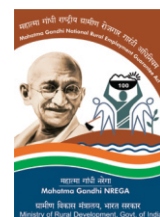




Implementation Manual for **COMMUNITY NUTRITION GARDEN**



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ABBREVIATIONS

AE	Assistant Engineer
APO	Assistant Program Officer
ATMA	Agriculture Technology Management Agency
CEO	Chief Executive Officer
CISF	Community Investment Support Fund
CNG	Community Nutrition Garden
CRP	Community Resource Person
CSR	Corporate Social Responsibility
DPR	Detailed Project Report
DWCD	Department of Women and Child Development
EE	Executive Engineer
FYM	Farm Yard Manure
GDP	Gross Domestic Product
GIS	Geographical Information System
HDPE	High – density polyethylene
ICAR	Indian Council of Agricultural Research
ICDS	Integrated Child Development Services
IPM	Integrated Pest Management
KVK	Krishi Vigyan Kendra
LULC	Land Use Land Cover
LLDPE	Linear low – density polyethylene
MGNREGA	Mahatma Gandhi National Rural Employment Guarantee Act
MGNREGS	Mahatma Gandhi National Rural Employment Guarantee Scheme
MIDH	Mission for Integrated Development of Horticulture
MP DAY SRLM	Madhya Pradesh Deen Dayal Antyodaya Yojna State Rural Livelihood Mission
MPSEGC	Madhya Pradesh State Employment Guarantee Council
NRLM	National Rural Livelihood Mission
PMFME	Pradhan Mantri Formalisation of Micro food processing Enterprises
PMKSY	Pradhan Mantri Krishi Sinchayee Yojna
PO	Program Officer
PVC	Polyvinyl Chloride
RDA	Recommended Dietary Allowance
RKVY	Rashtriya Krishi Vikas Yojana
SDM	Sub Divisional Magistrate
SECURE	Software Estimate Calculation Using Rural Employment
SHG	Self – help Group
SoP	Standard Operating Procedure
SoR	Schedule of Rates
SRLM	State Rural Livelihood Mission
TA	Technical Assistant

1. INTRODUCTION

A large part of the population in India suffers from inadequate micronutrient intake which is a consequence of low dietary diversity and limited consumption of nutrient-dense foods. Therefore, it is the need of the hour to meet the requirements of nutritive food at farm level only. It not only meets the nutritional demands of the families, but also contributes towards the farm family income through reduction in food and medical expenditures and also through selling of farm produce. To ensure a healthy diet, women and children in villages must be educated about the role of food, importance of cultivation of vegetables and fruits etc.

Fruit and vegetables are a natural source of micronutrients essential for human body which must be delivered through diet. The constituents obtained by human body from fruits and vegetables include water, carbohydrates, fats, proteins, fibres, minerals, organic acids, pigments, vitamins and antioxidants among others. Most fruits and vegetables are available almost year-round in a wide variety, and they not only taste good, but they also have favourable attributes of texture, colour, flavour and ease of use. They can consumed be fresh, cooked, hot or cold, canned, pickled, frozen, or dried.

Community Nutrition Garden (CNG) has the potential to secure this much needed supply of fresh and readily available fruits and vegetables throughout the year, thereby increasing dietary diversity among its members along with income. Apart from this, Community Nutrition Garden (CNG) provide multiple social benefits such as enhancing food and nutritional security, empowering women, promoting social justice and equality and preserving indigenous knowledge and culture.

In these Community Nutrition Gardens, a wide variety of horticultural crops can be grown which covers a wider range of crops such as fruits, vegetables, root and tuber crops, aromatic and medicinal plants, spices and plantation crops, which enhances diversity in nutrition. The choice of plants is made as per the community's requirements and traditional acceptance.



2. BENEFITS FROM THE COMMUNITY NUTRITION GARDEN

A nutritious diet is vital for proper growth and development in humans. It helps in preventing diseases, besides maintaining body metabolism for physical and mental well-being. Food provides energy, protein, essential fats, vitamins, antioxidants and minerals to meet our daily metabolic requirement. Most of them cannot be synthesized in the human body, and therefore need to be supplemented through diet. Further, anti-nutritional factors present in edible parts of the food exert adverse effects on human health. Consumption of Unbalanced diet affects billions of people worldwide and leads to poor health and socio-economic conditions.

Fruits and vegetables can be consumed at all times and due to their convenient size, they are an excellent between-meal snack. They are relatively low in calories and fat, have no cholesterol, are rich in carbohydrates and fibres, contain Vitamin C and carotene, and some are good source of vitamin B6. Fruits and vegetables are relatively low in sodium and high in potassium. Ascorbic acid in fruits and vegetables enhances the bioavailability of iron in diet. Because of all these characteristics, fruits and vegetables have a unique role in healthy diet. Fruit and vegetable consumption are associated with reduced risk of major diseases and possibly delayed onset of age-related disorders, promoting good health.

India is fortunate to have plethora of vegetables and fruits available throughout the year. Fruits, vegetables (including leafy vegetables) and nuts are important in daily diet as they contain micronutrients (vitamins and minerals), fibres, vegetable protein and bioactive compounds. Leafy vegetables like red and green amaranth, Indian spinach, water spinach, drumstick leaves, and jute leaves are excellent sources of iron, beta carotene (pro vitamin A) and Folic acid. Ripe mango, papaya, carrot, orange fleshed sweet potato and pumpkin contain high quantities of pro vitamin A, whereas local citrus fruits as well as star fruit, jujube and guava provide vitamin C, good for enhancing absorption of iron from the diet. For instance, a combination of one-fourth cup pumpkin, one-fourth cup carrot and half cup of a mango together supplies full RDA of vitamin A for a child under 5.

In India, research has now been focused on the development of biofortified crop varieties to achieve nutritional security of the country. Lot of efforts have been made towards development of biofortified varieties in horticultural crops like Pomegranate (var. Solarpur Lal) rich in iron and in zinc, Potato (Var Bhusona) & cauliflower (var. Pusa beta kesari 1) rich in high β -carotene, Anthocyanin rich variety Bhukrishna of sweet potato, a giant step towards food and nutritional security.

TABLE: 01 NUTRITIONAL PROPERTY OF IMPORTANT FRUITS AND VEGETABLES

SL.NO .	FRUIT/ VEGETABLE	PROPERTIES
1	Banana	Rich in vitamins and minerals
2	Underutilized fruits like Jamun, Tamarind, Jackfruit, Karondo, Khirnee, Wood apple, Mahua	Rich in minerals
3	Nuts	Rich in healthy fats
4	Potato and tuber crops	Rich sources of carbohydrates
5	Leguminous vegetables	Rich in proteins
6	Various fruits, vegetables and spices	Rich in phytochemicals
7	Underutilized leafy vegetables like Indian spinach, Chenopodium, water spinach, drumstick etc.	Rich in minerals
8	Medicinal plants	Rich in phytochemicals

The different kinds of other benefits derived from CNG can be grouped as follows:

- 1. Social benefits:** Activities at community nutrition garden (CNG) are labour intensive, which will create many on-farm person days and most of it in the production process, which is contributed by the SHG women along with her family members in the CNGs. It gives year-round availability of nutritious and seasonal food. Seasonal migration will be reduced, and women will be more empowered since they are organised in self-help groups and will lead these CNGs. Fodder and fuel shortage shall also be minimised.
- 2. Ecological benefits:** The diversity will be huge as various types of vegetables, pulses, fruits etc. will be cultivated in the CNG. As large number of local crops are proposed to be introduced, therefore, soil micro/macro fauna will be increased. The promotion of agroecological practices will also reduce any environmental harm. Each and everything will recycle within the system; it actually will be a zero-waste farming or natural farming system.
- 3. Economic benefits:** The income will be timewise and source-wise diversified, i.e., the farmer will get income throughout the year from different sources, which will reduce the dependency on a single system. As income will be diversified that is from different sub-systems, therefore, risk will also be reduced.
- 4. Health and nutrition benefits:** Consumption of fresh vegetables, fruits, pulses and spices from own nutrition garden will make the citizens healthier and reduce micronutrient deficiencies / increase dietary diversity. The promotion of agroecological practices lead to restricted use of harmful pesticides which will also increase the edible quality of fruits and vegetables obtained.



3. ROLES AND RESPONSIBILITIES OF MGNREGS IN CNG

MGNREGS has a major role to play in the successful and sustainable establishment of CNG. It will require coordination with many departments. The key roles and responsibilities of MGNREGS include:

a) State Level (Key persons – Commissioner, MGNREGS and state CNG Coordinator)

- Overall instructions and guidelines for establishing CNGs
- Co-ordination with different departments
- Timely approval of CNG proposals
- Market linkages
- Capacity building
- Awareness building among all stakeholders
- Monitoring

b) District Level (Key persons – District Collector, CEO Zila Panchayat and MGNREGS PO)

- Formation of District CNG Coordination committee (refer section 5.1.1)
- **Selection of site for the GNG as per the identified parameters (refer section 5.1.2)**
- Site allotment process (refer section 5.1.2)
- Facilitate SHG selection through SRLM (refer section 5.1)
- Preparation of Detailed Project Report (DPR) with various convergence schemes, action plan etc. followed by approval of DPR (technical sanction and administrative sanction) from appropriate levels (refer section 5.1.3)
- Development of CNG as per the approved DPR
- **Training and guidance to SHG in the implementation of the schemes.**
- Timely payment of wages to SHG members
- Provide support to SHG members for developing and maintaining CNG which includes plantation, watering, fencing etc.
- Monitoring of CNGs (refer section 5.4)
- Awareness building among all stakeholders
- **MGNREGS PO has an important role in all the above-mentioned district level activities.**

4. STAKEHOLDERS AND THEIR ROLES AND RESPONSIBILITIES

Many CNG and stakeholders will play an important role in the establishment of community nutrition garden. Coordination among them will be necessary in the development of community nutrition garden. All the CNG involved in the implementation will be expected to guide the self-help groups in implementing the schemes of their CNG. The effective implementation will lead to sustainability of the community nutrition garden. Different departments of Government of Madhya Pradesh and other stakeholders in the CNG ecosystem are as below:

- Self Help Groups (SHG)
- Gram Panchayat
- Janpad Panchayat
- Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS) Wing of Panchayat and Rural Development Department
- MP DAY SRLM Wing of Panchayat and Rural Development Department
- Department of Horticulture
- Department of Revenue
- Zila Panchayat
- Krishi Vigyan Kendras (KVK)
- Department of Forest
- Department of Women and Child Development (DWCD)
- Department of AYUSH
- Department of Tribal Welfare
- Department of Agriculture
- Department of Water Resources
- Department of Public Health Engineering
- Resource Partner, if any

These stakeholders work at different levels in the CNG ecosystem. Details are mentioned in the table below:

SL. NO.	ORGANISATION	INDIVIDUALS	LEVELS (DISTRICT/ BLOCK/VILLAGE)
1	Self Help Group (SHG)	All group members	Village
2	Gram Panchayat	<ul style="list-style-type: none"> • Sarpanch • Rojgar Sahayak (Rural Development) • Secretary (GP) • Community Resource Person (CRP) 	Village
3	Janpad Panchayat	CEO (Chief Executive Officer)	Block
4	MGNREGS	<ul style="list-style-type: none"> • APO (Additional Program Officer) • TA (Technical Assistant) 	Block
5	MP DAY SRLM	Block Mission Manager	Block
6	Horticulture Department	<ul style="list-style-type: none"> • Deputy Director Horticulture • Rural Horticulture Extension Officer • Nursery In-charge 	<ul style="list-style-type: none"> ▪ District ▪ Block ▪ Block

SL. NO.	ORGANISATION	INDIVIDUALS	LEVELS (DISTRICT/ BLOCK/VILLAGE)
7	Revenue Department	Sub-Divisional Magistrate (SDM)	Tehsil
8	District Officials	<ul style="list-style-type: none"> • District Collector • CEO, Zila Panchayat • Program Officer, MGNREGS • District Mission Manager, MP DAY SRLM 	District
9	Krishi Vigyan Kendras	Scientists	District
10	Forest Department and other departments	Department Head and their team as per the requirements	<ul style="list-style-type: none"> ▪ District ▪ Block ▪ CNG

ROLES AND RESPONSIBILITIES

As mentioned above, the CNG ecosystem consists of many stakeholders with well-defined roles and responsibilities. An overview of these roles and responsibilities of key stakeholders is as below:

1. Self Help Group (SHG) - SHG is a self-managing and self-sustaining group of women which is registered with SRLM. SHGs are unified by a common goal and have their own organisational structure. They get financial support in the form of Revolving Fund and Community Investment Support Fund (CISF) in accordance with the laws governing them. In the context of CNGs, the primary responsibility of SHG members is to establish CNG, prepare the land, do plantation, maintain the CNG and manage the produce.



2. Gram Panchayat – Gram Panchayat plays a very crucial role in mobilising the community and making nutrition as a community responsibility. The responsibility of Gram Panchayat is to make a contract with SHG for the purpose of CNG establishment and development. It is also responsible for issuing job cards to SHG members. In addition, it also plays a crucial role in land identification and removing encroachment from the land.
3. Janpad Panchayat – The responsibility of Janpad Panchayat is to ensure roll-out of the CNG. CEO, Janpad Panchayat plays a very crucial role as it is the point of convergence at the block level.
4. MGNREGS – The responsibility of MGNREGS wing is to prepare and approve CNG proposal so that the SHG members become entitled for MGNREGS wages for the work performed in CNG. Following the approval, it is also responsible for monitoring the work being performed by SHG members to develop and maintain CNG which includes plantation, watering, fencing etc. It releases wages of SHG members against all these works performed and also provides funds for fencing, watering etc.
5. State Rural Livelihood Mission (SRLM) – The responsibilities of SRLM include social inclusion, financial inclusion, livelihoods, program management and program support. As an organisation, SRLM has a presence at the state, district and block levels. In the context of CNG, the role of SRLM is to register the new SHG, support bank linkages and capacity building of SHGs.
6. Department of Horticulture – Department of Horticulture has presence at the district level and block level. They provide seeds, saplings and possess technical know-how from agriculture perspective.
7. Department of Revenue – Department of Revenue has detailed maps of the entire district along-with the type of usage of the land. The responsibility of Department Revenue officials is to help in land identification by providing details of land available and sanction of land for CNG. They also play a crucial role in getting the encroachment removed from the sanctioned land.
8. District Officials – The district officials have a steering role in implementing CNGs in the entire district. They have an active role to play in the district coordination committee.
9. Krishi Vigyan Kendras – KVKs have presence at the district level. They provide seeds, saplings and possess technical know-how from agriculture perspective.
10. Forest Department and other Departments – Forest department has a key role in providing bamboo plants along with technical guidance and maintenance subsidy. In addition, they also provide fruits plants and border plants. Other departments will support CNG through their key schemes suitable for CNG development. Their active participation in district level CNG coordination committee will have a direct impact on development of CNG at ground level.

5. STEPS OF CNG IMPLEMENTATION

CNG implementation is a complex process and involves several steps to be undertaken for establishing a successful CNG. Knowledge of these steps and completing them in a fixed time frame will help in laying a strong foundation for a stable CNG. This chapter discusses about these steps.

5.1 ADMINISTRATIVE STEPS

For roll-out of community nutrition gardens in the districts, certain administrative steps are needed. These steps are listed out as below.

