PROFORMA FOR COLLECTION OF DATA OF RESEARCH PROJECTS IN SERICULTURE

PART I: GENERAL INFORMATION

1.	Name of the Institute / University / Organization submitting the Project Proposal	:	**Central Sericultural Research & Training Institute,** Central Silk Board, Ministry of Textiles: Govt. of India, Berhampore - 742 101, West Bengal, India
2.	Status of the Institute(s)	:	NA
3.	Name(s) and designation of the Executive Authority of the Institute / University forwarding the application	:	Dr. B.B. Bindroo Director
4.	Project Title	:	Development of high yielding mulberry varieties using physiological growth parameters as markers for selection.
5.	Category of the Project	:	Applied
6.	Specific Area	:	P – **P**lant I – **I**mprovement B **- B**reeding
7.	Duration	:	**4 years** from Oct, 2012 to Sept. 2016
8.	Total cost:	:	**Rs. 0.18 lakh**
9.	Is the Project is single institutional or multi-institutional	:	Single institutional
10.	If the Project is multi-institutional, please furnish the following: Name, Designation and Address of the Project Co-ordinator	:	NA

11a. PROJECT SUMMARY:

Hybridization work will be undertaken between the selected parents and seeds collected. Seedlings will be raised and after initial screening in the nursery bed, healthy seedlings will be transplanted to main plot for evaluation. Selection of desirable seedlings will be done on morphological, yield and yield contributing factors as well as growth analysis parameters. The data will be analyzed and after the rooting test 20-25 mulberry genotypes will be identified for inclusion in the in primary yield trial(PYT).

11b. AIMS AND OBJECTIVES:

To develop mulberry varieties with superior quality and with 10% higher leaf yield over the ruling variety.

PART II: PARTICULARS OF INVESTIGATORS

12. NAME, DESIGNATION AND ADDRESS OF THE PROJECT CO-ORDINATOR.

CO-ORDINATOR AND EXECUTIVE AUTHORITY:

Dr.B.B. BINDROO
Director CSRTI, Berhampore
West Bengal

12 a) INVESTIGATORS

PRINCIPAL INVESTIGATOR:

Name : Dr. Jalaja S. Kumar (up to 31.5.2016), Scientist -D
Date of birth : 15.06.1962
Sex : Female
Address **:** Central Sericultural Research & Training Institute,
Central Silk Board, Ministry of Textiles: Govt. of India,
Berhampore - 742 101, West Bengal, India

Name : Mr. Suresh K. (w.e.f. 1.6.2016), Scientist -B
Date of birth : 13.07.1988
Sex : Male
Address **:** Central Sericultural Research & Training Institute,
Central Silk Board, Ministry of Textiles: Govt. of India,
Berhampore - 742 101, West Bengal, India

CO-INVESTIGATORS:

Name : Dr. M.K. Ghosh (upto 31.3.2016), Scientist –D
Date of birth : 11.01.1959
Sex : Male
Address : CSR & TI, Berhampore, West Bengal

Name : Dr. P.K. Ghosh, Scientist –D
Date of birth : 06.06.1957
Sex : Male
Address : CSRTI, Berhampore, West Bengal

Name : Dr. A.K. Misra (upto 31.9.2013),, Scientist –C
Date of birth : 07.09.1953
Sex : Male
Address : CSRTI, Berhampore, West Bengal

13. NUMBER OF PROJECTS BEING HANDLED BY EACH INVESTIGATOR AT PRESENT

1. Dr. Jalaja S. Kumar : Nil
2. Dr. M.K. Ghosh : 02
3. Dr. P.K. Ghosh : 02
4. Dr. A.K. Misra : Nil
5. Mr. Suresh,K. : 03

14. PROPOSED RESEARCH FELLOWS: Nil

PART III: TECHNICAL DETAILS OF PROJECT

15. INTRODUCTION:

Development of improved mulberry varieties is a continuous process and breeders are always aiming at improving the quantity and quality of mulberry utilizing various methods.

Mulberry is a cross-pollinated plant and its propagation is done through vegetative means, mostly by cuttings or grafts. The vegetative reproduction leads to the perpetuation of the characters with great precision. Therefore, once a promising variety is developed, its characters can be perpetuated through cuttings.

