
Five ml of the triacid extract was pipetted out into a 25 ml volumetric flask. Five ml of Barton's reagent was added and the volume was made up with distilled water and allowed for 30 minutes for the development of yellow colour and the intensity of colour was measured in a photoelectric colorimeter using blue filter (470 nm) after adjusting the transmittance of the meter to 100 with a blank The colour was stable for 24 hours. From the standard curve the concentration of P in the solution was deduced and from that value, the percentage of total phosphorus content of the manure was calculated.

Preparation of standard curve
About 0.4390 g of pure K H_2P0_4 (AR grade) was dissolved in water and the volume made up to 1000 mL with distilled water which formed the stock solution representing 100 ppm. Ten mL of 100 ppm solution was pipetted out into 100 mL volumetric flask and made upto the mark. This gave 10 ppm solution.
0.5mL of 10 ppm diluted to 25 mL -0.2 ppm
1.0mL of 10 ppm diluted to 25 mL -0.4 ppm
1.5mL of 10 ppm diluted to 25 mL -0.6 ppm
2.0mL of 10 ppm diluted to 25 mL -0.8 ppm
2.5mL of 10 ppm diluted to 25 mL -1.0 ppm

After pipetting out a known aliquot of 10 ppm solution into the respective 25 mL volumetric flasks; the colour was developed as described below: Five mL of 10 ppm solution was pipetted out and five mL of Barton's reagent was added and mixed well. The volume was made up with water. The intensity of colour was measured in a photoelectric colorimeter using blue filter. The readings were plotted against the concentrations to get the standard curve.

Estimation of total potassium [5]
About 5 ml of triacid extract was pipetted out into 25 ml volumetric flask and the acid with ammonium hydroxide was neutralized. The volume was made up with distilled water mixed well to make the solution homogenous. The concentration of K in the solution was measured by using a flame photometer. The concentration of K of the solution was deduced from the standard curve the percentage of potassium in the litter/ manure was calculated.

Preparation of standard solution
About 1.907 g of KCI is dissolved in one litre of distilled water. This gave 1000 ppm of K and 100 mL of 1000 ppm K solution was diluted to one litre and it gave 100 ppm solution. From this various standards were prepared ranging from 10 to 100 ppm.

Conc. required (ppm)	Volume to be pipetted out from 100 ppm stock solution (mL)	Volume to be made up (mL)
10	10	100
20	20	100
30	30	100
40	40	100
50	50	100
60	60	100
70	70	100
80	80	100
90	90	100

Estimation of total Calcium and Magnesium
Calcium alone
Ten mL of triacid extract was pipetted out into a porcelain basin and 10% sodium hydroxide solution was added drop by drop to neutralize the acidity (red litmus turned to blue) and another 5 ml excess to maintain the pH at 12. A pinch (50 mg) of murexide indicator was added and titrated with 0 02 N EDTA till the colour changed from pinkish red to purple or violet.

Calcium and Magnesium
Ten mL of triacid extract was pipetted out into a porcelain basin ammonium chloride - ammonium hydroxide buffer solution was added drop by drop to neutralize the acidity (red litmus paper used) and 5 mL excess to maintain the pH at 10 and 2-3 drops of Eriochrome Black -T indicator solution was added and titrated with 0.02 N EDTA till the colour changed from purple red to sky blue.

Estimation of total micronutrients [4]
The clear extract was fed into an Atomic Absorption Spectrophotometer (AAS) and the available Cu, Fe, Mn and Zn was measured *at* wavelengths of 324.75, 248.33, 279.48 and
2 3.85 nm respectively.

Results
Characteristics of major and minor nutrients of rind
Characteristics of rind of *G.superba*
The nutrient content of rind used in the present investigation was follows Major nutrients *viz*,. N- 0.36%, P-0.11% and K-0.74% and minor nutrients *viz.*, Ca- 0.02%, Mg- 0.02%, Fe-2021µg g^{-1}, Cu- 14.2 µg g^{-1}, Zn- 15.1µg g^{-1}, Mn- 356.2 µg g^{-1}(Table 1).