5.1.1 Formation of District level CNG Co-ordination Committee

The process of formation will be initiated by the Program Officer, MGNREGS and the letter for the coordination committee will be issued by District Collector/Chief Executive Officer (Zila Panchayat).

The objectives of forming a district level CNG coordination committee are as below:

- To Create a system where all departments can support through their knowledge, information, and schemes.
- To Facilitate the work of the CNG; make time-sensitive decisions during face-to-face meetings of the Members and act as a sounding board for the Chief Executive Officer
- To Enable and empower SHG women to live as independently as possible and as close to their community as possible
- To Facilitate the realisation of equal opportunities, protection of rights, and empower SHG women to live independently with self sustenance within the community
- To Extend support up to the SHGs level and create livelihood options through CNG
- To Provide need-based information, planning, and services to the CNG
- To Evolve procedures for monitoring the progress of CNGs
- To develop them as Model CNGs
- To Play an active role in coordination between departments
- To Perform ground verification at the time of project clearance and at the start of CNG.
- To Act as a think-tank and suggest activities for upcoming CNGs of the district, based on the local situation and economics

Structure of Committee - The district level coordination committee will have the following structure:

- a) Chairperson - Chief Executive Officer (CEO) ,Zila Panchayat
- b) Secretary - Program Officer, MGNREGS
- c) Members - Representatives of all departments
- d) Nominated Members from NGOs, representative from CSR partner

Frequency of Meeting - The District Level Coordination Committee meets regularly, at a minimum quarterly, via audio call or face-to-face meetings as determined by the Chairperson. Summaries of District Level Coordinating Committee meetings will be made available to all.

Roles and Responsibilities - Following are the roles and responsibilities of the District Level Coordination Committee.

- Facilitate implementation of CNGs in the district by creating a district level action plan
- Act as a convergence point for leveraging CNG specific schemes of all departments
- Monitoring of CNG roll-out
- Develop market linkages for the selling of surplus produce of CNGs

- Provide a platform for innovation and knowledge management at the district level with respect to CNG

5.1.2 CNG Site Selection and Allotment

CNG site selection is one of the most important steps in the entire process of CNG establishment. CNG site selection needs to be done with due diligence. The process of site selection is as below:

- **Formation of cluster and selection of villages:** To establish CNGs, each block is divided into three clusters. Now from each cluster two or three villages are selected, where community nutrition gardens can be established in the form of demo CNG. The location of these selected villages should be such that the CNGs established in these will act as examples for the remaining villages of the cluster. The main criterion for village selection is easy accessibility from other villages throughout the year.
- **Selection of sites:** After selecting villages, GIS technology will be used to identify potential CNG sites in these villages (refer Annexure 7.6). Parameters that will be used by GIS to identify potential sites are:
 - Distance from habitat
 - Type of land
 - Slope (should be less than ten percent)
 - Soil type and depth
 - Irrigation water availability, depth of ground water
 - Distance from forest area
 - Distance from nearest AWC, School
 - Free from common pathways
- **Physical verification of the potential sites:** After selection of potential sites through GIS, the sites will undergo physical verification. This task will be done by a team comprising of members of MGNREGS, Horticulture department, SRLM, Gram Panchayat and Revenue department. Efforts should be made to finalize 2 potential sites for a CNG with one of them as alternative site.
- **Allotment of CNG site to Gram Panchayat:** Revenue Department would allot the land through proper process to the respective Gram Panchayat. Before allotting, the revenue department would ensure that the land is encroachment free if it is encroachment free.
- **Allotment of CNG site to SHG:** The Gram Panchayat will allot the CNG site to the identified SHG. For this a formal agreement will be done between Gram Panchayat and SHG (refer Annexure 7.9 for the agreement format). The land can be given to the SHG for a period of 5 years and in case of good performance it can be extended for another 4 years, i.e., for a total of 9 years.

5.1.3 Detailed Project Report (DPR) – Preparation and Approval

DPR is prepared with different activities, and it is required for administrative and technical sanctioning of the works for the development of CNG.

- Selection of works for the CNG should be done in a participatory manner with the SHG. GIS based planning can be used for this purpose.
- A team consisting of Gram Panchayat Secretary, Gram Rozgar Sahayak, Patwari and Sub-engineer conducts a survey of the selected site.

- After the site visit and proper investigation, the estimate of the work is prepared by the Sub-engineer on SECURE SoR (Schedule of Rates).
- The prepared estimate is verified by the Assistant Engineer (AE) and technical sanction is accorded. If the work is highly technical in nature or the estimated cost of the work is found to be higher than the limit of sanction of the AE, then the estimate is further forwarded to the Executive Engineer (EE) or other senior authorities.
- DPR is prepared by compiling all the proposed works to be done in the CNG along-with their estimates. During the DPR preparation treatment of area should be proposed on watershed area treatment plan so that the water bodies can be proposed on lower contours.
- The DPR is put up for administrative approval in Gram Sabha. The necessary details like fund flow (convergence or purely MGNREGS) are also decided in the Gram Sabha. After approval from Gram Sabha, the proposal will be taken up for approval at Janpad Panchayat and finally by Zila Panchayat.
- The DPR once approved, is included in the SoP for the financial year, based on priority.

5.1.4 Selection of SHG

After selecting the site for the community nutrition garden, the appropriate self-help group will have to be selected from the existing self-help groups which are already formed by the State Rural Livelihood Mission (SRLM, Aajeevika Mission in Hindi). The selection of SHGs will be done by the team of SRLM. The grading tool (refer Annexure 7.7) developed by SRLM in this regard can also be used.

In group selection, preference will be given to women from landless families or women engaged in mid-day meals or women from malnourished families.

5.2 IMPLEMENTATION STEPS

Implementation of Community Nutrition Garden consists of several steps. These steps are detailed out as below.

5.2.1 Orientation of SHG

Effective implementation of CNG will happen only when SHG members are motivated and own the CNG. Therefore, the selected SHG members need to be oriented on the purpose of CNG which is livelihood generation and nutrition diversity. The SHG members also need to understand provisions of the scheme under which CNG is to be established.

5.2.2 SHG Management

For smooth implementation of the CNG, a proper work division among the SHG members is crucial. SHG members need to decide their roles and responsibilities, document them and carry out the work accordingly. This will also help in CNG produce distribution and management. It is also suggested that roles and responsibilities are also rotated among the members.

During the CNG implementation it is suggested that the SHG members document the meeting minutes, keep a record of each and every expenditure, production details, produce distribution details, produce sold in the market and income details etc.

5.2.3 CNG Models

Selection of fruits, pulses and vegetable crops for CNG depends upon size of land, agroclimatic zone and choice of the women SHG members. Two CNG models, viz., minimum 1 hectare and minimum 2 hectare are proposed. The 1 hectare model comprises of fruit tree plantation with intercropping of vegetables

and pulses. The 2 hectare model, in addition to the fruit tree plantation with sole or intercropping of vegetables and pulses, also consists of livelihood activities like dairy, pisciculture, goat farming, mushroom production, beekeeping etc. as per local conditions. (For details, please refer the letters issued by MGNREGS cell in the annexure 7.8)

The proposed area under each model:

Model	Fruits	Vegetables & Pulses	Allied activities	Proposed allied activities
01 Hectare Model	0.5ha (Inter cropping of vegetables & pulses in earlier stage)	0.4 ha as sole crop	0.1 ha including Nursery, community seed bank, net/polyhouse, pathways, irrigation channels (drip), compost pit, farm pond, live fencing etc.	Vermicomposting/Beekeeping (also refer various prototypes mentioned in chapter 7.5)
02 Hectare Model This model is mainly proposed with Gaushala so it has to be mentioned here	1.0 ha (Inter cropping of vegetable & pulses in earlier stage)	0.8 ha as sole crop	0.2 ha including Nursery, community seed bank net/polyhouse pathways, irrigation channels (drip), compost pit, farm pond, live fencing etc.	Dairy/Goat farming/Mushroom production/ Vermicomposting/Beekeeping/Pisciculture/Biogas (also refer various prototypes mentioned in chapter 7.5)

In 1 hectare model of CNG, proposed area under fruit orchards will be 50% with intercropping of vegetables or other short duration crops, 40% area for sole vegetables so that members can get crops from an early stage of establishment of CNG and 10% area for other activities like farm pond, vermicompost units, nursery structures, irrigation channel, compost pit, pathways etc. Similarly, in 2 hectare model 50% for orchard, 40% for sole vegetables and remaining 10%, i.e., 2000 sqm or half acres for allied activities like Dairy/Goat farming/Mushroom production/ Vermicomposting/ Beekeeping/ Pisciculture/ Biogas along with mandatory structures as suggested in 1 hectare model.

The same pattern to be followed accordingly based on the resources available in the CNG area. The area under fruit cultivation may be increased gradually based on local demand, demand from SHG members and feedback of CNG members.

Proposed crops:

At each CNG, three types of crops are proposed, i.e., fruits, vegetables and pulses. The fruit trees are perennial in nature and will be main or primary crop. On the other hand, vegetables and pulses will be secondary crops which can be planted as sole or as intercrop. The proposed crops are as follows:

Main or Primary crop: Fruit crop

Mango, Guava, Lime, Orange, Mosambi, Sapota, Papaya, Banana, Drumstick, Pomegranate, Aonla, Custard Apple, Karonda, Curry leaves etc and any other crop suggested by district Horticulture department.

Secondary Crops as Sole or Intercrops: Vegetable and Pulses crop

Leafy vegetables: Spinach or Palak, Fenugreek or Methi, Lettuce, Coriander, Pudina, Chaulai, Bathua etc.

Root crops: Potato, Colocasia, Yam, Turnip, Ginger, Garlic, Sugarbeet, Radish, Carrot etc.

Vine: Cucurbits like Sponge gourd, Bitter gourd, Bottle gourd, Cucumber, Pumpkin etc.

Pulses: Green peas, French bean and other beans

Others: Tomato, Brinjal, Chili, Potato, Chili, Beans, Okra, Mustard, Maize, Cabbage, Cauliflower, Knol-khol, drumstick/moringa etc.

Medicinal crops: Ashwagandha, Satavar, Tulsi, Mentha etc.

General principles to be followed

- In orchards, for the initial 4-5 years vegetable crops will be grown as intercrop and later on shade loving crops will be grown in the orchards.
- Shade loving vegetables like turmeric, ginger, Colocasia may be planted as intercropping between orchards.
- Three sides of the fence can be made to trail cucurbits during summer and rainy seasons, pea in winter and fourth side for perennial beans.
- Fences on all sides should be made with barbed wire or with live fence to protect from pilferage and animal menace. Fence may be made strong by planting Karonda at 1.0 m. distance along the fence. Bamboo plants can be used for fencing.



- Compost pits and vermicompost units may be provided on one corner of CNG for effective utilisation of farm waste. (Gaushala). During site selection for CNG, preference should be given for the site near to cattle shed.
- After allotting areas for perennial fruit crops, remaining area may be divided into 8-10 equal plots for raising annual vegetable crops. By following scientific crop rotation, three annual crops can be raised in the same plot. Companion cropping or accession cropping, inter cropping and mixed cropping can be followed for effective utilisation of space.
- Provide walking path at center as well as along four sides for movement and agricultural operations. Utilize ridges, which separate individual plots for growing root and tuber crops.
- As intensive and continuous cropping is done in a CNG, fertility and texture of soil may be maintained by applying adequate quantities of organic manure like vermicompost, leaf manure, poultry manure frequently.
- Since fresh vegetables are directly utilized, follow clean cultivation, mechanical removal of pest / disease affected plants, planting of resistant varieties, biological control and use of bio-pesticides or bio-fungicides for pest and disease control in a CNG.
- Preference should be given to long duration and steady yielding local varieties than hybrid ones, which require constant care. As per availability of seeds or planting material of biofortified varieties, it may be used at CNG.
- While allotting or arranging crops in each sub-plot, care should be taken to plant varieties / crops at ideal time of planting or season. Principles of crop rotation also should be followed in continuous cropping.
- In CNG, intensive and continuous cropping is done; therefore, beehives may be placed for ensuring adequate pollination of crops besides obtaining honey.
- For rainwater harvesting, a farm pond may be dug out in lower area of CNG
- For raising of vegetable seedlings at CNG, a nursery space should be allocated at upper place of the field to avoid water logging conditions during rainy seasons.
- The CNG where goushala or dairy is proposed, green fodder crop should be taken along with fruits and vegetable crops.

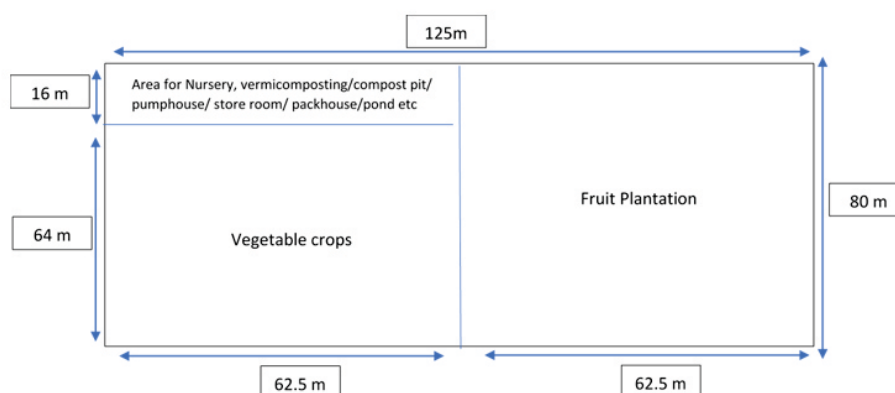
Layout & design for Community Nutrition Garden

Layout and design of CNG depends on agro-climatic conditions prevailing in the area. Depending on climatic and seasonal changes, modifications are to be done in layout and crop allotment. Actual layout will also depend on the basis of availability of land. The following points should be considered while doing the actual layout.

- Preferred shape of the garden should be rectangular compared to square ones.
- Southern and western side of the area is to be reserved for vegetables so that it will be receiving maximum sunlight.
- Fruit plants and Perennial vegetables like drumstick, curry leaf etc. should be planted on northern side of the garden so that they may neither shade remaining plants nor they interfere with intercultural operations.
- Vine or trailing type of crops like cucurbits and beans may be trained on fence.
- The row orientation should be in E-W direction

Layout* for 1.0 ha (10,000 sqm or 80m X 125 m) model

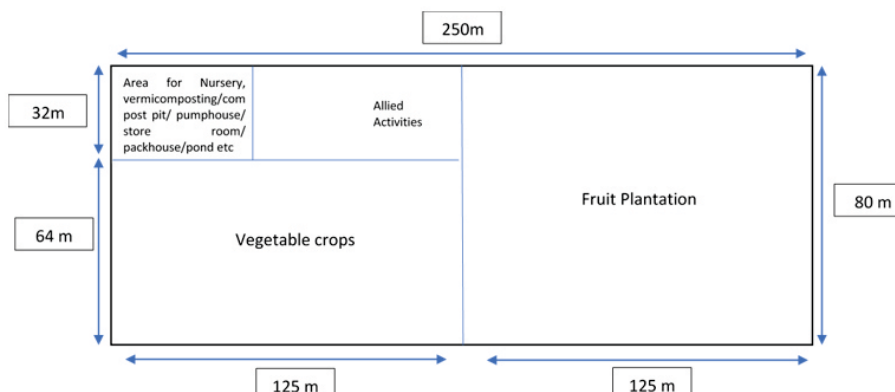
Area under fruit orchard : 5000 sq m (80 m X 62.5 m)
 Area under vegetable : 4000 sq m (64 m X 62.5 m)
 Other activities : 1000 sq m (16 m X 62.5 m)



*Indicative D

B. Layout* for 2.0 ha (20,000 sqm or 200m X 100m) model

Area under fruit orchard : 10,000 sq. m (80 m X 125 m)
 Area under vegetable : 8000 sq. m (64 m X 125 m)
 Other activities : 2000 sq. m (32 m X 125 m)



*Indicative Drawing

5.2.4 Land Preparation

After selecting the site and before planting fruit trees and vegetables, it is necessary to prepare the land by carrying out certain preliminary operations such as clearing and levelling of land, making provision for irrigation water, fencing, planting of windbreaks, planning of buildings and other allied infrastructures as per needs like nursery, polyhouse/ shade net house, vermicompost units, biogas plant, mushroom unit, dairy or goatry shed etc.



