

## I ORGANIZATION DETAILS

### Organization profile

<b>Organization Name</b>	: Vigyan Ashram
<b>Address</b>	: A Centre of Indian institute of education At/Po - Pabal, Tal -Shirur, Dist.-Pune. 412 403
<b>Mobile No.</b>	0213829236
<b>Email ID</b>	: vapabal@gmail.com
<b>Website</b>	: <a href="http://www.vigyanashram.com">http://www.vigyanashram.com</a>
<b>Founder</b>	: Dr. S. S. Kalbag.
<b>Director</b>	: Dr. Yogesh Kulkarni

### Organization background

Vigyan ashram is centre of Indian Institute of Education. Vigyan ashram is located in village Pabal approximately 70 km from Pune on Rajgurunagar-Shirur road. A scientist turned education list late Dr. S. S. Kalbag started Vigyan Ashram in 1983 to find out a solution to the problem in education ‘‘Vigyan’’ means a search of truth and ashram symbolizes simple living and high thinking, it is a modern version of the old Gurukul system. Over the year Vigyan ashram developed a complete program for giving training to the youth in rural and urban areas. Vigyan ashram developed several innovations and technologies and successfully commercialized them by training school drop outs. Many governments and private organization and individual donor supported program of the ashram.

Vigyan ashram believes in philosophy of learning while doing. It is the same way by which we learn to speak out mother tongue. This natural system of learning teaches us without overburdening us by teaching learning process. It believes activity to hand is the

quickest way to developed intellect. And also believes various rural development tasks can be integrated with school education.



## **TRAINING PROGRAMS**

Vigyan ashram conducts different training programmes throughout the year the different training programmers are user level courses, technician level courses, management level courses, academic level courses, awareness courses (through multimedia system) and technology transfer camps (off campus).

## **DIPLOMA IN BASIC RURAL TECHNOLOGY ( DBRT PROGRAM)**

DBRT is one year residential diploma courses offered at Vigyan Ashram. This course is recognized by the National Institute of open schooling and useful for students interested to learn by hands this is a multi-skill program in which training is given in the area of works in each of the section for 3 months they will work along with instructors to give various services. Most of the campus of Vigyan ashram is built by our own students as part of their project work.

- **Engineering:** (Fabrication & Construction & Basic Carpentry, Engineering, Drawing & Costing)
- **Energy & Environment:** (Electrical, Motor Rewinding, survey techniques, Solar/Biogas etc.)
- **Home and Health:** (Sewing, Food Processing and Rural lab)
- **Agriculture & Animal Husbandry:** playhouse, poultry, goat farming, dairy.

- **FAB LAB**

Centre of Bits and Atoms of Massachusetts Institute of Technology (MIT), USA installed a FAB LAB at Vigyan ashram. FAB LAB is a collection of set of computer operated fabrication tool which empowers to do lots of things. Rural areas are having lots of problems. Each problem is an opportunity to get some solution, but it is true that many of the scientific institution and big R & D Lab might not be interested in finding solution to the small problems Reason is very simple, the potential volume of such solution will be limited.

Equipment of FAB LAB at Vigyan Ashram.

Following equipment are installed at Vigyan Ashram

1. Laser Cutting Machine.
2. Scroll Saw.
3. Computers (models software).
4. LCD Projector, Printer, Digital Camera.
5. Electronic table (soldering equipment, etc.)

Vigyan Ashram encourages invention and innovation and put them to use. They also try to develop technology for income generation. Many of the technologies are developed by their students, who are dropouts from the to present education system.

1. Vigyan Ashram Developed Following Technology:
2. Pabal Geodesic Dome
3. Mechanical Bull Tractor and agricultural equipment's
4. LED Lighting solutions for rural areas
5. Biogas based Electricity generation

## **OBJECTIVE OF ORGANIZATION**

Following are the objective of organization:

- To learn while doing.
- To provide same quality of education to all.
- To use modern technology to improve quality of education
- Every Village will have the equipment and the skills that are the basis of all modern industry. To achieve the inventions at very low cost.