15.1: DEFINITION OF THE PROBLEM

15 a. ORIGIN OF THE PROJECT

Development of high yielding mulberry varieties through various breeding methods is a continuous process. The present study envisages to utilize the physiological growth parameters as markers for selecting high yielding varieties

15 b. EXPECTED OUTCOME

The successful completion of the project is expected to come out with superior mulberry varieties with high yield.

15.2: ORIGIN OF THE PROPOSAL/ RATIONALE OF THE STUDY

So far, development of the improved mulberry varieties has been accomplished mainly on the basis of indirect selection for yield based on morphological characters. Through this approach, it is certain that some physiological traits with direct effects on yield have been concurrently improved with yield. The continuing pressure to produce higher yielding cultivars has simulated interest in physiological factors contributing to final yield and in possibilities for using such factors for selection (Buttery and Buzzell, 1972).

Considerable improvement in a crop variety indicates mostly the genetical improvement which may be considered as a permanent one. However, yield as a selection trait provides only an empirical evaluation without giving information on the metabolic process that underline the productivity. Hence, selection based on morphological traits alone may not be able to bring about commendable genetic improvement.

In the long run, the most effective approach would seem to be to identify physiological components causing varietal differences in economic yield and require understanding of genetic control thereby leading to more rapid and predictable yield improvement (Wallace *et al.*, 1972). Genetic behaviour and dry matter accumulation studies have long been in vogue to assess the physiological basis of yield in crop plants (Evans, 1975). Certain breeding programmes have also utilized the growth analysis procedures in evolving improved crop cultivars. Growth determinants such as Crop growth rate (CGR), Relative growth rate (RGR), Net assimilation rate (NAR), Leaf area duration (LAD), Biomass duration (BMD and Leaf area index (LAI) have been analyzed in various crop plants and marked variability was observed. Growth analysis also plays an important role in comparison of genotypes of a species as a part of breeding programme (Wilson and Cooper, 1969; Tollenaar,1991).

Identification of these physiological components of yield and their genetic controls should make it possible to plan crosses to maximize segregation of genotypes possessing the physiological complementation and balance required for high yield, thereby leading to more rapid and predictable yield improvement.

Analysis of physiological basis of yield improvement may provide insight into avenues for future yield improvement combining the physiological trait with other desired morphological traits that have been accumulated in elite varietal selections.

Future yield increases may come about by modifying the physiological traits that affect yield. Identification of these physiological components of yield and their genetic controls should make it possible to plan crosses to maximize segregation of genotypes possessing the physiological complementation and balance required for high yield, thereby leading to more rapid and predictable yield improvement.

Analysis of physiological basis of yield improvement may provide insight into avenues for future yield improvement combining the physiological trait with other desired morphological traits that have been accumulated in elite varietal selections. Parents for crosses based on potential physiological complementation assuming genetic recombination of recognized physiological components will on the average give more high yielding progenies than crosses between parents for which nothing is known about the component ability.

For initiating a breeding programme for bringing about genetic improvement of yield and other component characters, requires information on the nature and magnitude variation in available material and knowledge of association of various plant characters with yield and among themselves is required so that a rationale choice of characters of selection can be exercised.

Growth behavior and dry matter accumulation studies have long been in vogue to assess the physiological basis of yield in crop plants (Evans,1975). Certain breeding programmes have also utilized the growth analysis procedures in evolving improved crop cultivars (Wallace *et al*,1976). Growth analysis studies assist in explaining growth from the view point of dry matter production by analyzing total growth into a series of components of growth of foliage, shoots, stem and root. Growth determinants such as crop growth rate (CGR), relative growth rate (RGR), net assimilation rate (NAR), leaf area duration (LAD), leaf area index (LAI) etc., have been analyzed in crop plants and marked variability was observed. Growth analysis also plays an important role in comparison of genotypes of a species as a part of breeding programme (Wilson and Cooper,1969). It is evident that components of plant growth and the genetic variation could contribute greater to an improvement of crop (Tollenaar,1991).

Many studies have been conducted during the past 70 years to identify the physiological processes that control yield. Although, the exact mechanism involved in many of these processes and how these processes interact under various environmental conditions are still not known; progress has been made in their identification and the experimental methodology used in their analysis (Fedrick and Hesketh, 1994).