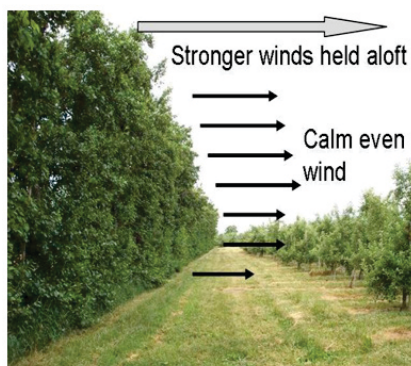
Source: Dr. Vijay Agrawal, Assistant Professor, College of Agriculture, Jawaharlal Nehru Krishi Vishwavidyalaya

i. Clearing and levelling the land

If the land is already under cultivation, nothing except preliminary preparation is necessary. If uncultivated, it is necessary to put them under deep ploughing and levelling. If the selected site is under forest, the existing trees and bushes should be removed by uprooting. The land then should be thoroughly ploughed, harrowed and levelled. While preparing the land, the subsoil which is usually less fertile than the surface soil, should not be disturbed much possible.

ii. Fencing

Fence is necessary to protect CNG from animal disturbances. Fence can be made from barbed wire or chain linked fence, or live fence. (It is suggested to get this activity done through convergence with other department). But priority should be given to adopt live fencing. The plant suitable for live hedge is Karonda (*Carissa carandas*). This fruit species is easy to raise by seeds, drought resistance, dense foliage, thorny in nature and having thick and compact growth. To establish a live hedge, plants can be raised in nursery and planted at 1 meter distance around the farm in pre-dugged 2 feet wide and 2 feet deep at the commencement of the rainy season. The CNGs where goat farming is proposed Manila tamarind (*Inga dulcis*) may be planted as fencing, because the leaves may be suitable as fodder for goats, whereas fruits are edible and rich in magnesium and calcium. Cattle proof trench, stone fencing and bamboo fencing are other methods which can be adopted depending upon the local conditions.



iii. Windbreaks

Windbreak is a barrier of trees rows which reduces the wind velocity and prevents damage caused by high velocity of wind, cold waves and frost. An ideal windbreak should be upright in growth and occupy as little space as possible. It should be tall, mechanically strong, quick growing and sufficiently dense and evergreen in nature to offer the maximum resistance to the wind. One to two rows of such trees are planted at a close spacing, usually 12-23 ft. apart for having a tall and close tree-wall which can help to resist the incoming heavy flow of

wind. The Fruit trees should be preferred as wind breaks in CNGs because these fruit producing trees are also adding to the income of the garden. The commonly grown that can be used used as windbreaks are Jamun, Tamarind, Mango, Jackfruit, Mulberry, Khirni etc. Apart from these other species like Neem, Arjun, Mahua, Manila tamarind etc. may also be used as wind breaks.

iv. Building and infrastructure

Any building or infrastructure which is needed at the CNG site should preferably be constructed before planting. Such infrastructures would include nursery, vermicompost units, mushroom unit, cattle shed etc.

v. Pathways, irrigation and drainage channels

For easy approach and convenience in farm operation, pathways are absolutely necessary to be planned in each garden. The permanent irrigation and drainage channels should be dug in straight lines and without interfering the main roads to economize the use of irrigation water by avoiding seepage in the channels during the dry and hot seasons and for efficient drainage of excess water from the individual plot of the orchard during rainy season or flood-affected areas. In case, drip irrigation is planned to be used, PVC pipes as main line may be buried at 2 feet depth as per layout and design. For more information we may refer to the irrigation systems used in horticulture as detailed out in section 5.2.6 of this manual.

5.2.5 Soil and water management

Though most of the fruits, and vegetable may be grown on a wide variety of soil such as clay, sand, sandy loam, clay loam, loam etc., a loam or sandy loam soil is considered to be the best for most crops. Shallow soils with rocky substrata, soils with very high or low pH, soils having poor drainage and high-water table during rainy season should be avoided. The site where fruit plantation is proposed, should have uniform soil with at least three to four feet topsoil. However, the orchard soil of poor fertility can be improved in the course of orchard soil management by green manuring, intercropping, etc. Before, sowing of crops, soil testing should be conducted preferably during summer season from each plot. The nutrient management strategy should be followed on the basis of soil testing recommendations.

At CNG, vegetable and fruit crops are main crops to be grown round the year. These crops need frequent irrigation for better yield. Therefore, availability of irrigation water is very much important. The source of irrigation at each CNG should be a permanent one assuring supply of requisite quantity of irrigation water throughout the year. Whatever may be the source of irrigation, e.g., a well, a shallow or a deep tube well, pond etc, it should be sunk well ahead of planting. The areas where rainfall is inadequate and evaporation from soil is not very high, water harvesting pond may be installed for collection of rainwater to tide over the critical periods of the year. Use of organic manure in the garden will also improve the water holding capacity of the soil.

5.2.6 Irrigation management at CNG

Irrigation is essential to the production of most vegetables and fruits in order to have an adequate yield with high quality. Choosing the right type of irrigation system for cultivation of vegetables and fruits is very necessary. At CNG, selection of an irrigation system for vegetables and fruits production must consider many factors. These may include issues related to:

- a. Field considerations such as soil type, drainage, erosion potential, location of power sources, topography (including pumping lifts), and distance from water supplies
- b. Water considerations such as availability, quantity, quality, costs to develop a water supply, and annual crop water requirements
- c. Crop considerations such as yield potential, frost protection requirements, and cultural practices relating to planting, pest management, and harvesting
- d. System considerations such as the type of power supply, labour requirements and availability, and initial capital and annual operating costs

On the basis of above criteria, we may use following types of irrigation systems for our CNG:

A. Surface irrigation system

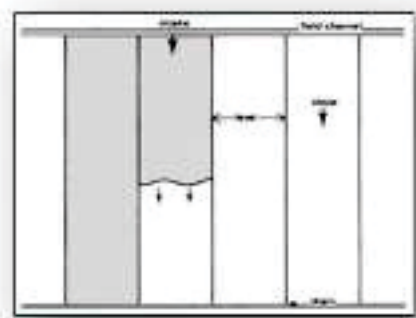
Surface irrigation is the oldest form of irrigation and has been in use for thousands of years. In surface irrigation systems, water moves across the surface of agricultural lands, in order to wet it and infiltrate into the soil. Surface irrigation can be subdivided into:



i. Furrow



ii. Basin



iii. Border strip

Micro irrigation system

Micro-irrigation, sometimes called localized irrigation, low volume irrigation, or trickle irrigation is a system where water is distributed under low pressure through a piped network, in a pre-determined pattern, and applied as a small discharge to each plant or adjacent to it.

- Sprinklers
- Drip irrigation system
- Low pressure drip irrigation system

Each irrigation system type has its own advantages and disadvantages for a given application. Once a particular type of irrigation system is chosen, it will need to be customized for the particular field and crop application.

1) Sprinklers

In the sprinkler method of irrigation, water is sprayed into the air and allowed to fall on the ground surface somewhat resembling rainfall. The spray is developed by the flow of water under pressure through small orifices or nozzles. The pressure is usually obtained by pumping. With careful selection of nozzle sizes, operating pressure and sprinkler spacing the amount of irrigation water required to refill the crop root zone can be applied nearly uniform at the rate to suit the infiltration rate of soil.



2) Drip Irrigation System:

At proposed CNG, Drip irrigation system will be preferred as compared to other systems. Whereas, in leafy vegetable, onion, coriander, garlic etc, mini sprinkler may be installed in place of drip irrigation system.

Under this system, water is applied directly to the root zone of the plant. With row crops such as vegetables drip irrigation with inline laterals will be used, this type of irrigation most often is delivered via an inline lateral pipe that runs along the length of the row. With larger crops like fruit crops, individual inline laterals with dripper (water delivery devices) located at intervals along the laterals are often employed to avoid watering between plants.

Major Advantages:

- 1) **Water Saving:** 40-70% of water can be saved over flood method
- 2) Minimise **Evaporation**
- 3) Minimise **Deep Drainage**
- 4) Absence of **Soil Compaction**
- 5) High Application **Efficiency**- up to 95%
- 6) Adaptable for **Chemigation**
- 7) Minimised **Fertilizer Loss**
- 8) High **Yield/Quality**
- 9) Minimised **Soil Erosion**
- 10) Reduced **Weed Growth**, Disease & Pest problem
- 11) Low **Labour Cost**: labour is required only to start or stop the system

Payback period:

Cost benefit analysis of drip irrigation technology has been done many a time. On an average, the payback period has been found to be around three years.

Components of drip irrigation system:

A typical drip irrigation system has the following components:

Emitters/ drippers:

They are used to dissipate pressure and discharge water in a drip irrigation system. Ideally, it permits a small, uniform flow of water at a constant discharge which does not change significantly throughout the field.

The emitter designs can be classified as two types, inline dripper, which are widely used for vegetable crops and online drippers which are used for distant crops like fruits.

Distribution lines and fittings:

Distribution lines consist of a network of graduated pipe sizes starting with a single, large main line followed by smaller sub main and lateral lines. Main and sub main lines are normally buried and made of PVC, HDPE and polyethylene distribution lines. PVC pipes can be joined by using PVC resin. Whereas laterals which go upto plant roots are made up of LLDPE.

Control system:

This includes pump, primary filter, pressure regulator, pressure gauge, water meter and usually chemical/ fertilizer injection equipment.

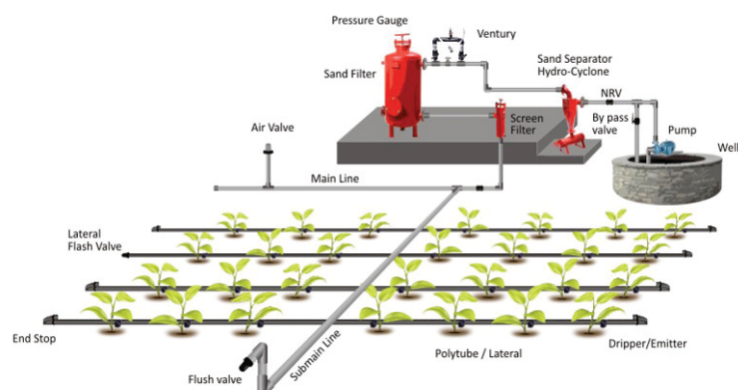
Planning and design of drip irrigation system:

The planning and design of drip irrigation system is essential to supply the required amount of irrigation water to all the plants in the irrigation regime at the constant quantity at any point of time. The water requirement of the plant per day depends on the water taken by plant and the amount of water that evaporates from the soil in the immediate vicinity of the root zone in a day. The plant intake is affected by the leaf area, stage of growth, climate, soil condition etc. The water requirement and irrigation schedule can be estimated directly by pan evaporimeter. The design of drip system broadly involves selection of emitters, laterals, sub mains, mains and head equipment.

The steps that need to be followed for designing the drip irrigation system are given below.

- Layout of the field
- Crop water requirement
- Hydraulic design of system
- Components and its selection

For installation of drip irrigation at CNGs, please contact the officials of horticulture department or representative of government empaneled micro irrigation companies in the state.



Maintenance of drip irrigation system:

Daily maintenance

- Clean the sand and screen filters for 5 minutes before starting the system
- Ensure all drippers are working properly without any leakage
- Before stopping irrigation, backwash the sand filter for about 5 minutes

ii. Weekly maintenance

- Clean the sand filter by hand
- Flush the sub main by opening the flush valve for 5 minutes
- Flush laterals 5 numbers at a time for 5 minutes

iii. Monthly maintenance

- Treat the system with chlorine / acid.

Note: The frequency of chemical treatment depends on the degree of problem at the site.

iv. Chemical treatment

Clogging or plugging of drippers may be due to precipitation and accumulation of certain dissolved salts like carbonates, bicarbonates, Iron, Calcium and Manganese salts. The clogging is also due to the presence of microorganisms and the related Iron and Sulphur slimes due to algae and bacteria.

The clogging is usually avoided / cleared by chemical treatment of water. Chemical treatments commonly used in drip irrigation systems include addition of chloride and/or acid to the water supply.

- Acid treatment

Hydrochloric Acid (HCl) is injected into drip systems at the rate suggested. The acid treatment is performed till a pH of 4 is observed and the system is shut down for 24 hours. Next day the

system is flushed by opening the flush valve and lateral ends.

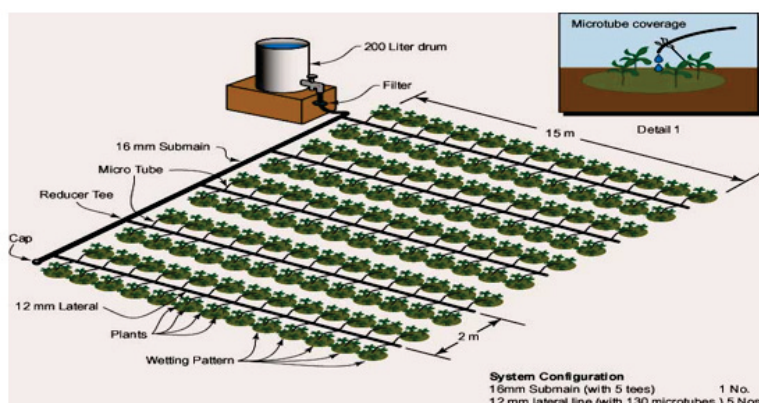
- Chlorine treatment

Chlorine treatment in the form of bleaching powder is performed to inhibit the growth of organisms like algae, bacteria. The bleaching powder is dissolved in water and this solution is injected into the system for about 30 minutes. Then the system is shut off for 24 hours. After 24 hours the lateral ends and flush valves are opened to flush out the water with impurities. Bleaching powder can be directly added into the water source at a rate of 2 mg / litre or through venture assembly.

3) Low pressure drip irrigation system

Low pressure drip irrigation system one of the best technological options in the field to run the drip irrigation system in small land holding with gravitational energy rather than commonly used electrical energy. This system not only saves irrigation water and fertilizer but precise irrigation scheduling for crops like vegetable is also possible. This system provides a means of maximising returns on their cropland by increasing the agricultural production per unit of land and water and increasing cropping intensity by growing a crop during the dry season.