### **III INTRODUCTION**

The Black soldier Flies are sleek looking that many confuse with a Wasp. However like most flies, the Black Soldier Flies only have two wings (Wasp has four) and does not possess a stinger. Although the loud buzzing they create when flying is enough to concern many people, adult soldier flies pose no danger. The Black Soldier Fly is often associated with the outdoor and livestock, usually around decaying organic matter such as animal waste and plant material. Since Black Soldier fly larvae consuming decaying matter, they have been used to reduce animal manure in commercial swine and poultry facilities. Although they are not known as a disease vector, adult soldier flies are a potential mechanical vector of various pathogens. A more likely negative interaction would be accidental ingestion of Black Soldier Fly larvae by animal or human. The adult larvae are Black and Blue in color and some have metallic appearance. The adult soldiers are ranges from 15 to 20 mm in length. The female BSF deposits a mass of about 500 eggs in crack and crevices near or in decaying matter such as dung, garbage and other organic waste. The eggs hatch into larvae in about 4-5 days. Each oval shaped egg is about 1 mm in length and pale Yellow in color. The larvae can reach 27 mm in length and 6 mm in width in 14 days. They are whitish color with small projection mouth part. The larvae pass through six instars and require approximately 14 days completing development. During development BSF larvae are insatiable feeders. As adults they do not need to feed and rely on the fats stored from the larval stage. Before pupation, the sixth instar larvae disperse from the feeding site to dry sheltered areas to initiate pupation. The exoskeleton (skin) darkens and a pupa develops within 15-20 days. Pupation requires about two weeks. . Also for growing and multiplication of Black Soldier Flies the system required necessary environment, in which temperature required about 30°C-35°C, humidity is about 70% and darkness required at the stage larvae undergoes the pupation period.

#### **Objective:**

1. To develop the system with necessary environment for multiplication of Black Soldier Flies.

**Scientific classification:**

Kingdom	Animalia
Phylum	Arthropoda
Subphylum	Hexapoda
Class	Insecta
Subclass	Pterygota
Infraclasse	Neoptera
Order	Diptera
Suborder	Beachycera
Family	Sratiomyidae
Sub-family	Hermetiinae
Genus	Hermetia
Species	Hermetia illucens

## **II PROBLEM DEFINATION**

For decaying the organic waste, Black Soldier Flies are used. It is known from the study that, BSF requires specific conditions for completing their lifecycle. The specific conditions like temperature, humidity, darkness. The temperature requires about 30°C-35°C, humidity is about 70% and darkness required till BSF undergoes the pupation period.

Life phases of BSF-

1. Eggs stage
2. Larvae stage
3. Pre-pupation stage
4. Pupation stage
5. Fly stage

Challenge is to develop the system which can maintain the above mentioned conditions.

## IV REVIEW OF LITRATURE

### Introduction-

For development of the system with necessary conditions for the multiplication of BSF, following literatures reviewed.

**Limaye.T.N *et al.*(2018) [1]**- This book is for study and understanding the lifecycle of Black Soldier Flies and to take the knowledge about growing and multiplication of Black Soldier Flies, and also how to maintain their necessary conditions. Also information about required structures and how it fabricates for producing Black Soldier Flies

**Paul Donahue *et al.*(2017) [2]**- Technical handbook of domestication and production of dipteran Black Soldier Flies, *Hermetia illucens*. This technical book which was prepared for a board audience ranging from scientists to producers, sums up knowledge on Black Soldier Flies biology and rearing. So it aims is spreading knowledge and know how gained during the Bioconversion project.

## V SCHEDULE OF WORK

Sr. No.	Date	Schedule of work
1.	01.01.2019.	Reporting to Vigyan Ashram.
2.	02.01.2019-  15.01.2019.	<p>Campus visit for understanding projects and works undergoing In Vigyan Ashram and the work culture.</p> <p>Made protection cover for six bulbs as assignment</p> <p>Worked with other interns on assignment of manually operated chopper.</p> <p>Learning of plasma cutting machine, laser cutter, and 3D printer, Basic information about solid works software, 123D software and Google sketch up software.</p>
3.	16.01.2019-  31.01.2019.	<p>Black Soldier Flies (BSF) as project allocated by Dixit sir.</p> <p>Repairing works of composter shaft includes sharpening and welding operations done.</p> <p>Practice and learning of design software like Sketch up, 123D design as assignment done.</p> <p>Technical discussion and lecture on Distillation unit problem by Dixit sir.</p> <p>Literature study of the project related data and information.</p> <p>Did voluntary work in the village and cleaning of Ashram area on the occasion of Republic day.</p> <p>Celebration of republic day.</p>