Yield in most crops is the result of an integration of many physiological processes that occur during growth and development. These processes are expressed at the morphological, phenological, physiological and biochemical levels of organization and in most cases are controlled by many genes. Since many factors control yield and the contribution of each factor to yield may vary with environment and even cultivars within a species, it remains to be seen whether one physiological trait can be widely used as a selection criteria in yield improvement programme. However, this task may not be impossible as selection for individual traits has been used with some degree of success in maize (Hageman and Lambet,1987).

However, leaf yield, morphological parameters and physiological parameters such as leaf area, leaf area duration, specific leaf weight etc., are composite characters and generally the relationship considered as trivial and purely formal at first sight. Physiological traits may be helpful in the choice of morphological characters which may be used as secondary traits in indirect selection.

Many approaches have been used in the development of high yielding cultivars. Such approaches range from selection for yield to selection of physiological traits associated with high yield. The present study is aimed at utilizing the physiological components responsible for high yield in mulberry in screening and selection to obtain high yielding varieties.

15.3: RELEVANCE TO THE CURRENT ISSUES AND EXPECTED OUTCOME

The study is very much relevant to the current sericultural conditions as the main objective of mulberry breeding is to continuously put efforts for developing high yielding varieties for commercial exploitation by farmers

15.4 OBJECTIVES

To develop mulberry varieties with superior quality and with 10% higher leaf yield over the ruling variety.

16. REVIEW OF STATUS OF RESEARCH AND DEVELOPMENT OF THE SUBJECT.

16.1 INTERNATIONAL STATUS

At the international level, physiological growth analysis parameters have not been used for development of mulberry. However, a lot of work on the above aspect has been done in other crops which have been reviewed.

One of the first attempts to analyze yield in terms of antecedent growth was made by Balls and Holton (1915) and Balls (1917) on the cotton crop in Egypt. The height measurements were used to account for short period fluctuations in flowering.

The first step in developing a procedure for analyzing growth in terms of changing dry weight was made by Blackman (1919). He pointed out that increase in dry weight can be regarded as a process of continuous compound interest, the increment produced in any interval adding to the capital for growth in subsequent periods. In sugar beets and wheat, differences in leaf area per plant were mainly due to variation in leaf size and not due to leaf number per plant between varieties in same year and between years in same crop. The differences in yield of dry matter reflected mainly the differences in leaf area (Watson, 1947).

The mean yields of dry matter for wheat, barley, potatoes and sugar beet were found to be approximately proportional to mean Leaf Area Duration (LAD), so the ratio of dry matter yield to LAD was nearly the same for the crop studied (Watson, 1947 a). Watson (1953) stressed the importance of leaf growth while reviewing the physiological basis of variation in yield.

The increase in LAR during early period of growth and subsequent decrease was primarily caused by initial increase in the growth of leaves compared to stem and *vice versa* (Friend *et al* ,1965). Troughton (1965) reported that the RGR of shoot system in *Lolium perenne* depends upon the growth of its component parts viz., the number of tillers and their size; it was found to be positively correlated to these attributes. Thus variation in RGR of shoot between plants is most likely due to variation in both components.

Mc Cree and Troughton (1966) observed no optimum LAI for the production rate of white clover. Both photosynthesis and respiration were maximum at the highest LAI. Brown and Blaser (1968) reviewed the various concepts of growth and its usefulness in pasture grass management. Expansion of research on the inter-relationships among leaf area, light interception, photosynthesis and growth has increased the possibilities for more efficient light utilization and the production of higher yield.

The basis of differences in yield between six sugar-beet varieties was studied (Loach, 1970) by measuring the changes in their leaf areas and dry weights. Varieties that maintained the largest net assimilation rates produced largest sugar yields and showed smallest losses in lamina dry weight through leaf senescence. Buttery and Buzzel (1972) recorded significant varietal difference in mean Relative Growth Rate in soyabean cultivars. The environmental correlation indicated that those plots with high NAR tended to have a high RGR and RLGR and vice versa.