In low pressure drip systems, gravitational energy is used by placing the water supply tank at a minimum height of 1.5 m. The platform of locally available materials like brick, stone, wood, bamboo plank is made of minimum 1.5 m height to place the water tank of 200–500 liter which is sufficient to irrigate 250–500 sqm area over it. The tank can be filled by hand or other means. The lateral pipe of 12–16mm fitted with dripper of discharge of 0.6–1 litre/hour is commonly used in this system. These drippers (holes) placed along water delivery lines supply water precisely at the root zone of the plants.



Establishment activities

Major activities are:

- Uniform leveling of land for equal water distribution.
- Constructing a raised platform (1.5m) for placing the storage tank.
- Installation of water pipes along the beds; check the spacing of drip holes by turning on the system and note where the drips fall, then select the particular drip point for sowing the vegetable seedlings.
- Fill the tank with water at desired intervals and introduce liquid manure as and when necessary.

Maintenance

Maintenance usually involves repairing leakages in the pipes and joints with help of adhesive and clearing blockages in the drip holes with a pin.

Benefits

- Small scale vegetable production by using this technology can fill an important technology gap
- Improved water-use efficiency (reduced loss through evaporation)
- Well directed, selective and targeted irrigation
- Ensures constant water supply in the crucial phase of germination
- Improved ground cover: better crop growth, greater area under irrigation.
- Higher yields, better quality, higher germination rate and lower incidence of pest attack
- Facilitates pre-monsoon sowing

As the coverage of this type of system is very low, i.e., up to 500 sqm, therefore more than one system can be installed at each CNG as per layout. The prefabricated low pressure drip kits are easily available in Indian market with price range of Rs 5,000 to 10,000.

5.2.7 Manure and Fertilizer Management

Plant requires 16 elements for its growth such as C, H, O, N, P, K, Ca, Mg, Bo, Cu, Fe, Zn, Mo, and Cl. Among these plants take 3 elements viz. C, H & O directly from our atmosphere, remaining 13 elements are taken from soil and other external nutritional resources. The quantity of fertilizers and manures to be supplied to the plant is governed by requirement of the plant in terms of nutrient removal and other factors relating to soil and climatic conditions and efficiency of fertilizers used. Therefore, application of nutrient to the soil is always based on soil testing.

Types of nutrients

The essential nutrients are divided into macro-nutrients (as these are required in relatively large amounts), which are nitrogen (N), phosphorus (P), potassium (K), magnesium (Mg), sulfur (S) and calcium (Ca), and micro-nutrients (required in relatively small amounts), which are iron (Fe), manganese (Mn), boron (B), copper (Cu), zinc (Zn), molybdenum (Mo) and chlorine (Cl). The missing three are hydrogen (H), oxygen (O), and carbon (C), that are taken from water and air, partly from the soil pores.

Fertilizer

Fertilizers are simple or complex inorganic compounds which contain plant nutrients in fairly large amounts and in soluble form.

Examples: Urea, super phosphate, Muriate of potash etc.

Manure

Manures are complex organic compounds containing limited amount of essential nutrients. These nutrients are not readily available. They are released only after decomposition of manure by micro-organism. Hence, these nutrients are not lost by leaching. The water holding capacity and structure of the soil is improved by the addition of organic manure.

Examples: Farm Yard Manure (FYM), Vermicompost, Nadep Compost, Oilcakes, Fish meal, Bone meal, Green manure, Biofertilizers, Jewamarit, Ghan jeevaamrit etc.

Time of application of manures and fertilizers

Organic manures are complex organic compounds which need microbial degradation before the release of nutrients in an available form. Hence, they should be applied 2-3 months in advance of flowering and fruiting or at the time of land preparation.

In chemical fertilisers, nutrients are present in soluble form and therefore should be applied a week before flowering or vegetative growth.

Application of Manure and Fertilizer at CNG

At CNG, the produce like fruits and vegetable are expected to be organic, hence all the management practices especially nutrient and pest management also need to be compatible with that.

Source of organic waste for manure production

The organic wastes that are available in agricultural areas include cattle dung, biogas slurry, leaves, crop stubble from harvested crops, husks and corn shells, weeds, kitchen waste etc. All these materials can be used to produce organic manure.

Advantages of organic manures

1. Organic manure improves both the structure and texture of the soils.
2. It increases the water holding capacity of the soil.
3. It improves the physical, chemical, and biological properties of the soil.
4. It provides all the nutrients that are required by plants but in limited quantities.
5. It helps in maintaining C:N ratio in the soil and also increases the fertility and productivity of the soil.

Therefore, application of organic manure is preferred to be used at CNG. The different form of organic manure, their formulation and application procedures are as follows:

1. Farm Yard Manure (FYM)

FYM is partially composed dung, urine, bedding and straw. FYM contains approximately 5 – 6 kg nitrogen, 1.2 – 2.0 kg phosphorus and 5 – 6 kg potash per tonne. Though FYM is the most common organic manure in India, the farmer, in general, do not give adequate attention to the proper conservation and efficient use of the resource.

For preparing better quality FYM, the use of pit method for areas with less than 1,000 mm annual rainfall and heap method for other places is recommended.

In the pit an absorbent layer is created at the bottom by spreading straw at the rate of 3 – 5 kg per animal kept. The substrate containing well mixed dung, urine and straw is spread over the absorbent layer daily to form a layer of 30 cm thick and the process continued until the pit is filled. Each day's layer should be pressed, moistened if dry and covered with a 3 – 5 cm layer of well ground fertile soil to hasten the decomposition and to absorb the ammonia. The pit should be prepared on high lying area to avoid the entry of rainwater. In the heap method, the daily collections from cattle shed are spread in uniform layers until the heap attains a maximum height of one meter above ground. The top of the heap is rounded and plastered with dung and mud mixture. In both the pit and heap methods aeration is allowed in the beginning and later on anaerobic conditions set in and continue for a long period. The manure is ready for use after 5 – 6 months.

2. Compost

Composting is the process of transforming organic materials of plant or animal origin like straw, leaves, paddy husk, ground nut husk, sugarcane trash, bagasse, cattle dung, urine, crop residues, kitchen and vegetable wastes, hedge clippings and all other residues counting organic matter into humus in heaps or pits. Compared with uncontrolled decomposition of organic material, decomposition in the composting process occurs at a faster rate, reaches higher temperatures and results in a product of higher quality.

- **NADEP Compost:** This method is based on the principle of aerobic decomposition with natural flow of optimum air. The substrate is converted at the top by plastering with dung and soil to minimise the loss of 21 moisture. To obtain 2-2.5 tonnes of compost with 0.6-1.0, 0.5-0.8 and 1.2-1.5 percent nitrogen, phosphorus and potash respectively, the required raw materials are 1.4 to 1.5 tonnes of organic refuse, 90-1000 kg of cattle dung, 1.7 to 1.8 tonnes of



pulverized dry soil and 1,500-2,000 litres of water. These materials are filled layer by layer in a tank of 3 m x 2 m x 1 m size and made-up bricks with holes (15-20 cm rectangular) on all four walls for easy entry and circulation of air. The tank is constructed above ground at high lying area to avoid entry of rainwater from surrounding place. Internal surface of tank is painted with dung slurry.

The tank is filled in layers. The first layer is made by spreading 100-110 kg of organic wastes on the floor of the tank. This is followed by a second layer containing a slurry of 4-5 kg cattle dung in 125-150 litres water. Over the second layer, 50-60 kg of pulverized good quality soil is spread. The three-layer combination is repeated till the tank is filled up to 45-50 cm above the brick level. The complete filling is done within two days, using materials of 10-11 layers. Topping of the tank is done by 5 cm plastering with a paste of dung and soil. Cracks are not allowed to develop on the heap to prevent the gas leakage. After 15-20 days, when the substrate

shrinks down, a second filling is made in a way similar to that adopted in the beginning. The top is then arranged in a hut like shape and replastered. The moisture level of the mass is maintained at 15-20 percent by sprinkling with water and dung slurry through holes. Normally the substrate takes 3-4 months to attain maturity without turning. From one tank about 4.5 - 5.0 cubic metre mature compost 1.5 - 2.0 cubic metre under composed raw refuse, weighing about three tonnes are obtained. The 2.5 tonne compost obtained from one NADEP pit is sufficient for 2.0ha land.

- **Vermicompost:** Vermicomposting is a method of preparing enriched compost with the use of earthworms. Partly degraded cow dung, cane trashes, poultry & farm wastes and other domestic wastes are brought to vermicomposting unit for preparation of compost. This process takes place to complete in 45-50 days. The time period depends upon no. of worms/square meter. On an average 1gm of weight of worms collects 5gm of waste material per day. At CNG, low-cost readymade portable vermicomposting beds of size 12x4x2 feet size made up of polyethylene net window with netted outlet at the bottom of the bed can be installed.

Vermiwash is drained out extract of vermicompost. To prepare vermiwash, a vermicomposting unit is arranged with water trickling arrangement. This is used as a vermiwash for crop production. It contains more nutrients than vermicompost and finds favour for use as liquid manure. (Detail is given in other allied intervention)

3. **Green Manures:** Green manure are the plant grown to accumulate nutrients for the main crop. When they have built up maximum biomass, they are turned into the soil for decomposition. Green manures improve the physical structure of the soil, as well as soil fertility. Crops, like dhaincha and sun hemp are used as green manure. These plants are grown in the field for 6-8 weeks, and then, they are ploughed and turned in the soil where they have grown.



4. **Oil cakes:** The solid platy residue left after the extraction of oil from seeds is known as 'oil cake'. These oil cakes are applied to add nutrients to the soil, as well as, to improve the soil structure.

The cake formed during the extraction of oil from seeds may be:

- Edible oil cakes: Groundnut cake, linseed cake, rapeseed cake, sesamum cake, etc.
- Non-edible oil cakes: Karanj cake, neem cake, castor cake, etc.

5. **Bone Meal:** Bonemeal is a mix of ground slaughterhouse waste products like animal bones. It is a very good source of phosphorous and amino acids. Being organic it is also a slow-release fertilizer.

5.2.8 Plant Protection Management

At CNG, more focus should be on prevention of pest and disease rather than control. A healthy plant is less susceptible to pest and disease infestation. Therefore, a major aim for the grower is to create conditions which keep a plant healthy. The health condition of a plant depends to a large extent on the soil fertility. When nutrition and pH is well balanced, the plant becomes stronger and therefore has less chances of infection. Climatic conditions, such as suitable temperatures and sufficient water supply, are further factors which are crucial for a healthy plant. If one of these conditions is not suitable, the plant can become stressed. Stress weakens the defense mechanisms of plants and makes them easy targets for pests and diseases. One of the most important points for the CNG is therefore to grow diverse and healthy plants to avoid many pests and disease problems.

A. Prevention Practices and Monitoring

A.1 Preventive practices

1. Selection of local and resistant varieties
2. Selection of healthy and clean seed and planting material
3. Adoption of suitable cropping system
4. Maximum use of organic matter as input
5. Balanced use of nutrients
6. Conservation and promotion of natural predators
7. Use of good water management practices
8. Proper field sanitation

A.2 Monitoring

This is a very important tool; regular monitoring of pest and disease helps in effective management. It is necessary that a technical person at CNG should have adequate competency to identify the symptoms of damages caused in the crop. Typical signs of pest and diseases on crop plants are as follows:

a. Sign of pest attacks on crop plants:

In fruits and vegetables, pests belong to the insects, mites and nematodes are more common.

Insect damage can be categorized by Piercing and sucking types (white flies, aphid, jassids etc), Boring type (Leaf miner), Cutting and chewing type (caterpillars, weevils, beetles etc.) & hidden or underground (Stem borer etc). In case of caterpillar and beetle attack, leaves with holes or missing parts are found. Curled and deformed leaves is an indication of sucking pests like white flies, aphid, jassids. Damaged, curled or rotten fruits are often caused by the larvae of fruit flies. Withered plants are caused by larvae of stem borer.



Mites like red spider mites are very small and cannot be seen with the naked eye. They attack on the fruits and vegetable plants. It weaves a typical tissue on attached plant parts like leaves and fruits and can, therefore, easily be detected. Its presence is noticed by yellowing of leaves and fruits.

Nematodes are very small and therefore, they are not easy to observe with the naked eye. They mostly attack on plant roots. The affected plants become yellow, wither and die.

b. Sign of disease infestation on crop plants:

In fruits and vegetables, most of the diseases are caused by the fungi, viruses and bacteria.

Fungi are the major of infection in crops. The symptoms like mildew, sooty mould, anthracnose,

rust, smuts, blights, wilt, scab, rot etc on the any plant parts or entire plant. The affected parts of plant or total crop plant can wither or die due to its infection.

Systemic diseases are mostly caused due to viruses. Chlorosis or yellow colour patches on leaves are generally occurred due to its attack. These patches may form characteristic mosaic patterns, resulting in general reduction in growth and vigour of the plant. Generally, sucking insects like white flies are served as carrier for viruses.

Bacteria cause internal damage to plants by breaking down the cell walls of plants, damaging of plant tissues, block the narrow channels preventing water getting from the roots upto the shoots and leaves. The most common symptoms are rotting, sudden dieback of the plants, overgrowth of plant tissues and form tumours, cankers etc. appeared over plants.



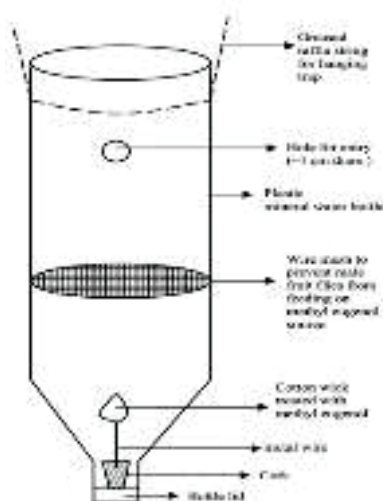
Therefore, careful and continuous monitoring of pest and disease levels at every CNG especially at growth stage of the crop is compulsory for successful management.

c. Scouting

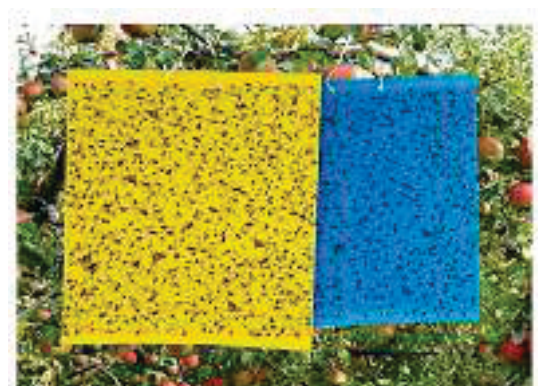
For early detection of the problem and to avoid unnecessary use of chemical and pesticides, scouting should be planned and done in an organized way. Due to regular scouting, presence of pest and diseases can easily be detected on early stage.

The following mechanical tools can be used for monitoring purposes:

Light traps: Light traps are especially needed where noctuids (e.g. moths, cutworms, African armyworm, and cotton bollworm) are a problem. Within crops attacked by cutworms, visual checks of caterpillars have to be done by dawn.



Fruit fly traps: These are especially used to monitoring of fruit flies. Fruit flies are a major pest of fruiting vegetable crops and fruits. Traps attract the male fruit flies into a trap by using bait trap. Readymade traps are available in market. Low-cost traps using PE-bottles can also be prepared and hung in trees for monitoring.