4.	1.02.2019-  15.02.2019.	<p>Information and data about Domes available in Vigyan Ashram studied from VA website and blogs.</p> <p>Allotment of Dome where the project will run, done along with discussions related to project with Project guide.</p> <p>Knowing about structure required for project and searching regarding the details of structures.</p> <p>Cleaning of the dome and shade net is covered around the dome from outside for controlling the temperature. Foams are placed in between the dome and shad net for better temperature control.</p>
5.	16.02.2019-  28.02.2019	<p>The darkness is necessary for BSF larvae in project, so the black paper is covered from where the light is coming into the dome like windows and some other holes.</p> <p>Styrofoam placed at windows and installation of exhaust fan into the dome for controlling temperature and humidity.</p> <p>Old structure of setup was too lengthy to install in dome so reworks of it done according to dome size.</p> <p>Lecture on Artificial Intelligence.</p>
		<p>Repairing of the door of dome.</p> <p>Lecture on Carbon and Nitrogen cycle by Dr. Dixit sir.</p>
	15.03.2019.	<p>Experimentation for attracting the Black Soldier Flies done by taking cows feed and water in a tray and waiting for 3-4 days.</p>

		Another experiment with old BSF culture and 70% water added and waiting about 5-6 days.
7.	16.03.2019-	Due to unavailability of BSF larvae decided only to maintain the required condition and fabricate another type of structure.
	31.03.2019.	Decided to make a hand operated weeding tool after discussions with Dr. Kulkarni sir with the purpose of making digital agriculture tools library.
		Design the agriculture tool in Solid works software and cut it using CNC plasma cutter.
8.	01.04.2019- 15.04.2019.	Lecture on Mendeleev table and balancing the chemical equation.
		To maintain humidity in dome is necessary, so for sieving the gunny bag of size 7ft*5ft and fit it at the top side from the inside of the dome.
		Installed electric motor in dome and made the sprinkler design for spraying water on the gunny bags by sprinkler also installation of the drip system for spraying of water.
		Taken the temperatures and humidity readings inside the dome by spraying of water.
9.	16.04.2019-	Designed a small model for growing the BSF larvae in solid works and made its Bill of Material.
		Lecture on objectives of starting and running Design innovation Centre (DIC).
	24.04.2019	Fabrication of designed model completed in workshop.

## VI WORK ACCOMPLISHMENT

### Procedure followed:

1. Study.
2. Site selection.
3. Infrastructure management.
4. Repairing of structure.
5. Controlling of required conditions.
6. Experiments to attract BSF.
7. Design and fabrication of small model.

### 1. Study

For understanding Black Soldier Flies (BSF), information and data studied from the literature mentioned in chapter IV. Following are the points understood from “Kala Shipai” book of author Mr. Limaye T.N.,

1. BSF’s history –

Native of tropical, subtropical and temperate regions of the American continent, BSF is nowadays present in the rest of the world, between latitude 40° south and 45° north because the atmosphere in this area is naturally suitable for growth of BSF, and has been found in many countries across Europe, Africa, Oceania (Australia and New Zealand) and Asia (Indonesia, Japan, Philippines and Sri Lanka). In India BSF larvae firstly found in Punjab region in the poultry farm.

2. BSF life cycle –

The BSF life cycle varies between populations and environments (temperature, humidity, light intensity, quality and quantity of available food).

- Laying of eggs-

The females lay between 320 and 1000 eggs, on a dry substrate in a humid environment using their ovipositor. Eggs are laid into tight rows, close to a potential food source., and they die soon after oviposition. Eggs have

an ovoid shape, and are about 1 mm long. They change from beige to yellow/beige colour during the incubation period, which lasts from a little bit more than 4 days, to about 3.5 days at 30°C.

- Hatching of eggs-

As soon as larvae have hatched (0.66 mm long), they use surrounding organic matter as a food source. The duration of the larval stage lasts from 4 weeks. Temperature is also a key parameter for larval development and survival rates, the optimum temperature being in the range 30-35°C.

- Larvae-

*Hermetia illucens* characterized by a marked colour change from beige to dark brown, made easier by modification of mouth organs in hooks.

- Pupation-

The last stage refers to pupae, which are 12 to 25 mm long.. Generally, the metamorphosis is completed within 2 weeks and males often emerge earlier than females .