Wallace *et al.,* (1972) examined aspects of genetic variation related to growth analysis, harvest index, light interception and utilization, net CO_2 exchange, translocation and portioning and stressed the importance of identifying physiological components which affect economic yield and select for these in breeding programmes.

Delanney and Dobrens (1974) found SLW in different alfa alfa genotypes was related directly to the thickness of leaf and of palisade tissue and inversely to leaf area. However, Barnes *et al*., (1969) concluded that SLW and leaf area were under separate genetic control, with all possible combination being encountered. Yoshida (1972) and Evans (1975) while reviewing the factors influencing the crop productivity, stressed the importance of source size in productivity. They observed that increased Crop Growth Rate (CGR) and productivity in many recently developed crop varieties are essentially due to increased leaf area.

Roberts and Wareing (1975) examined the extent of the variation in growth rate between several selected genotypes of Scots pine (*Pinus sylvestris* L.) and the physiological characteristics underlying such variation through growth analysis and direct measurement of photosynthetic rates. Differences in relative growth rate (RGR) and Net Assimilation Rate (NAR) in first two years of seedlings reflected in the size differences at the 14th year and found important in the assessment of performance in tree breeding programme. Hurd (1977) has conducted various studies on plant growth analysis in controlled environments and field conditions and developed statistical methods of fitting curves to log dry weights and long leaf areas.

Wilhelm and Nelson (1978) recorded higher mean net assimilation rates and higher mean relative leaf area growth rate for the high yielding genotypes than the low yielding genotypes in Tall fescue. Growth analysis of tall fescue indicated that high yielding genotypes exhibited greater increase in leaf dry weights and leaf area between harvests compared to low yielding genotypes. In forage crops it was found that high yielding genotypes had greater leaf growth rates and were able to develop a larger plant size resulting in high yields (Wilhelm and Nelson, 1978a).

Hunt (1984) compared two new schemes for analyzing the rate of crop dry matter production per unit area of ground (CGR) followed by integrated growth analysis in which CGR is taken as the product of biomass and the relative growth rate (RGR) of individual plants and further sub-divided to the various concepts of traditional plant growth analysis (Hand *et al.,* 1985, Evans, 1975 Hunt, 1982).

Machii (1984) reported that RGR increased with the growth of plants in mulberry. The growth pattern of *M. acidiosa* has been discussed in relation to RGR, NAR and LAR during different seasons.

Shih and Snyder (1984) observed a linear relationship between dry matter accumulation and LAI until LAI reached 10 (r^2 = 0.8 to 0.97). According to Kokubun (1988) seed yields in soybean were positively correlated with Crop Growth rates (CGR) and Leaf Area Indices (LAI) at all growth stages, particularly with CGR during late flower to early pod growth. Further, he opined that increasing soybean seed yield needs increasing LAI from earlier growth stage, and also reducing the decline of NAR with increasing LAI.

Machii (1988) investigated the process of dry matter production in M strain of mulberry and recorded variation in CGR, NAR and LAI in different strains and also reported that differences in CGR and LAI existed between the varieties of mulberry and improved strains maintained lager LAI.

Tollenar (1991) has analysed the physiological basis of genetic improvement of Maize hybrids from 1959 to 1988. He attributed the improvement in dry masses accumulation from old to new hybrids to increased yield and tolerance of high plant density. Corlwy and Lee (1992) evaluated the physiological basis for genetic improvement of oil palm in Malaysia in terms of dry matter production and partitioning by comparing unselected and selected deli dura palms. It appeared that breeding has contributed about half the yield increase for maize.

The value of the optimum leaf area index at which the net photosynthesis of a population or foliage was investigated by Ito (1997) for mulberry using the simulation programme in which a model mulberry population is generated and its light intercepting conditions and net photosynthesis are predicted through the method of numerical experiment. Simulations predicted that the optimum LAI was never constant.

Ehara *et al*., (1998) conducted a field test to analyse the growth characteristics and compensatory effect on the yield of rice broadcasted in submerged soil at four levels of seedling density. The relative tillering rate (RTR) and relative growth rate (RGR) were greater in higher density plots in the early growth stage and greater at lower seedling densities in the subsequent growth stage. The difference in RGR was mainly attributed to LAR in the early growth stage and NAR in the subsequent stage. A difference in specific leaf area was observed during the growth period which was responsible for the difference in LAR and NAR at 58-79 days after sowing.