Sticky traps: Adhesive coated plastic boards are used for trapping aphids, white flies, jassids, thrips and other sucking pest in the field. Yellow sticky boards are appropriate for whiteflies whereas, blue boards are used for thrips monitoring.

B. Control:

After monitoring and considering information about the pest, its biology, and environmental factors, you can decide whether the pest can be tolerated or whether it is a problem that warrants control. If control is needed, then cultural and biological control should be preferred at CNG. As per necessity, chemical control based on Integrated Pest Management (IPM) strategies can also be used.

B.1: Botanical Pesticides:

Some plants contain components that are toxic to insects. When extracted from the plants and applied on infested crops, these components are called botanical pesticides or botanicals.

Generally, botanical pesticides are contact, respiratory, or stomach poisons. Therefore, they are not very selective, but target a broad range of insects. The toxicity of botanical pesticides is usually not very high and their negative effects on beneficial organisms can be significantly reduced by selective application. Furthermore, botanical pesticides are generally highly bio-degradable, so that they become inactive within hours or a few days. This reduces again the negative impact on beneficial organisms, and they are relatively environmentally safe compared to chemical pesticides.

- a. **Neem:** Neem (*Azadiracta indica*) found everywhere in India, contains insecticidal compounds azadiractin, which both repel and kill many species of insects. Seeds contain oil and used for extraction of neem oil, whereas leaves alone or along with seed can be used to prepare the solution. Neem cake (ground neem seed or neem kernel powder) has also been used as soil nutrients as well as to control soil borne insect and nematodes.
- b. **Pyrethrum:** Pyrethrum is a powerful, rapidly acting insecticide originally derived from the crushed dried flowers of the daisy *Chrysanthemum cinerariifolium*. The dust made up of crushed flowers can be used directly or infused into water to make a spray. To apply in liquid form, mix 20g pyrethrum powder with 10 L of water and add soap or shampoo for sticky effect to make more effective.
- c. **Garlic:** Garlic has antifeedant (insect stop feeding), insecticidal, nematocidal and repellent properties. Garlic is reportedly effective against a wide range of insects at different stages in their life cycle (egg, larvae, adult). This includes ants, aphids, armyworms, diamondback moth, whitefly, wireworm and termites. Garlic is non-selective, has a broad-spectrum effect and can kill beneficial insects as well. Therefore, it should be used with caution. To make the garlic extract, grind or chop 100 g garlic into 0,5 L of water. Allow mixture to stand for 24 hours, add 0,5 L of water and stir in liquid soap. Dilute at 1:20 with water and spray in the evening. To improve efficacy, chilli extract can be added
- d. **Chilli:** Chillies have both repellent and insecticidal effects. It is used against aphids, small caterpillars, snails and ants. To make the chilli extract grind 200 gms of chillies into a fine dust, boil it in 4 L water, add another 4 L of water and a few drops of liquid soap and dilute at 1:20 with water for spray.

Apart from above, plants like marigold, coriander, nasturtium, chives, chilli, garlic etc are known to have repellent effect against different types of insects. Therefore, it can be grown as intercrop/border crop in the CNG.

B.2: Biological control:

In this natural enemies are used to manage the pest population and diseases in the field. The natural enemies and their role in pest and disease control are as follows:



Sl. No.	Name of Natural enemy	Pest and disease
1	Bacteria- <i>Bacillus thuringiensis</i> (Bt)	African armyworm, African bollworm, bean armyworm, beet armyworm, cabbage webworm, cabbage moth, cabbage looper, cotton leafworm, diamondback moth, giant looper, green looper, spiny bollworm, spotted bollworm, pod borers, tomato looper
2	Virus - <i>Nuclear polyhedrosis virus</i> (NPV)	Cater-pillar pest species
3	Fungi- <i>Beauveria bassiana</i>	Sucking pest like whitefly, thrips, aphids and mealybugs
4	Fungi- <i>Trichogramma species</i>	lepidopteran pests and aphids
5	Fungi - <i>Trichoderma sp</i>	Prevention of soil-borne diseases such as damping-off and root rots in vegetables

B.3 Other Practices for Disease Control:

- 1. Bordeaux mixture:** Bordeaux mixture is both fungicidal and bactericidal. As such, it can be effectively used against diseases such as leaf spots caused by bacteria or fungi, powdery mildew, downy mildew and various anthracnose pathogens.

Preparation of Bordeaux mixture (1%)

Materials required:

Copper sulphate powder - 1 kg

Lime - 1 kg

Water - 100 litres

How to Prepare

1 kg of copper sulphate powder is dissolved in 50 litres of water. Similarly, 1 kg of lime is powdered and dissolved in another 50 litres of water. Then copper sulphate solution is slowly added to lime solution with constant stirring or alternatively, both the solutions may be poured simultaneously to a third contained and mixed well.

Preparation of 0.5% Bordeaux mixture is same as above but reducing the copper sulphate and lime half of the amount but keeping water same as 1% mixture preparation.

In general, 1% Bordeaux mixture is applied to hardy plant parts such as roots, stem and 0.5% of mixture is applied on leaf/foilage.

Bordeaux Paste: Bordeaux Paste consists of same constituents as that of Bordeaux mixture, but it is in the form of a paste as the quantity of water used is too little. It is nothing but 10 per cent Bordeaux mixture and is prepared by mixing 1 kg of copper sulphate and 1 kg of lime in 10 litres of water. The method of mixing solution is similar to that of Bordeaux mixture. It is a wound dresser and used to protect the wounded portions, cut ends of trees etc., against the infection by fungal pathogens.

Baking soda: It has been used to control mildew and rust diseases on plants. Spray with a mixture of 100 g of baking or washing soda with 50 g of soft soap. Dilute with 2 L of water. Spray only

once and leave as long gaps as possible (several months). Do not use during hot weather and test the mixture on a few leaves because of possible phytotoxic effects.

Many plant extracts are known to have fungicidal effects. Onion and garlic are effective against many diseases such as mildew and fungal and bacterial diseases.

5.2.9 Crop cycle and Crop rotation

Sl. No.	Season	Month	First fortnight (seasonal crops)	Second fortnight (seasonal crops)
1	Rabi	October	Late cauliflower, late cabbage, potato, Carrot, turnip, radish, methi, palak, bathua, Coriander, table pea, desi pea, onion seed, onion bulb, garlic & knol-khol.	Bottle gourd, pumpkin, radish, turnip, methi, coriander, onion seeds, onion bulb, garlic & palak.
2		November	Parwal, methi, coriander, turnip, radish, potato, onion bulb, cabbage, knol-khol, palak & french bean, lettuce	Potato, knol-khol, radish, methi, coriander, table pea & palak.
3		December	Palak, radish, turnip, coriander & methi.	Palak, hill potato, radish, turnip, coriander & methi.
4		January	Potato, palak, coriander, methi, bottle gourd, musk melon & watermelon.	Palak, Coriander, Methi, Radish, Brinjal and Bottle gourd
5		February	Okra, sponge gourd, cucumber, bottle gourd, radish, palak, methi, coriander, chilli, watermelon, podina & brinjal.	Vegetables not sown in the previous fortnight may be sown in this fortnight but may not produce the same results as expected in first fortnight sowing.
6		March	Same as second fortnight of feb, with few other crops like: cowpea & tinda may be sown.	Pudina or mint roots, yam, palak, coriander & radish.
7	Zaid or Summer	April	Same as march	Same as march
8		May	Radish, Okra, Bottle gourd & Cucumber, kharif onion seed, tomato nursery, Ginger	Same as for the previous fortnight.
9		June	Cucumber, turmeric, ginger, snake gourd, radish, coriander, brinjal & okra.	Cucumber, brinjal, okra, radish, bottle gourd, sponge gourd, pumpkin, ash gourd, cowpea, palak & early cauliflower.
10	Kharif	July	Early cauliflower, tomato, brinjal, okra, bottle gourd, pumpkin, tinda, french bean, chilli & sponge gourd.	Early cauliflower, tomato, brinjal, okra, bottle gourd, pumpkin, tinda, french bean, chilli, sponge gourd & early potato.

5.2.10 Plantation and Nursery Management

At 01 ha model, 0.5 ha (5000 sqm) land will be used for fruit orchards and in 02 ha model, 1.0 ha (10,000 sqm) land will be allocated for fruit orchards. As the intercropping of vegetables and spices are proposed in orchards, hence proper planning and layout is compulsory for getting maximum output.



Proposed Fruit Crops & their varieties:

Crop	Varieties
Mango	Bombay Green, Dashehari, Langra, Fazli, Mallika, Amrapali, Pusa Pratibha Bombay Green, Langra, Mallika, Amrapali, Pusa Pratibha,
Guava	Sardar (L-49), Allahabad Safeda, Chittidar, Lalit; Shweta, Dhareedhar
Lime	Kagzi Lime, Pramalini, Vikram, Balaji (Tenali Selection)
Sweet orange	Mosambi
Sapota	Kalipatti, Cricket Ball
Papaya	Co-2, Coorg Honey Dew, Taiwan, Pink Flesh Sweet, Sunrise Solo
Banana	Dwarf Cavendish, Grand Naine, Red Banana
Pomegranate	Bhagwa, Jyoti
Aonla	Kanchan (NA-4), Krishna (NA-5), NA-6, NA-7, NA-10
Custard Apple	ArkaSahan, Balanagar
Drumstick	PKM-1, PKM-2
Karonda	Lal-gulabi
Curry leaves	
Jamun	Local genotype
Jackfruit	Local genotypes (Khaza, Singapore, Silon)
Litchi	Shahi, Late Large Red (Muzaffarpur)
Ber	Thar Sevika, Thar Bhubhraj, Seb, BanarsiKadaka, Umran
Peach	Florda Prince, Prabhat, Florda Sun, Sharbati
Pear	Kashmirinakh, Patherinakh, Baggughosa



Apart from above, as per demand of local conditions new fruits may be added at CNG.

At CNG, plantation is proposed at north side of the garden so that they may neither shade remaining plants nor they interfere with intercultural operations. The land should be on a gentle slope sufficient to allow excess water to run off without causing soil erosion. Where necessary, a proper drainage system must be built to avoid water logging and damage during periods of heavy rainfall. The exact design of the drainage system will depend on the requirements of the site. The general principle is to direct excess water to the sides and keep the main pathways dry.

The first requirement after preparation of soil is water. Before layout, we have to decide which irrigation system we follow, then move for layout. At CNG, as per land dimensions two type of planting systems will be followed viz. square system and rectangular system. Whereas, in rectangular system planting of those fruit trees prefer which require less distance between plant to plant than row to row distance. It has almost all the advantages of square system but cultivation between plant to plant is difficult.

A pit is a hole made in the soil at the place of planting a fruit tree.

The size of the pits is determined by the fruit plant species, its final size, quality of soil, quality of sub-soil, root system etc. Generally, for large size of fruits like Litchi, Mango, Sapota the size of pit should be dimension of 1m long X1m width X1m depth (1.0 cubic meters). Whereas for medium size fruit plants like guava, pomegranate, citrus etc. a pit size of 0.75mX0.75 mX0.75m (0.75 cubic meters) is enough. For other crops like Papaya, Banana the pit size could be 0.50m X 0.50m X 0.50m (0.50 cubic meters). Generally, for soils like gravely/ rocky and problematic, the pit size has to be big, whereas or well drained loamy soil, it could be smaller. If the soils are poor in nutrient status, bigger pits are made; In case of rich soils smaller pits serve the purpose.

Point to remember while digging of pit

- Before digging the pits, two outer pegs are fixed with the help of planting board.
- Already fixed peg is kept in the central notch to mark the right point to plant each tree.
- During digging of actual pit, the central peg is removed, and two outer pegs remain undisturbed.
- These outer pegs help in locating the point where the plant is to be put in.
- When the soil is taken out of the pit, the soil from upper half is kept on one side and from lower half on other side.
- This soil is allowed to weather for 2-4 weeks during summer months so that any type of infection in soil may be destroyed by sunlight.

Filling of pits

- The only time you will be able to apply fertilizer or a nutrient directly to the roots of the fruit tree is when you plant out. It is advisable to use farmyard manure and commercial fertilizer only if it can be afforded. Incorporating as much fertile soil as possible is most important.
- Before filling the pit, a mixture of well – decomposed FYM (50 kg), superphosphate (100 gm), murate of potash (100 gm) and Imidacloprid for termite control is prepared and mixed with upper as well as lower soil of the pit.
- The mixture of upper soil is filled first followed by lower soil mixture.
- During filling of pits soil is pressed well so that there is no air pocket inside the pit.
- The upper level of pit is kept 15cm above from the field level.
- After filling, the pits are irrigated to settle down the soil of the pit.
- The purpose of digging and filling the pit is to provide congenial conditions for plant growth and development, specially to young plants.

Planting

- However, in case of sprint planting, if there is a period of hot and dry weather with low humidity, it may result in a high mortality rate for young plants.
- The planting is done in evening when the high humidity prevails in the atmosphere.

Planting procedure

- Remove the fruit tree from the container, holding the tree at bottom and below the grafting or budding union.
- Place the fruit tree in the centre of the planting hole.
- Place the stem of the improved tree at the same depth as it was in the container. The grafting or budding union must be 15 to 20 cm above ground level.
- Do not cover the grafted or budded union with soil by planting the tree too deep in the hole.
- Fill the hole with soil and water until all the soil is moist. This will take 3 to 4 bucketsful.
- Press the soil around the tree, creating good contact between the roots and the soil mixture.
- If there is plenty of rain or strong wind, use a stick and tie the tree below the grafting union to the stick, without strangling it.

Maintenance of Fruit Trees after planting

Staking

The stake can be a 1.2 m long wooden or bamboo stake. The young tree is tied to the stake with a string in a figure eight formation. It is strongly recommended to place a rubber cushion or cardboard paper between the tree and the string to avoid the tying material from bruising the tree. Staking the tree helps young trees grow in the desired direction and protects the branches from breaking. The staking also helpful to keep plant stem straight and save the plant from damage by breaking from graft union.

Frost protection

- The young plants are more prone to frost damage during winter months.
- The most common method to save the plants from frost is to thatch them.
- The thatching can be of any type of dried grasses or of polyethylene sheet.
- The plants are covered on all sides except North-West and South-East so that the sunlight may enter in morning and evening times.
- This thatching material is used in winter months and may also be used in summer months against the hot winds.

Protect Tree against Sunburn

For the protection of the planted tree against sunburn the farmer can use white lime paint diluted with in water. The application of the mixture should be 5 cm below the soil surface up the entire trunk including the dormant buds. The process should also be repeated for the second season while including any large branches that are also exposed to the afternoon sun.

Irrigation

The young tree's water requirement is approximately 8-20 liters per plant. During initial stage frequent irrigation (at 7 days interval) is essential to save plants from desiccating winds. Irrigation through drip irrigation is system is more suitable in undulating topography.

Fencing

If grazing is common in your area, protect the tree immediately and well from animals. Putting tree guard made up of bamboo could do this.

Weeding

- Weed shallowly, being careful not to damage or disturbing the developing root system.
- Use a fork hoe or scratch the soil with a normal hoe in a shallow angle, especially with bananas and shallow-rooted fruit trees.
- Weed twice a month in the rainy season, once a month in the dry season.