- Flies-

After emergence, young adults take off after few minutes, after they have unfolded their wings. Mating takes place about 2 days after the emergence of the imago and another 2 days are needed before egg laying. An imago lives only 5 to 14 days, its life expectancy being unquestionably dependent on body size and on access to water

### 3. Necessary environment –

The necessary environment for the growth of BSF is temperature required about 30°C-35°C, humidity is about 70% and darkness required until larvae undergoing to pupation period.

### 4. Nutrient value of BSF –

The BSF larvae having the high nutritional value, in the BSF larvae proteins present about 40%-60% also Lipids present about 30%. So the dry larvae are used in feed of poultry and fish farm.

- Converting the wet organic waste into manure -  
 BSF feed the wet organic waste and grow, but after their completion of feeding stage some organic waste is remains. This organic matter is used as feeding to the biogas plant or directly spread in the soil.
- Reproduction and multiplication of BSF -  
 After completion of the pupation period larvae act as a flies and they attracts toward the light. So we provide artificial light in the warehouse. When flies are going into the warehouse, male and female intercourse to each other, and male is die. Female lay eggs and die.
- Structure required - The proper structure is required for the growth and multiplication of BSF is given below.
  - a) Eggs nest
  - b) Puparium
  - c) Papparium tray
  - d) Feeding tray
  - e) Warehouse with light bulb

## **2. Site selection**

There are some standard atmospheric conditions required for the growth, decaying the waste using the Black soldier flies, so for attending this conditions proper site selection is important. Following are the conditions to achieve,

1. The normal temperature required for the growth of Black soldier flies is 30°C to 35°C.
2. Maximum difference in the wet and dry bulb temperature required is about 5°C- 6°C, and the relative humidity is about 70%, also ventilation is required.
3. Darkness is required from hatching stage of eggs to the completion of pupation period. The light is required at the intercourse time of Black soldier flies.

It is found that Dome can be suitable location by considering above factors and the structures available in Vigyan Ashram with objective of controlling

and/or maintaining temperature, humidity.

### **3. Infrastructure management**

#### **1. Eggs nests-**

For the laying of eggs to female BSF in the warehouse eggs nests are required. This nests are in the form of wooden strips, 4-5 strips are join together and bind them by rubber band, keep 1cm distance in between the two strips by providing the drawing pin.

#### **2. Puparium-**

The Puparium is rack like structure in which feeding trays as well as pupation trays are placed one another one vertically, and black polythene paper is wrapped on whole puparium structure. In the puparium BSF eggs are kept for hatching, after hatching larvae feed the waste which is kept in feeding tray.

#### **3. Warehouse-**

Warehouse is the final structure of the project, is fabricate from circular steel bar of 1cm diameter and mosquito net is wrapped around the structure. The bulb is provide in the warehouse. Intercourse of male and female of BSF is done in the warehouse, eggs nests are kept in warehouse for laying the eggs to female BSF.

#### **4. Feeding tray-**

Feeding trays are kept in the pupation trays, and the organic waste is kept in the feeding tray. When the larvae hatched then they feed this waste about 15kg having 70% water by 10000 larvae in 12-15 days.

#### **5. Puparium trays-**

BSF larvae are undergoing the pupation period after 15-18 days from hatching. BSF larvae are purane For undergoing the pupation larvae required dry matter like powder of tree leaf, so keep these type of matter in pupation tray about 5cm thick layer.



**Fig: 3.1 Eggs collecting nests**



**Fig: 3.2 Puparium for pupation**



**Fig: 3.3 Warehouse**

#### 4. Repairing project structure

The project structure is required to repair according to Dome size.

- Cutting of steel bar of warehouse -

The warehouse bar is cut at the right side four corners to reduce the width of the warehouse.

- Welding of steel bar-

Weld the cutting bars at respective corners and join.

- Repairing of dome door-

The door of dome was broken, so hinges of the door replaced.



**Fig: 4.1 Cutting of warehouse structure**



**Fig: 4.2 Welding of Warehouse**



**Fig: 4.3 Repairing of dome door**

## **5. Controlling Temperature and Humidity**

For the growth of Black soldier flies controlling temperature and humidity conditions and proper ventilation with darkness is necessary.

- **Temperature-**

To reduce temperature inside the dome, outer surface of dome covered by Styrofoam and these foams are covered by shed net. In Winter if temperature goes below the required then due to foam, temperature can maintained at required level in dome. Table 5.1 shows the data of temperatures and humidity inside the dome with current arrangements around the dome.