Analysis of the production structure and yield components were made for mulberry varieties adapted to warm districts of Japan (Machii, 1984, 1988; Machii *et al*., 1985; Iwata *et al.*, 1985) and also varieties adapted to snowy districts (Yakuwa *et al.*, 1987).

Khokhal et al., (1999) evaluated growth analysis of different cultivars of garden pea (*Pisum sativum*) and noticed continuous increase of dry matter linearly with LAI and CGR. High yielding cultivars recorded more LAI, DMA and CGR. Xu *et al*., (1997) recorded higher dry matter production for a newly bred high yielding rice cultivar, Takanari. Takanari exhibited higher NAR owing to better light intercepting characters and the CO2 exchange rate.

Ookawa *et al*., (1999) found higher CGR dry matter production and high NAR in high yielding soybean (*Glycine max*) cultivar, Tachinagaha when compared with Emrei, a relatively low yielder.

16.2 NATIONAL STATUS

The studies on genetic and physiological parameters on mulberry are meagre. In the absence of sufficient information pertaining to growth analysis in mulberry, the literature has been reviewed for other crops also.

Studies on growth analysis of *Trigonella foenum-gracum* and *T. corniculata* revealed that RGR was maximum at vegetative stage and then declined and increased again at fruiting stage. Maximum NAR in both the species was at later stage. RGR and NAR exhibited positive correlation in both the species, while LAR and SLR showed negative correlation with plant biomass in two species (Anand and Sharma, 1992).

Gupta *et al.*, (1980) envisaged a study of parents and their hybrids for seven developmental traits and eleven growth stages in upland cotton. The parents and hybrids showed almost similar pattern of dry matter production. Venkataramana *et al*., (1984) evaluated various sugarcane varieties using growth analysis. NAR and RGR were found to be high during the early growth stages but declined with the age of crop.

Neelam Kumari *et al*., (1992) examined the dry matter accumulation and growth of four brassica cultivars and basis of difference in biomass production seemed to be LAI and or NAR which were linearly related. Bhatt *et al*., (1993) recorded marked differences in dry matter production specific leaf weight and NAR in different genotypes of *Pennisetum pedicillatum.* Dry matter accumulation showed positive significant correlation with LAI, SLW and NAR indicating direct positive effects of these characteristics on dry matter production.

Chauhan *et al.* (1996) noticed wide variation in growth parameters, biological yield and harvest index in upland rice genotypes. They suggested that breeding lines with higher physiological efficiency as exemplified by CGR, NAR, LAI and harvest index may be used as donors in a breeding programme to improve rice yield under rainfed upland condition. Hussain *et al*., (1997) observed strong correlation of total dry matter production both with that and post flowering leaf area duration. However, seed yield was poorly related with LAD.

Dutta and Mondal (1998) demonstrated that seed yield in lentil (*Lens culinaris* Medik) genotypes did not depend on leaf area development, leaf area ratio and nitrate reductase activity . On the other hand, total dry matter CGR, NAR, RGR, soluble protein and harvest index showed significant and positive correlation with seed yield indicating prime importance of photosynthetic potential of varieties and proper distribution of assimilates towards the reproductive growth for the maximum yield expression of lentil.

Studies on physiological basis of yield variation in short duration cultivars of rice revealed positive association of LAI, SLA, LAR, RGR, NAR, CGR, RLGR and LAD with grain yield (Sahoo and Guru, 1998). LAD (flowering to maturity) RLGR (46 to 60 days) and both LAI and LAR at flowering were found to be suitable physiological parameters to fit in regression equations for predicting grain yield of rice.

Kumar et al., (2010) have computed the physiological growth parameters in mulberry during different growth periods and found that all the growth analysis parameters showed significant variation between varieties. They have also concluded that LAD, BMD, LAI and RGR have significant co-relation with leaf yield and can be used for predicting yield while screening and selecting mulberry varieties.