Characteristics of rind of *G.superba* + FYM
The nutrient content of rind fortified with FYM was as follows major nutrients *viz.*,N- 0.50%, P-0.14% and K- 0.98% and minor nutrients *viz.*, Ca- 0.09%, Mg- 0.03%,
Fe- 2680µg g^{-1}, Cu- 21.3 µg g^{-1}, Zn- 35.6µg g^{-1}, Mn- 459.7 µg g^{-1} (Table 1).

Characteristics of fortified rind of *G.superba* + FYM
The nutrient content of fortified rind of *G. superba* + FYM was major nutrients *viz.*, N- 0.67%, P-0.19% and K- 1.22% and minor nutrients *viz.*, Ca- 0.11%, Mg- 0.05%,
Fe- 3854µg g^{-1}, Cu- 49.7 µg g^{-1}, Zn- 50.51µg g^{-1}, Mn- 520.10 µg g^{-1}(Table 1).

Table 1: Characteristics of nutrient content of rind of *G.superba*

Rind Sample			Rind + FYM			Rind + FYM after 12 days		
Nitrogen	N	0.36%	Nitrogen	N	0.50%	Nitrogen	N	0.67%
Phosphorus	P	0.11%	Phosphorus	P	0.14%	Phosphorus	P	0.19%
Potassium	K	0.74%	Potassium	K	0.98%	Potassium	K	1.22%
Calcium	Ca	0.02%	Calcium	Ca	0.09%	Calcium	Ca	0.11%
Magnesium	Mg	0.02%	Magnesium	Mg	0.03%	Magnesium	Mg	0.05%
Iron	Fe	2021 µg/g	Iron	Fe	2680 µg/g	Iron	Fe	3854 µg/g
Copper	Cu	14.2 µg/g	Copper	Cu	21.3 µg/g	Copper	Cu	49.7 µg/g
Zinc	Zn	15.1 µg/g	Zinc	Zn	35.6 µg/g	Zinc	Zn	50.51 µg/g
Manganese	Mn	356.2 µg/g	Manganese	Mn	459.7 µg/g	Manganese	Mn	520.10 µg/g

Discussion

Value addition of *G.superba* rind

The rind of *G. superba* goes as waste. The present investigation clearly indicates that the rind also has nematicidal properties and the efficacy is comparable and equal to the leaves, seeds, flowers, rhizomes as evidenced by its efficacy on inhibition of hatching of *M. incognita* eggs and juvenile mortality. The present experiment revealed that quantity of major nutrients like N, P, K and minor nutrients *viz.*, calcium, magnesium, iron, copper and manganese substantially increased when the rind incorporated with farm yard manure. Further, a significant increase hasbeen noticed in their nutrient content if the rind is decomposed with Farm Yard Manure [6].

Value addition of *G. superba* rind by fortification with FYM and their decomposed products showed a significant increase in the major and minor nutrients, and form a low cost or no cost technology. It has amany fold advantage of having antinemic, antifungal, antibacterial, action besides increased nutrient contents by value addition. Another important advantage is that this technology can be easily included in the integrated pest and disease management programmes. The Prime objective of any plant protection strategies is to have highest benefit with lowest cost and without causing deterioration to the environment. Many of the plant protection chemicals used for the past one century deteriorated the soil and environment, and hence the plant protection in recent years is marching towards non chemical means, development and use of botanical pesticides and nematicides are the best option. The awareness on the benefits of *G. superba* to be used as a potential botanical pesticide due to their antifungal and antibacterial activities is seen only in recent years. Research on the antinemic activity of *G. superba* has not been carried out extensively. The present study clearly indicated that all the parts of *G. superba* exhibited antinemic activity against *M. incognita* in addition to their antifungal and antibacterial actions. Further, the rind of *G. superba* which is discarded by the farmers, also have the nematicidal activities, and FYM enriched rinds with enhanced nutrients can be applied to soil as amendment. This can be one of the component in the Integrated Nematode Management programmes as it is one of the lowcost or no cost technology.

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