**Table no.5.1 Data of temperature and humidity,**

<b>Sr. no</b>	<b>Time</b>	<b>Dry bulb temperature</b>	<b>Wet bulb temperature</b>
1.	11 am	25°c	20°c
2.	12 am	28°c	22°c
3.	1 am	30°c	22°c
4.	2 am	32°c	24°c
5.	3 am	35°c	24°c
6.	4 am	34°c	23°c
7.	5 am	33°c	22°c
8.	6 am	32°c	21°c
9.	7am	28°c	19°c
10.	8 am	27°c	19°c

**Data from the table 5.1 shows that the average temperature during the day hours from 11 am to 8 pm is 30.4 and the humidity is .....%**

**So, it is necessary to increase humidity from ...% to ...%.**

- **Humidity-**

To maintain humidity at 70%, two experiments were conducted as mentioned below:

Exp.1. Spraying of water by the hand spray

In this experiment water is sprayed by hand spray after each one hour. Table 5.2 shows the data of temperatures and humidity during the experiment:

**Table no.5.2 Data of temperature and humidity for experiment 1**

<b>Sr. no</b>	<b>Time</b>	<b>Dry bulb temperature</b>	<b>Wet bulb temperature</b>	<b>Water sprayed in lit</b>	<b>Humidity (%)</b>
1.	11 am	28°c	23°c	1.30	63
2.	12 am	28°c	24°c	1.70	71
3.	1 am	29°c	24°c	2.00	66
4.	2 am	32°c	26°c	2.20	63
5.	3 am	31°c	25°c	2.20	62
6.	4 am	30°c	25°c	2.30	66
7.	5 am	29°c	24°c	2.40	65.9
8.	6 am	28°c	23°c	2.00	65.2
9.	7am	26°c	21°c	1.90	64
10.	8 am	25°c	20°c	1.80	63

**Data from the table 5.2 it is observed that the average temperature during the day hours from 11 am to 8 pm is.....and the humidity is.....%** During this experiment required humidity were not maintain throughout the day around 70%.

**Exp.2. Spraying water on gunny bag curtain**

In this experiment gunny bags used as curtain hanging to the roof from inside the dome and on this curtain water is sprayed using sprinklers and the pump after one hour interval Table 5.3 shows the data of amount of water sprayed, temperature and humidity during the experiment.

**Table no.5.3 Data of temperature and humidity for experiment 2**

Sr. no	Time	Dry bulb temperature	Wet bulb temperature	Water sprayed in (lit)	Motor running time in (sec)	Humidity (%)
1.	10 am	24°C	20°C	1.30	20 sec	69
2.	11 am	25°C	20°C	1.70		63
3.	12 am	27°C	21°C	2.0	30sec	58
4.	1 am	30°C	24°C	2.20	15 sec	60
5.	2 am	32°C	26°C	2.20	30 sec	63
6.	3 am	33°C	28°C	2.30	15 sec	68
7.	4 am	32°C	26°C	2.40	30 sec	68
8.	5 am	30°C	24°C	2.0		65
9.	6 am	28°C	22°C	1.90	20 sec	66
10.	7 am	26°C	22°C	1.80		72

**Data from the table 5.3 shows that the average temperature during the day hours from 11 am to 8 pm is.....and the humidity is.....% So by this experiment humidity is maintain around 70% which is suitable to our requirement.**

- Sprinklers detail-

No of lines-2

Distance between two lines-2.5ft

No of sprinklers- 6

Distance between two sprinklers- 2.3ft

Discharge of each sprinkler- 800ml/min

Wetting diameter of each sprinkler- 1.8m<sup>2</sup>

- Water pump details-

Power-70watt

Head-3 meter

Discharge of pump-

- Darkness-

The darkness is required to the Black soldier flies till pupation period from hatching, so all windows and small holes are closes by the foams and black paper so light does not come from outside and outer temperature don't affect inside due to the foams.

- Exhaust fan-

Install exhaust fan for maintain the ventilation into the dome and to reduce the excess humidity inside the dome.