16.3 IMPORTANCE OF THE PROPOSED PROJECT IN THE CONTEXT OF CURRENT STATUS

Development of mulberry varieties for higher yield is a routine procedure. However, a barrier has been reached in obtaining high yield. Marker assisted breeding is the new concept being employed for directional breeding. The present study is aimed at improving the leaf yield using physiological growth parameters which has not been tried till date. It is expected that mulberry varieties with high yield can be developed using this methodology which will be very useful for the farmers of the eastern and north eastern regions.

16.4 ANTICIPATED PRODUCTS, PROCESSES/TECHNOLOGY, PACKAGES/ INFORMATION OR OTHER OUTCOME FROM THE PROJECT AND THEIR EXPECTED UTILITY

The expected outcome of the project will be identification of about 20 promising varieties with high productivity which may be further be evaluated under Primary yield Trial(PYT).

16.5 EXPERTISE AVAILABLE WITH PROPOSED INVESTIGATION GROUP / INSTITUTION ON THE SUBJECT OF THE PROJECT:

Expertise on all the parameters envisaged to be studied is available within the investigating group with all the investigators having sufficient experience in mulberry breeding.

17. WORK PLAN

17.1 Methodology:
Parents selected for the study:

Female parents			
SN.	**Name**	**Accession No.**	**Source**
1	M. indica HP	MI - 0099	India (WB)
2	China White	ME - 0042	China
3	Chinese F_1 10	-	India (WB)
4	MS-30	-	India(Mysore)
5	M. multicaulis	ME - 0006	Russia
6	Kajli OPH	MI - 0068	India (WB)
Male Parents			
1	V- 1	S30 × C776	India (Mysore)
2	Ac.No.1190	CSRT-MI-0050	India(Mysore)
3	Almora Local	MI - 0015	India (UP)
4	Berhampore-B	CSRT-MI-0003	India (WB)
5	Bishnupur-10	MI - 0117	India (WB)
6	C-776	English balck x Multiculis	India (WB)
7	Charitul	MI - 0169	India (J & K)
8	English Black	ME - 0004	France
9	Kosen	ME - 0066	Japan
10	KPG-1	MI - 0144	India (WB)
11	MS-7	CSRT-MI-0069	India (Mysore)
12	Nagaland	MI - 0167	India (Nagaland)

Hybridization of selected parents and raising progeny. Selection of seedlings utilizing physiological growth parameters.

hybridization will be conducted between the selected parents mentioned above, seeds will be collected and sown in nursery for raising seedlings.

The seedlings will be transplanted to a seedling plot and data will be recorded on the morphological and yield contributing traits during rainy season and non-rainy season. The Promising seedlings will be further short listed utilizing physiological growth analysis parameters - Crop growth rate (CGR), Leaf area duration (LAD), Biomass duration (BMD) and Leaf area index (LAI). Superior genotypes will be shortlisted and subjected to rooting test. A joint score analysis of all parameters will be done and finally about 20-35 genotypes will be selected for Primary Yield Trial (PYT).

17.2: ORGANISATION OF WORK ELEMENTS

Sl. No.	Name of the scientist	Designation	Time	Organization of work elements
1.	Dr. Jalaja S. Kumar	Scientist - C	40%	Hybridization and recording data on the morphological and yield contributing traits
2.	Mr. Suresh, K.	Scientist - B	30%	Recording data on the morphological and yield contributing traits. To study physiological growth analysis parameters of promising progenies. Propagation and Rooting studies of promising progenies
3.	Dr. M.K. Ghosh	Scientist - D	10%	Co-investigator will assist in execution ofthe experiments in the project.
4.	Dr. P.K. Ghosh	Scientist - C	10%	Hybridization and recording data on the morphological and yield contributing traits
5.	Dr. A.K. Misra	Scientist - C	10%	Co-investigator will assist in execution of experiments related to physiology in the project.

17.3 PROPRIETARY / PATENTED ITEMS, IF ANY, EXPECTED TO BE USED FOR THIS PROJECT: Not applicable

17.4 SUGGESTED PLAN OF ACTION FOR UTILIZATION OF THE EXPECTED OUTCOME FROM THE PROJECT

The 20-25 high yielding varieties genotypes isolated will be utilized for further evaluation under PYT.