Mulching

Mulching is the placement of any organic or inorganic material over the top of a soil surface to protect it. It helps to retain the soil moisture, reduce evaporation and weed infestation. At orchard and vegetable garden, organic mulching using paddy straw, dry leaves, straw may be used to cover root area of the plant. Now a days, ultra-stabilized plastic mulch is also used in horticultural crops. Generally black mulch of 100-micron thickness are used in orchard. Whereas, 25-micron silver colour mulch films are used in vegetable crop.



Early De-blossoming

- Young plants prepared through asexual methods of propagation start flowering immediately after the year of planting or even at the nursery stage.
- This adversely affects the growth and vigour particularly when such types of plants are allowed to set fruits.
- This fruiting is at the expense of growth and hinders the formation of strong framework of the plant.
- Therefore, these inflorescences should be nipped off immediately after emergence so that it may not disturb vegetative growth.
- The de-blossoming should continue till the plant attains three years age.
- By this time plant attains normal size and it is physiologically sound to bear the fruits.

5.2.11 Procurement of seeds for CNG

Preference should be given to local and open-pollinated varieties than hybrid ones, especially in vegetable crops. These varieties are cheaper than hybrids along with seed multiplication is possible at CNG level. Apart from these continuous access to quality seeds and planting materials, which is one of the most crucial elements of CNG to remain productive, is also possible.

The community seed bank may also be established at selected CNGs where open-pollinated seeds of vegetables, pulses, and millets and planting materials (e.g., grafting, budding, seedling, saplings etc.) would be conserved scientifically. This will ensure easy access to quality seeds and planting materials of diverse crop species of local communities to other CNGs also. In case of surplus availabilities of quality seeds, commercial opportunities can be explored like sale of seed packets. It helps in maximizing the profit of CNG along with the inculcation of entrepreneurship skills among community members.



Establishment and maintenance of community seed bank

The collection, maintenance and preservation of seeds and planting materials require specific scientific skills and expertise. CNG members thus need to be trained thoroughly by agricultural scientists of Krishi Vigyan Kendra or any other related agencies so that they can develop seed and planting materials carefully, conduct seed production and regeneration activities regularly, maintain various data and records in a proper way.

The Community Seed Bank needs to have proper physical infrastructure such as air-tight glass jars for keeping vegetable seeds, double-layered high quality plastic bags for storing seeds and digital handheld moisture meter and large insulated chamber to keep the seeds. Otherwise, the germination and productive capabilities would be adversely affected.

In the context of CNG, open-pollinated varieties of vegetables like tomato, brinjal, chilli, peas, coriander, potato, garlic, onion, cucurbits, leafy vegetables, drumstick etc would be promoted. Besides, seeds of vegetables, planting materials in the form of seedlings of vegetables, fruit tree species (cuttings, grafting, budding etc.) would also be promoted. Proper collection of seeds and preservation of seeds are necessary as the degree of germination is highly dependent on these issues.

Seeds always need to be treated before planting or raising nursery. In order to have high vitality, seeds dressing through a dry formulation or wet treated with a slurry or liquid formulation is mandatory. Seed treatment or dressing takes care of insect and fungi attack while storing the seeds for the next seasons to plant. Seed coating is effective in dealing seed borne diseases and soil pathogens. In fact, treated seeds can even withstand initial moisture stress leading to less germination loss.

The Community Seeds Banks would be commercially viable where community members in general would access seeds and planting materials against price that would develop a self-financing mechanism for sustainability of the Seed Bank

5.2.12 Intercropping of vegetable crops for year-round production

Vegetable crops are herbaceous plants having parts like pods, fruits, modified roots, underground stems and leaves that are used for food. These vegetable crops are short durational species, which are most suitable for intercropping in comparison to other species. Intercropping is based on the principle of efficient utilisation of canopy space available in fruit orchard.

Among different species of intercrops, growing tuber crops like Colocasia, Turmeric and Ginger have been reported to be suitable to perennial tree plantation. These are shade loving tuber crops, which have great potential to withstand and grow under canopy of fruit plants.



The common vegetable crops which are more suitable for intercropping in fruit orchards are Okra, French bean, Brinjal, Potato, Cauliflower, Pea, Arvi (Colocasia), Bottle gourd, Pumpkin, Radish, Spinach, Methi etc.

Intercropping of vegetable crops under canopy of fruit trees has no negative impact on growth, flowering, fruiting and yield of trees.

Advantages

- Generation of additional crop yield income per unit area than sole cropping.
- Improving food security and preventing soil erosion through orchard floor covers.
- Moisture conservation and reduced evaporation
- More nutrient is produced per square meter of land

Points to remember:

- Intercrops occupy a secondary place in the orchard, primary consideration being given to the perennial fruit plants.
- Fruit crops that grow tall and have tendency towards excessive growth should be discouraged
- Dwarf type fruit varieties should be preferred
- Short duration vegetable crops should be preferred for intercropping

5.2.13 Livelihood activities

Depending on the agro-climatic conditions, land availability for CNG, family requirement and the market demand, the following additional components can be integrated:

1. Goat rearing
2. Dairy farming
3. Mushroom cultivation
4. Vermiculture units
5. Bee keeping
6. Horticulture nursery
7. Pisciculture (Minakshi Talab Scheme)

1. Goat Rearing: Goat is a prolific breeder with a capacity to increase the herd size within a short span of time. Improved breeds of goat like Jamunapari with higher fecundity and growth rate can be maintained even in the backside shelter of the CNG with ease. Since goat eats all types of leaves, the lopping of the commonly available trees may be used for feeding the goats. However, care has to be ensured to not to let loose the animals so as to avoid damage to the garden.



2. Dairy farming: Dairy Rearing of milch cows is the easiest way of converting wastes into resourceful products. Of late demand of A2 milk of local breed (desi cows) are getting premium prices in the market. Apart from this, cow dung and cow urine may be utilised for natural farming at CNG. Therefore, desi breeds of dairy cows like Sahiwal etc. are widely adopted and can give better profits. Cultivation of improved varieties/ hybrids of forage grass and legume mixtures on farm bunds and using for dairy on a regular basis can bring down the production cost of the dairy with enhanced profits. Balanced feeding with regular checkup of the animal for infertility problems can bring greater dividends.

3. Mushroom cultivation: Production of Oyster (paddy straw) mushrooms can be practiced in almost all the CNGs without much problems. The major ingredient for mushroom production viz paddy straw is normally available with the farm households. The mushroom spawn (seed) is normally available with most of the places and the production can be taken up on a wooden stand with provisions for protection from sun light and upkeep of the humidity. As this is a short duration enterprise, the intermittent returns can be established through tying up with a regular market outlet.





4. Vermicomposting: The supply of fertilizers in the rural areas and their cost is increasing day by-day. Continuous use of chemical fertilizer is also affecting the soil quality and the productivity of land. Recycling of available bio-resources and on-farm production of vermicomposting also helps to provide required essential plant nutrients to farms. Besides, use of organic manures also improves the water holding capacity of soil and thereby reduces the water requirement of the crops.

5. Beekeeping: As per the district agro-climatic conditions and availability of flora with varying flowering periods during different months of the year, bee keeping can easily be practiced. Initial colonization of the honeybees requires proper identification of site, installation of proper beehives and attracting the queen honeybee. The nectar yielding plants can also be planned as a regular source of food for the honeybees. Due to the medicinal value of the honey, the family can be benefited with proper planning.



6. Horticulture Nursery: Assessing the local needs of planting material and planning for graft progenies in important crops of demand can fetch greater dividends. A small area in the CNG with facility for protection from the direct sunshine and rainfall with availability of irrigation can better be utilised especially for rare plants to earn more income for community members. The seasoning in production can better be planned depending on the crop so as to have continuity in production during different months of the year.

7. Pisciculture: Pisciculture or fish farming is a process of breeding, raising, and transporting of fishes for domestic and commercial purposes. Fishes are the healthy and nutritional food options as they are a rich source of proteins and other minerals.



5.2.14 Convergence with available schemes

Convergence will be the backbone of the CNG program in MGNREGS for setting-up of Community Nutrition Garden. Financial resources and technical expertise of line departments may be utilised in implementation of the proposed program. A proper activity plan and relevant schemes used for convergence may be identified with the coordination of different departments to optimise the benefits. Secondly, appropriate convergence strategies will bring enhanced economic opportunities for the target mass in the project locations which will strengthen the employment and livelihood of the people. The platform of district CNG coordination committee should be used for this purpose. The activity plan will be a base and guiding line for the convergence.

Convergence Benefits:

- Intervention becomes more holistic in comparison to piecemeal approach
- Improved effectiveness of projects / schemes / programs and process sustainability.
- Enhancing employment opportunities, income opportunities, savings and investments through different farm and off/non-farm activities.
- Improved creation of productive asset base at community level.
- Technical support in different allied livelihood areas like product value addition, marketing, mushroom cultivation, bee keeping, goat farming, dairy, vermicomposting, horticulture nursery etc.

Sl. No.	Department	Area of support	Scheme
1	Department of Panchayat and Rural Development	Implementation of the scheme including land and all type of infrastructure development	Mahatma Gandhi NREGS, NRLM
2	Department of Women and Child Development	Linkage with Anganwadi Centres	ICDS
3	Department of Horticulture and Food Processing	Training, Nursery, seed and seedlings, Fruit Plants, Micro Irrigation- Drip/Sprinklers, Protected cultivation infrastructures- Polyhouse/walk-in-tunnel, Vermibeds, Pond lining, Processing and value addition, Cool chambers etc	MIDH, PMKSY, RKVY, PMFME
4	Department of Farmer Welfare and Agriculture	Training, Organic Farming, Water harvesting, Pond, Tube well, Micro Irrigation	ATMA, PMKSY
5	Department of Animal Husbandry and Fisheries	For implementation of allied interventions like Training, Dairy, Goat rearing, Fisheries, Organic Farming etc.	
6	State Agricultural University Krishi Vigyan Kendra	Training, Demonstration, Technical advice and Planting material	ICAR schemes

5.3 PRODUCE MANAGEMENT

5.3.1 Harvesting and Post-harvest management

The utmost care should be taken while harvesting of fruits and vegetables from the field as these are perishable in nature. The carrying out of harvesting operations must observe the following basic principles:

- Harvest a good quality crop in good condition
- Keep the harvested produce in good conditions until it is consumed or sold

In accordance with the above principles, below mentioned points should be followed:

- 1. Maturity at harvest:** Harvesting crops at the proper maturity allows handlers to begin their work with the best possible quality produce. Produce harvested too early may lack flavor and may not ripen properly, while produce harvested too late may be fibrous or overripe and have a shorter shelf-life.
- 2. Harvesting time:** The preferred time is the coolest part of the day, usually in the early morning or late afternoon. It is not desirable to harvest produce when it is wet from dew or rain as this greatly increases the risk of post-harvest spoilage and the tissue is more prone to physical damage.



- 3. Harvesting technique and operations:** Many fruits (mangoes and guava) and vegetables (tomatoes) are adequately harvested by hand, without mechanical aids. However, the provision of simple harvesting tools such as scissors will invariably increase the speed of harvesting for crops such as berries, lemons and oranges. Sharp knives are indispensable for harvesting of commodities like lettuce, cabbage, capsicum and broccoli. It is almost compulsory that the harvesting of roots and tubers be carried out with some digging implement to reduce the damages.
- 4. Post-harvest handling:** It encompasses those steps required for harvested produce to meet market quality standards. Grading and sorting are the important operations to be carried out after harvesting for removal of damaged, diseased, blemished, over-ripe or under-ripe produce. For enhancing the shelf life of the produce, removal of field is compulsory. Therefore, precooling or keeping produce in cool and dark place or in pre-cooling chambers enhances the keeping quality of the produce.

5.3.2 Self-consumption of produce

The role of CNGs is to add substantially to the family's nutritive and energy requirements on a continuous basis. They play an important role in enhancing national food security and dietary diversity to combat malnutrition. Apart from these, CNGs also contribute to income generation, improved livelihoods, and household economic welfare as well as promoting entrepreneurship and rural development.

The main produce of community nutrition gardens are horticultural products like fruits, vegetables, spices, herbs etc. Apart from these, other produce like Milk, Honey, Mushroom etc are also produced from 2.0-hectare model. Due to easy availability, increased consumption of fruits and vegetables among households brings health and nutrition behavior change and has a positive effect on health. Harvested produce will be available for self-consumption of the SHG members and the surplus will be available for market linkages. It is suggested that SHG members should frame a governance mechanism and come

up with clearly laid out rules for self-consumption. The produce like leafy and green vegetables should be included in every diet compulsorily. Vegetables and spices that are surplus after self-consumption will be converted into value added products by doing primary or secondary processing.

The following value-added products can be prepared for self-consumption during off-season:

1. Solar dried: Tomato, Brinjal, Onion, Methi, Palak, Pea, Pudina, Okra, Bathua, Mushroom, Banana, Mango, Ginger, Garlic, Coriander, Chilli
2. Dried Powder: Turmeric, Ginger, Coriander
3. Chips: Potato Chips
4. Jam/Jelly/Ketchup: Tomato, Mango, Guava, Karonda etc
5. Pickle: Ginger, Aonla, Mango, Tomato, Garlic, Carrot, Karonda, Lime etc
6. Candy: Ginger, Aonla, Mango

5.3.3 Selling and Marketing of surplus

After self-consumption, the surplus will be sold as fresh or after doing value addition for income generation. The potential produces, that can be sold through different market linkages from CNGs are Fruits, Vegetables, Spices, Milk, Honey, Vermicompost, Vegetable seeds, Seed tubers, Fruit plants, Processed products etc. Proper branding of the produce is necessary for easy access to market.

The probable market linkages will be as below:

1. Local Market: Outlet at village market for retail as well as local traders where CNG is established.
2. Government Supply: In Anganwadi centres, Health centres, Hospitals, Government office mess, School or college canteens etc.
3. Local weekly Haat/Bazar/Jaivik Haat: Processed spices like coriander and turmeric powder, raw mango powder, pickles, jam, jelly, murraba, candy, honey, mushroom, vegetable seedlings, planting material, vermicompost etc.

It is suggested that SHG members should strive for assured market linkage so that they get the market for their surplus produce at the farm gate itself. District coordination committee can play a crucial supportive role in this area.

5.4 MONITORING

Continuous monitoring of the community nutrition garden is an important aspect for its effective implementation. This monitoring is required at different levels.

- The most important monitoring would need to be done with the cooperation of the Gram Panchayat at the village level. Therefore, it would be appropriate to develop such a system wherein at regular intervals, the members of the Gram Panchayat discuss and review the progress of the community nutrition garden.
- At the district level, it would be appropriate to monitor all the CNGs established in the district by the district level Coordination Committee once in a month. This committee will support in overcoming the difficulties faced in the implementation of the CNGs, as well as help in their capacity development and marketing of the produce.
- Monitoring at the state level will be helpful for development of new CNGs, review of different activities in established CNGs, capacity development and support in developing marketing linkages at the state level. In this line, it is also proposed to prepare a monitoring app and a state level
- CNG progress dashboard. The progress of work at all levels can be reviewed with the help of this monitoring app and dashboard.

6. CAPACITY DEVELOPMENT

For successful implementation and roll-out of community nutrition gardens, it is of utmost importance to enhance the capacities of all the relevant stakeholders.