**Fig: 5.1 Placing black paper on windows**



**Fig: 5.2 Installation of exhaust fan**



**Fig: 5.3 Install of motor for water circulation**



**Fig: 5.4 Gunny bag curtain**



**Fig: 5.5 Pipeline for water spreading on gunny bag curtain**

## 6. Experiments to attract BSF

There is possibility of BSF flies present in atmosphere naturally as well as in old culture, so two experiments were conducted as follows:

- In the first experiment 500gm of cow feed taken in a tray and water is mixed into it and this tray kept at a place where external insects can easily attract, the mixture should maintain continuously wet.
- In second experiment 600gm of old Black soldier flies culture taken and 400gm of 35% poultry feed taken in feeding tray and add 70% of water in it. This tray kept in puparium for 5-6 days, if some old eggs are present in the culture then after 5-6 days small larvae will hatched.



**Fig: 6.1 Experiment no. 1**



**Fig: 6.2 Experiment no .2**



**Fig: 6.3 Experiment no. 2**

## **7. Design and fabrication of small model**

To run the project, initially small project model is required with the controlled conditions. A feeding tray and a pupation tray needed inside the model.

### **Procedure to fabricate the model**

- Cut the square pipe in 60 cm, 50 cm, 40 cm by using cutter machine and welded it to make the frame as shown in the figure.
- Grind all the corners of the frame by using Grinding machine and also surfaces of the pipe and make it soft.
- Cut L angle in 20cm length and weld at the base corner as a leg of the model a shown in fig.
- Purchased Acrylic sheet from Pune and cut it into specific dimensions by referring the size of top, right, left and front sides.
- These Acrylic sheets are placed on respective sides and pasted by the Acrylic gum.
- Two hinges fitted at the right side for opening and closing the door of system.



**Fig: 7.1 Project Model front side**



**Fig: 7.1 Project Model back side**

### **Tools used for fabricate the model**

Various tools were used to fabricate the structure.

1. Drilling machine
2. Grinder machine
3. Cutting machine
4. Acrylic cutting machine
5. Arc welding machine
6. Rivet gun

### **Coasting of model**

Sr. NO	Material	Price (Rs.)
1	Square pipe	250/-
2	Acrylic	2266/-
3	Sealant	100/-
4	Hinges	20/-
5	Clip	10/-
	<b>Total</b>	<b>2646/-</b>

## **VIII. SUMMARY AND CONCLUSIONS**

### **SUMMARY**

BSF is refer as the 'Black soldier flies' is the insect belonging to the family Animalia and class insecta. This is the ant type insect which converts organic waste into the useable compost and the the larvae having protein and oil rich contents which is used as best feed for poultry as well as fish. For the growth and production of this insect standard conditions required like temperature around 30°C-35°C, and humidity around 65%-70%, and for the hatching to pupation period darkness is required. So in this project efforts were done to achieve these conditions in enclosed area.

### **CONCLUSIONS**

By doing study and performing various experiments as mentioned in above report towards achieving objectives, it is possible now to maintain desired parameters like temperature around 30°C-35°C, humidity around 70% and darkness for growth and multiplication of Black Soldier Flies. The system is ready now for multiplication of Black Soldier Flies.

## **IX. TRAINING OUTCOME**

1. Got Practical knowledge.
2. The project of achieving the controlled conditions required for the growth and production of Black Soldier Flies is successfully done.
3. It is an also overview for various activities such as workshop conducted and different assignment.
4. The training has improved the technical skills.
5. Helped to develop and improve the communication skills.

## **X. APPENDICES**

### **APPENDIX-A**

#### **IMPORTANT CONTACTS**

- 1. Name of the Organization** : Vigyan Ashram, Pabal
- 2. Address of Organization** : A Centre of Indian Institute of Education  
At/Po-Pabal, Ta -Shirur, Dist.-Pune. 412 402
- 3. Phone No.** 0213829236
- 4. Email ID** : [vapabal@gmail.com](mailto:vapabal@gmail.com)
- 5. Website** : <http://www.vigyanashram.com>
- 6. Founder** : Dr. S. S. Kalbag
- 7. Contact Person** : Mr. Ranjeet Shanbhag - 9579734720
- 8. Stipend** : No stipend
- 9. Accommodation** : At Vigyan Ashram
- 10. Mess** : At Vigyan Ashram

## **XI. SUGGESTIONS**

1. It is perfect place for practical work and extending our knowledge in various subjects.
2. It will be worth to send more number of students for In-plant training at Vigyan Ashram, Pabal.