17.5. TIME SCHEDULE OF ACTIVITIES GIVING MILESTONES

Sl. No.	Milestone / Activity	Expected Date of		Expected Outcome/visible / measurable indicator
		Starting	Completion	
1	Tagging of selected parents, cultural operations.	Oct. 2012	Dec., 2012	Selected parents will be maintained
2	Pruning of parents, hybridization between selected parents and collection of seeds.	Jan. 2013	Mar. 2013	Seeds of crossing programme will be collected.
3	Raising of seedlings and establishment of seedling plot.	Apr. 2013	Mar. 2014	Seedling plot will be established.
4	First round selection under irrigated condition/ rainy season.	Apr. 2014	Mar. 2015	Isolation of superior genotypes.
5	Second round selection under non-rainy season.	Apr. 2015	Mar. 2016	Isolation of superior genotypes.
6	Propagation and Rooting studies.	Apr. 2016	Jun. 2016	Isolation of superior genotypes.
7	Joint-score analysis of data, short listing of 20-25 genotypes for inclusion under PYT and report preparation.	July, 2016	Sept. 2016	Promising genotypes for PYT and Final report.

17.6. PROJECT IMPLEMENTING AGENCY/ AGENCIES :

Name of the Agency	Address of the Agency	Proposed Research Aspects	Proposed Amount	Cost Sharing %
CSB	CSB,Bangalore			100 %

PART IV: BUDGET PARTICULARS

18. **BUDGET (in Rupees): Rs.2.15lakh**
[In case of multi-institutional projects, the budget details should be provided separately for each of the institute]

A. Non-Recurring (e.g. equipments, accessories, etc.) [Rupees in Lakh]:

B. Recurring:
B1. Manpower: -

Sl.No.	Position	Nos.	Consolidated Emoluments	1st Yr	2nd Yr	3rd Yr	4th Yr	5th Yr	6th Yr	Total
	JRF/SRF/RA	Nil	NA	-		-		-		-
	HRA	NA	NA	-		-		-		-
	CCA	NA	NA	-		-		-		-
	Sub-total B1:	-	-	-		-		-		-

B2. Consumables:

Sl. No.	Item	1st Yr	2nd Yr	3rd Yr	4th Yr	5th Yr	6th Yr	7th Yr	Total
1.	Stationeries/ Office Contingencies.	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.35
2.	Research Operations (FYM, Fertilizers) .	-	-	0.10	0.10	0.25	030	0.35	1.05
3.									
	Sub-total B2:	**0.05**	**0.05**	**0.15**	**0.15**	**0.30**	**0.35**	**0.40**	**1.45**

Other Items:

Sl.No.	Item	1st Yr	2nd Yr	3rd Yr	4th Yr	5th Yr	6th Yr	7th Yr	Total
B3	Travel								
B4	Contingency	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.70
B5	Overhead charges								
	Sub-total (B1+B2+B3+B4+B5) :	**0.15**	**0.15**	**0.25**	**0.25**	**0.40**	**0.45**	**0.50**	**2.15**

PART V: EXISTING FACILITIES

19. AVAILABLE EQUIPMENT AND ACCESSORIES TO BE UTILIZED FOR THE PROJECT:

[Should be provided separately for each of the Institution]

Sl.No.	Name of the Equipment / Accessory	Required or not	Make	Model	Funding Agency	Year of Procurement
1.	WORKSHOP FACILITIES	-				
2.	WATER & ELECTRICITY	✓				
3.	STAND-BY POWER SUPPLY	✓				
4.	LABORATORY SPACE & FURNITURE	✓				
5.	AIR CONDITION ROOM FOR EQUIP	-				
6.	TELECOMMUNICATION	-				
7.	TRANSPORTATION	-				
8.	ADMIN. & SECRETARIAL SUPPORT	✓				
9.	LIBRARY FACILITIES	✓				
10.	COMPUTATIONAL FACILITIES	✓				
11.	REARING / GLASS HOUSE	✓				
12.	MULBERRY GARDEN	✓				
13.	REARING EQUIPMENT	✓				
14.	LAND	✓				
15.	LABOUR	✓				
16	SPECTROPHOTOMETER	✓				
	HOT AIR OVEN	✓				
16.	ANY OTHER					

All the facilities including the equipments required for implementation of this project are available in Mulberry breeding and Genetics section.

PART VI: REFERENCES

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