6.1.1 Capacity Development of SHG

Capacity development of SHG members is essential for the successful roll-out of CNGs. Following topics for capacity development of SHG members are suggested:

- Orientation on CNGs
- Provisions of MGNREGS particularly in the context of CNG
- CNG Development and Maintenance, agroecological practices
- Livelihood activities and convergence mechanisms
- CNG Produce Management and market linkages
- SHG Management

District level coordination committee will develop mechanisms for delivering the required trainings to SHG members, as and when needed.

6.1.2 Capacity Development of MGNREGS officials

Capacity development of MGNREGS officials at state, district and block levels is equally important for the successful roll-out of CNGs. Following topics for capacity development of officials are suggested:

- Orientation on CNGs
- Provisions of MGNREGS particularly in the context of CNG
- CNG Development and Maintenance, agroecological practices
- Livelihood activities and convergence mechanisms
- CNG Produce Management and market linkages
- Steps of CNG implementation in detail
- Detailed Project Report preparation, Technical and administrative sanctions
- Monitoring and Evaluation

District level coordination committee will ensure that the required trainings for district and block level officials are held as and when required.

Training section of Madhya Pradesh State Employment Guarantee Council (MPSEGC) will ensure the following:

- Required trainings for state level officials are done as and when required
- Provide support and guidance to the district teams and also provide relevant training material
- Ensure that a pool of master trainers is developed for imparting trainings at district and block levels

7. ANNEXURE

7.1 PACKAGE OF PRACTICES OF AGRICULTURE AND HORTICULTURE CROPS

Crop	Varieties	Seed rate	Sowing/ planting	Spacing	Planting time	Irrigation	Major Insect/ diseases	Expected yield
Ginger	Varda, Mahima, Suprabha, Suruchi, Surubhi	12-15 q/ha	Direct sowing	45X20 cm	May-June	Irrigation for May planted crop and once a week during post monsoon	Rhizome rot / soft rot	200-250 q/ha
Turmeric	Pratibha, Prabha, Alleppey	20 q/ ha	Direct sowing	45x20 cm	May-June	Irrigation for May planted crop and once a week during post monsoon	Rhizome rot/ soft rot	250-300 q/ha
Chillies	Pusa Jwala, Local Selections	500 g/ha	Transpl- anting	45x75 cm	June / Nov	7-10 days interval	Fruit borer, white fly, thrips, Leaf curl, mosaic	Green - 90-100 q/ha Dry- 15-20 q/ha
Brinjal	Arka Nidhi, Pusa Purple cluster	500 g/ha	Transpl- anting	60X75 cm	June / Nov	4-6 days interval	Shoot and fruit borer, Bacterial wilt	250-300 q/ha
Tomato	Arka Rakshak, Avinash, Naveen	250 g/ha	Transpl- anting	60X75 cm	June/ Sept	Once in 4 days	thrips, white fly, leaf minor, fruit borer,	400-500 q/ha
Potato	Kufri Jawahar, K.Chipsona -1,2,3, Kufri Frysona	25-30 q/ha	Direct sowing	20X60 cm	Oct	7-10 days interval	Aphid, borer, blight, mosaic	400-500 q/ha
Onion	AFLR, AFDR, Pusa red	10 kg/ha	Transpl- anting	10x15 cm	June/ Oct	Once in 4 days	Thrips, Smut	250-300 q/ha
Garlic	G-273	4-5 q/ha	Direct sowing	10x15 cm	Sept	10-12 days interval	Thrips, Purple blotch	150-200 q/ha

Crop	Varieties	Seed rate	Sowing/ planting	Spacing	Planting time	Irrigation	Major Insect/ diseases	Expected yield
Cabbage	Golder acre, Pride of India	500 g/ha	Transpl- anting	45X60 cm	Sept- Nov	8-10 days interval	Aphid, DBM, Caterpillar, Damping off, Alternaria blight	200-250 q/ha
Cauli - flower	Pusa Snowball K-, Pusa Katki	500 g/ha	Transpl- anting	30X60 cm	May- Nov	6-8 days interval	DBM, Caterpillar, Damping off, Alternaria blight	150-200 q/ha
Cowpea	Pusabarsa ti, Pusa dophasli	20 kg/ha	Direct sowing	20x45 cm	June- July and Jan- Feb	Once in 4 days	White fly	30-40 q/ha
Pea	Arkel, Bonnevill	50-60 kg/ha	Direct sowing	10X30 cm	Oct-Nov	7-10 days interval	Thrips, Leaf miner, Powdery milder	35-40 q/ha
Carrot	Pusa kesar, Nantes	8-10 kg/ha	Direct sowing	10X45 cm or 10cm apart on ridges	Oct-Nov	7-10 days interval	Leaf spot	250-300 q/ha
Radish	Pusacheta ki, Japanese White	8-10 kg/ha	Direct sowing	10X45 cm	Oct-Feb	7-10 days interval	Aphid, Flea beetles, white rust	250-300 q/ha
Coriander	Local, Kumbhraj, Pant Haritima	10 kg/ha	Direct sowing	20x30 cm	May- June or October -Dec	7-10 days interval	Aphid, Fusarium wilt, Powdery mildew, stem rot, Root rot	Leaves :15-20 q/ha
								Grain: 20q/ha
Spinach/ Palak	All green	8-10 kg/ha	Direct sowing	10X20 cm/ broad casting	Aug- Dec	7-10 days interval	Aphid, Cercospora leaf spot	30-40 q/ha (6-8 cuttings)
Beans	Hisar Kirti HD-18	8-10 kg/ha	Direct sowing	45x45 cm	June- July	As and when required	Aphid, Mosaic	200 q/ha

Crop	Varieties	Seed rate	Sowing/ planting	Spacing	Planting time	Irrigation	Major Insect/ diseases	Expected yield
Fenugreek / Methi	Pusa early bunching, RMT-1	10-12 kg/ha	Direct sowing	10X20 cm/ broad casting	Aug- Dec	7-10 days interval	Root rot, Powdery mildew	Leaves: 40-50 q/ha
								Grain: 5-7 q/ha
Okra	Parbhani Kranti, Arka Anamika, Pusa sawni	10-12 kg/ha	Direct sowing	45x30 cm	June / Feb	Once in 4 days	White fly, Jassid, Yellow Vein Mosaic	100-150 q/ha
Musk melon	Hara Madhu	1.0 kg/ha	Transpl- anting	2x1 m	Feb- March	5-7 days interval	Red Pumpkin Beetle, Fruit fly, Mosaic	80-100 q/ha
Bottle gourd	Pusa summer prolific long, Varad	1.5 to 2.0 kg/ha	Transpl- anting	2x1 m	Feb- March & June- July	5-7 days interval	Red Pumpkin Beetle, Fruit fly, Mosaic	200-250 q/ha
Bitter gourd	Pusa do mausami, Local Selection	1.5 to 2.0 kg/ha	Transpl- anting	2x1 m	June/ Nov	5-7 days interval	Red Pumpkin Beetle, Fruit fly, Mosaic, Mildew	80-100 q/ha
Pumpkin	Local Selection Pusa Naveen	1.5 to 2.0 kg/ha	Transpl- anting	2x1 m	Feb- March & June- July	5-7 days interval	Red Pumpkin Beetle, Fruit fly, Mosaic	250-300 q/ha
Cucumber	Sheetal, Local Selection	1.5 to 2.0 kg/ha	Transpl- anting	2x1 m	Feb- March & June- July	5-7 days interval	Red Pumpkin Beetle, Fruit fly, Mosaic, Mildew	2.5 to 3.0 tonnes / 1000m ²
Water melon	Sugar baby	2-2.5 kg/ha	Transpl- anting	2x1 m	Feb- March	5-7 days interval	Red Pumpkin Beetle, Fruit fly, Mosaic, Mildew	250-300 q/ha

7.2 OTHER AGRI-ALLIED INTERVENTIONS

Incorporation of multi-enterprise agriculture system along with fruit and vegetable cultivation at CNG will help to increase productivity and profitability through integrated use of water, nutrient, and energy in small farms. It has the potential to reduce cultivation cost by synergetic recycling of biproducts/residues of various components within the system and ensure a regular source of income and employment. The governing idea behind adoption of other allied interventions is that a community members can choose enterprises such as dairy, bee keeping, mushroom, goat farming, vermicompost production and horticulture nursery etc. depending upon resources and capital, marketing scope and processing options to improve family income and generate employment at farm level. Before choosing and establishment of such units, proper scientific training is necessary for successful implementation.

1. Vermicompost Production

Vermicomposting is a method of preparing enriched compost with the use of earthworms. It is one of the easiest methods to recycle agricultural wastes and to produce quality compost. Earthworms consume biomass and excrete it in digested form called worm casts. Worm casts are popularly called as Black gold. The casts are rich in nutrients, growth promoting substances, beneficial soil micro flora and having properties of inhibiting pathogenic microbes. Vermicompost is stable, fine granular organic manure, which enriches soil quality by improving its physico-chemical and biological properties. It is highly useful in raising seedlings and for crop production. Vermicompost is becoming popular as a major component of organic farming system.

Vermicomposting materials - Decomposable organic wastes such as animal excreta, kitchen waste, farm residues and forest litter are commonly used as composting materials. In general, animal dung mostly cow dung and dried chopped crop residues are the key raw materials. Mixture of leguminous and non-leguminous crop residues enriches the quality of vermicompost. There are different species of earthworms viz. *Eisenia foetida* (Red earthworm), *Eudrilus eugeniae* (night crawler), *Perionyx excavatus* etc. Red earthworm is preferred because of its high multiplication rate and thereby converts the organic matter into vermicompost within 45-50 days. Since it is a surface feeder it converts organic materials into vermicompost from top.

Advantages of vermicompost:

- It provides efficient conversion of organic wastes/crop/animal residues.
- It improves soil structure, texture, aeration, and water-holding capacity and prevents soil erosion.
- It helps in reducing population of pathogenic microbes.
- It contains valuable vitamins, enzymes and hormones like auxins, gibberellins etc.
- It helps in reducing the toxicity of heavy metals.
- It is economically viable and environmentally safe nutrient supplement for organic food production.
- It is an easily adoptable low-cost technology.

Sources of organic waste for manure production

The organic wastes like cattle dung, stubble from harvested crops, weeds, kitchen waste etc. available at CNGs can be used to produce vermicompost at CNGs.

Methods of vermicomposting

Vermicomposting is done by various methods; among them bed & pit methods are more common.

- a. Bed method: Composting is done on the cemented or kachcha floor by making bed (6x2x2 feet size) of organic mixture. This method is easy to maintain and to practice.
- b. Pit method: Composting is done in the cemented pits of size 5x5x3 feet. The unit is covered

with thatch grass or any other locally available materials. This method is not preferred due to poor aeration, water logging at bottom, and more cost of production.

- c. Plastic vermibeds: Low-cost readymade portable vermicomposting beds of size 12x4x2 feet size made up of polyethylene net window with netted outlet at the bottom of the bed. These are very easy to install and can shift easily from one place to another. This method is cheap and easy than permanent structure.

Process of vermicomposting (Steps)

- Vermicomposting unit should be in a cool, moist and shady site
 - Cow dung and chopped dried leafy materials are mixed in the proportion of 3: 1 and are kept for partial decomposition for 15 – 20 days.
 - A layer of 15-20cm of chopped dried leaves/grasses should be kept as bedding material at the bottom of the bed.
 - Beds of partially decomposed material of size 6x2x2 feet should be made.
 - Each bed should contain 1.5-2.0q of raw material and the number of beds can be increased as per raw material availability and requirement.
 - Red earthworm (1500-2000) should be released on the upper layer of bed.
 - Water should be sprinkled with can immediately after the release of worms
 - Beds should be kept moist by sprinkling of water (daily) and by covering with gunny bags/polythene
 - Bed should be turned once after 30 days for maintaining aeration and for proper decomposition.
 - Compost gets ready in 45-50 days
 - The finished product is 3/4th of the raw materials used.
 - Harvesting when raw material is completely decomposed it appears black and granular.
 - Watering should be stopped as compost gets ready.
 - The compost should be kept over a heap of partially decomposed cow dung so that earthworms could migrate to cow dung from compost.
- After two days compost can be separated and sieved for use.

2. Horticulture Nursery

Community nutrition gardens have proved to be a vital source for diversified intake of nutritious food by socially and economically backward households in rural India. Timely and regular availability of quality seedlings and saplings are large challenge in rural areas. Purchased of planting material from market will added extra financial burden for CNGs. Therefore, establishment of Nursery at 2.0 ha model is proposed.

In these Nurseries, planting material, such as seedlings, saplings, cuttings, etc., are raised, propagated and multiplied under favourable conditions for transplanting in prepared beds. These nurseries may act as cluster nursery and in case of surplus availability of planting material, other nearby CNGs or farmers will purchase or procure from them.

Advantages of Nursery:

- Sowing seeds in a nursery allows additional time for doing preparatory tillage in the main plot. Harvesting of the previous crop can also be prolonged, if needed.
- Small and expensive seeds can be raised more effectively with high germination percentage due to better care and management.
- The seed requirement of nursery raised crops is less as compared to direct seed sowing of the same crop due to better management.
- It is possible to grow and maintain a large number of fruits plants per unit area.
- The management of seedlings can be done in a better way with minimum care, cost and maintenance as the nursery area is small.
- Better and uniform crop growth can be obtained in the main field by selecting vigorous and

healthy seedlings.

- Off-season sowing of seeds becomes possible, which ultimately results in fetching more returns.
- Management of insect-pests, diseases and weeds is easy in a nursery.

Location and Infrastructure required: It must be ensured that the nursery site gets adequate sunlight. However, care must be taken that the plants are protected against severe heat. The topography of land at the nursery site must be even with proper drainage facility. The soil must preferably be loam or sandy loam with large quantity of organic matter.

Open field nursery: Such a nursery is established in open areas without any permanent structure. Usually, raised, flat or sunken seedbeds are prepared. These are vulnerable to natural environmental conditions.

Hi-Tech nursery: This type of nursery is established under protected structures. The protected structures in which the nursery can be successfully raised are as follows.

Thatched roof: In this type of nursery, a thatched roof is constructed over the nursery beds, which protects the seedlings from damage caused by extreme wind, rain, heat, etc.

Shade-net: Such a nursery is raised under shade-net houses. To give different amount of shade to plants based on their requirements, shade-nets of different colours and mesh sizes are used as covering material.

Poly-tunnel: The nursery is covered with insect proof net and UV stabilized plastic film or sheet to form a tunnel. It is miniature structure, which produces greenhouse-like effect. Besides not being expensive, it is easy to construct and dismantle. The seedlings are protected from cold, wind, storm, rain, frost and insects. Due to modified conditions, there is better germination and plant growth.

Greenhouse or polyhouse: It is a framed structure covered by poly-film or shade-net so that the plants can grow under partially or completely modified environment. Such structures are ventilated and may have temperature and humidity controlling devices. The seedlings are raised inside the structure on raised beds or in plug-trays, and also for hardening of tissue cultural plants.

3. Bee Keeping

Bee keeping at CNG will offer not only diverse products, for example honey and wax among others, which can be sold in local markets and become an important source of regular income for farm families, but can also provide complementary services, such as crop pollination. Moreover, bee products improve farm family nutrition and can provide for traditional health care remedies. Therefore, it is an enterprise that can provide for employment, income and economic security for the farm family. The CNG, where beekeeping activity will be proposed, should be having favourable agro-climatic conditions along with availability of flora round the year.

Advantages of Nursery:

- It is an income generating activity
- Provides food and medicine – value of honey and other hive products are invaluable
- It supports agricultural activities carried out CNG through cross pollination and increase in yield of crops
- It contributes immensely to forest conservation
- It provides supplementary income to farmers/ Tribal etc.
- It provides proportionately more and immediate return than any other agro-based profession

Items needed for Beekeeping:

- Bee boxes with live bee colonies,
- Tool kit (containing a smoker, bee veil, Knife & hive tools),
- C.F. Sheet (One kg CF sheet for each bee colony) and
- Stainless steel honey extractor

The number of colonies of honeybees required per hectare very much depends on the strength of foraging bees in the colony, the crops and prevailing weather conditions. The optimum number of colonies of average strength may range from 3 to 9 colonies per hectare, since the bees usually forage within a radius of about 1 to 2 km to harvest their nectar and pollen loads, and then return to their own hive.

4. **Mushroom Cultivation**

In India, generally 04 types of mushrooms viz. Button, Milky, Oyster and Paddy straw mushroom are usually grown commercially. On the basis of local demand and availability of resources, species should be selected for cultivation at CNG.

As the production technology of Oyster mushrooms is simple and can be practiced in almost all the CNGs without much problems. The oyster mushroom is one of the most suitable fungal organisms for production of protein rich food from various agro-waste without composting.

Substrate Preparation

Oyster mushroom can be grown on various substrates viz., paddy straw, maize stalks/cobs, vegetable plant residues etc. Since paddy straw is easily available and cheap, it is widely used. If paddy straw is used then it should be fresh and well dried.

Soaking - Chop paddy straw into 3-5 cm pieces and soak in fresh water for 8-16 hours. If maize stalks/cobs are used, soaking period should be 24-48 hours. Drain off excess water from straw by spreading on raised wire mesh frame.

Sterilization - Sterilization of substrate results in minimising contamination problem and gives higher and almost constant yields. It can be done in two ways, i.e., Pasteurization by dipping the filled bag in hot water of 80-85° C for about 10- 15 minutes and in case of sterilization by chemicals method, slowly steep 10 kg of chopped paddy straw in the water. Mix 125ml of formaldehyde (37-40 percent) and 7 g of Bavistin dissolved in 10 liters of water in another container and pour the solution slowly into the drum. Straw should be pressed, and drum should be covered with a polythene sheet. Take out the straw after 12 hrs.

Spawning - When the pasteurized substrate has cooled down to room temperature, it is ready for filling and spawning. At this stage, substrate moisture content should be about 70%. Polythene bags (35 x 50 cm, 150 gauge) or polypropylene bags (35 x 50 cm, 80 gauge) may be used for its cultivation. One 500 ml bottle spawn (200-250 g) can be used for 10- 12 kg wet straw (3 bags). Spawning can be done in layer spawning or through spawning.

Spawned bags should be stacked in racks in neat and clean place, in closed position. Temperature at 25±5 °C and humidity at 70- 85% should be maintained by spraying water twice a day on walls and floor. It takes 20-22 days when bags will be fully covered with white mycelium.

Cropping and harvest

After 20-22 days, when bags are fully impregnated with white mycelium, transfer the bags into cropping room and remove polythene/ polypropylene covers. The open blocks should be kept in racks about 20cm apart. Rack should be 60 cm wide with gap of 50-60 cm between two shelves. Mushrooms grow in a temperature range of 20-33° C.

Mushrooms should be plucked before they shed spores to maintain quality. After 1st flush of

harvest, 0.5 to 01 cm outer layer of the block should be scrapped. This helps to initiate 2nd flush which appears after about 10 days.

After harvest, the lower portion of the stalk must be cleaned with dry cloth. They should be packed in perforated (5-6 small holes) polythene bags to keep them fresh. It loses freshness after about 6 hours, which can be enhanced by keeping them in refrigerator.

Oyster mushroom can be sun dried for 2 days and dried product marketed in polythene bags. Dried mushrooms should be soaked in water for 10 minutes before use.

5. Dairy farming

Milk is a wholesome food among all the animal products. It contains in proper proportions the various essential food nutrients required by human body in an easily digestible form. Inclusion of milk in the human diet increases the digestibility of other types of food as well. It also provides a source of daily income with a relatively low level of risk. It is evident that a lot of employment generation and potential for entrepreneurial activities exist in the dairy sector.

There are 41 well-known registered indigenous cow breeds in India, some of which are of milch type, such as Gir, Hariana, Sahiwal, Red Sindhi and Tharparkar. Of late demand of A2 milk of desi cows are getting premium prices in the market, apart from this, cow dung and cow urine may be utilised for natural farming at CNG. Buffaloes are also important cattle for dairy industry and at present in almost every part of India and can be considered the backbone of the milk supply and milk processing industry in India. Some of the important breeds of buffaloes are Murrah, Nili-Ravi, Surti, Mehsana, Jaffarabadi and Bhadawari. Therefore, on the basis of local demand and space availability, dairy of 2 to 5 milch animals may be established at selected CNG.

6. Goat rearing

Goats are among the main meat-producing animals in India, whose meat (chevon) is one of the choicest meats and has huge domestic demand. Due to its good economic prospects, goat rearing under intensive and semi-intensive system for commercial production has been gaining momentum for the past couple of years. Goat farming will be suitable in dry and rainfed agro-climatic conditions of the state. There are about 28 recognised breeds are available in different regions of India. But for MP breeds like Jamunapari, Sirohi and Barbari will be more suitable for CNGs. A lot of (1:25 male & female ratio) may be placed at selected CNG.

Goat required shelter/housing for protection from harsh weather conditions such as rains, excessive heat and cold during winter in addition to protecting from predator attack. The housing should be made of locally available material. The optimum floor space of 1.5 to 2.0 sqm/goat is required for covered rearing, whereas in open paddock system 3.0 to 4.0 sqm/- goat area is required.

Since goat eats all types of leaves, the lopping of the commonly available trees may be used for feeding the goats. However, care has to be ensured to not to let loose the animals so as to avoid damage to the homestead garden.

7. Pisciculture

Pisciculture or fish farming is a process of breeding, raising, and transporting of fishes for domestic and commercial purposes. The farmed fish provides high quality protein for human consumption. Fish farming can be integrated into the existing farm to create additional income and improve its water management. The farmers can select the fish species with

desired characteristics to raise. At CNG, where surplus water and market is available, then pisciculture may be included as other livelihood activities. On the basis of location, fish farming methods can be selected. Generally, pond system of fish farming should be preferred. In this system, people need a small pond or tank where fishes grow. It is one of the most beneficial fish farming techniques because the water containing fish waste is used to fertilise the agricultural field. Poor and infertile piece of land also be utilised for fish farming.

7.3 CNG AS RURAL TOURISM CENTRE

Rural tourism in India has come up as a big opportunity. People want to see diversity and feel the real taste of village life by staying in villages. Rural tourism has a high potential to stimulate local economic growth and social change because of its complementarity with other economic activities, its contribution to GDP, job creation, and its capacity to handle seasonal unemployment.

Rural Tourism is "A type of tourism activity in which the visitor's experience is related to a wide range of products generally linked to nature-based activities, agriculture, rural lifestyle/culture, etc".

In case of CNG, rural tourism would showcase the rural life, food, agriculture processes, practices, produces etc. Other things that can be showcased are the rural art, culture, and heritage. This will benefit the local community economically and socially. CNG based rural tourism will offer an immersive experience wherein the tourist will participate in the daily farming activities of the CNG. The tourist will also get a chance to imbibe the traditions and culture of the area. Rural tourism may also include an overnight stay in which the visitor will also get to know and watch the unique lifestyle of the village closely.

CNG based rural tourism can play a big role in valuing villages along with their associated landscapes, knowledge systems, biological and cultural diversity, local values, and activities (agriculture, forestry, livestock, and/or fisheries), including their gastronomy.

7.4 MARKET LINKAGE THROUGH E-COMMERCE PORTALS

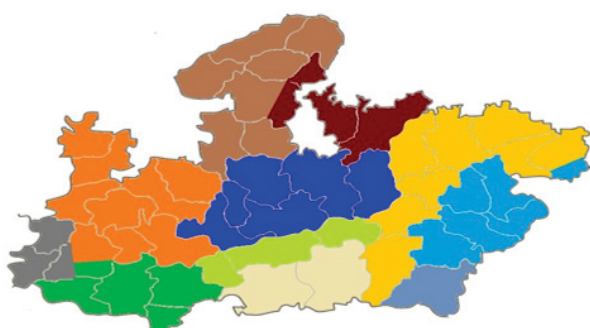
Indian market offers huge potential for most e-commerce business enthusiasts and budding entrepreneurs. Today there is a need for marketing rural products on the e-commerce portals.

CNG has a wide range of products like vegetables, fruits, pulses, staple food, etc. which can be both organic as well as non-organic. CNG can also produce packaged products and indigenous seeds. These products have a potential for market linkage through various e-Commerce portals, which will result in reaching the doorstep of customers worldwide according to their utility and shelf life.

7.5 PROTOTYPES FOR AGRI AND ALLIED LIVELIHOOD ACTIVITIES

S. No.	Agro climatic Zones	District covered	Crops suitability		
			Vegetable	Fruit	Others
1	Chhattisgarh plane & Balaghat Region	Balaghat	All vegetables, Ginger, Colocasia	Mango, Sapota, Guava, Lime, Papaya, Drumstick, Jackfruit, Jamun	Dairy, Goatry & Beekeeping
2	Northern Hill Region of Chhattisgarh	Shahdol, Mandla, Dindori, Anuppur, Sidhi (partly), Singroli, Umaria	All seasonal vegetables including medicinal Crops	Pear & Peach (In A.pur district) Litchi, Mango, Jack Fruit, Guava, Jamun	Dairy, Goatry, Mushroom & Beekeeping
3	Kymore Plateau & Satpura Hills	Rewa, Satna, Panna, Jabalpur, Seoni, Katni, Sidhi	All seasonal vegetables including medicinal Crops	Mango, Guava, Lime, Ber, Aonla, Bael, Custard apple, Drumstick	Dairy, Goatry, Mushroom & Beekeeping
4	Central Narmada Vallery	Narsinghpur, Hoshangabad, Harda, Sehore (partly), Raisen (partly)	All seasonal vegetables including Onion	Guava, Mango, Acid Lime, Orange, Ber, Aonla, Papaya, Custard apple, Drumstick	Dairy, Goatry & Beekeeping
5	Vindhya Plateau	Bhopal, Sagar, Damoh, Vidisha, Raisen (except Bareilly Tehsil), Sehore (except Budni Tehsil), Guna (partly)	All seasonal vegetables including Coriander & Onion	Guava, Orange, Acid lime, Mosambi, Aonla, Mango, Ber, Sapota, Papaya, Custard apple, Jamun	Dairy & Beekeeping
6	Grid Region	Gwalior, Bhind, Morena, Sheopur-Kala, Shivpuri, (except Pichore, Karera, Narwar, Khandwa, Guna (except Aron, Raghogarh, Chachoda Tehsil), Ashoknagar	All seasonal vegetables including coriander	Orange and sweet orange, Lime, Guava, Ber, Aonla, Custard apple	Dairy & Beekeeping
7	Bundelkhand	Chhattarpur, Datia, Tikamgarh, & Shivpuri (partly)	All seasonal vegetables including Ginger, Turmeric, Dioscoria, Colocasia, Chilli	Acid lime, Aonla, Mango, Sapota, Karonda, Bael, Custard apple	Dairy, Goatry & Beekeeping

S. No.	Agro climatic Zones	District covered	Crops suitability		
			Vegetable	Fruit	Others
8	Satpura Plateau	Betul & Chhindwara		Orange, Mosambi, Acid Lime, Mango, Guava	Goatry, Mushroom & Beekeeping
9	Malwa Plateau	Mandsaur, Neemuch, Ratlam, Ujjain, Dewas, Indore, Shajapur, Rajgarh & Dhar (partly) Jhabua (partly)	All seasonal vegetables, onion and garlic	Orange, Acid Lime, Mosambi, Sapota, Guava, Pomegranate, Custard apple, Jamun	Dairy, Goatry, Mushroom & Beekeeping
10	Nimar Plains	Khandwa, Burhanpur, Khargone, Barwani, Dhar (partly)	All seasonal vegetables including medicinal Crops, Onion and Garlic	Mango, Banana, Grape, Papaya, Sapota, Lime, Guava and Pomegranate	Dairy, Goatry, Mushroom, Beekeeping & processing of spices & medicinal plants
11	Jhabua Hills	Jhabua District (except Petlawad Tehsil) & Dhar (partly)	All seasonal vegetables including Onion and Garlic	Mango, Lime, Mosambi, Ber, Guava, Custard Apple, Pomegranate, Guava	Goatry & Beekeeping



I	II	III	IV	V	VI	VII	VIII	IX	X	XI
Agro-climatic zones										
Chhattisgarh plain	Northern hill zones of Chhattisgarh	Kymore Plateau and Satpura hills	Vindhyan Plateau	Central Narmada Valley	Gird region	Bundelkhand Zone	Satpura Plateau	Malwa Plateau	Nimar Valley	Jhabua Hills
Soil type										
Red & Yellow (Medium)	Red & Yellow Medium black & skeletal (Medium/light)	Mixed red and black soils (Medium)	Deep black (deep)	Medium black & deep black (Medium/Heavy)	Alluvial (Light)	Mixed red and Black (Medium)	Shallow black (Medium)	Medium black (Medium)	Medium black (Medium)	Medium Black skeletal (Light/Medium)
Rainfall (mm)										
1200 to 1600	1200 to 1600	1000 to 1400	1200 to 1600	1200 to 1400	800 to 1000	800 to 1400	1000 to 1200	800 to 1200	800 to 1000	800 to 1000
Districts covered										
Balaghat	Shahdol, Mandla, Dindori, Anuppur, Sidhi (Partly), Singrol, Umaria	Rewa, Satna, Panna, Jabalpur, Seoni, Sidhi (Partly), Singrol	Narsimhpur, Hoshangabad, Harda, Sehore (Partly), Raisen (Partly)	Bhopal, Sagar, Damoh, Vidisha, Raisen (except Bareilly), Sehore (except Budni), Guna (Partly)	Gwalior, Bhind, Morena, Sheopur, Kala Shivpuri (except Pichore, Karera, Narsur, Khamadana), Guna (except Aron, Raghogarh, Chachoda), Ashoknagar	Chhattarpur, Datia, Tikamgarh, Shivpuri (Partly)	Betul, Chhindwara	Mandsaur, Neemuch, Ratlam, Ujjain, Dewas, Indore, Shajapur, Jhabua	Khandwa, Burhanpur, Khargone, Barwani, Dhar (Partly)	Jhabua (except Petlawad), Dhar (Partly)

Fig. Agro-climatic Zones of Madhya Pradesh*

*Nahatkar et.al. (2021) Agriculture Atlas of the State of Madhya Pradesh.- Publ., Office of the Dean Faculty of Agriculture, JNKVV, Jabalpur 19.96p

7.6 IDENTIFICATION OF POTENTIAL CNG SITES USING GIS

With the help of Composite Water Resource management (CWRM) process, suitable site for developing a community nutrition garden can be identified. There are certain steps that can be taken up to identify the site with accuracy. This process is taken up by doing of Gram Panchayat wise planning within the districts on the Google Earth Platform.

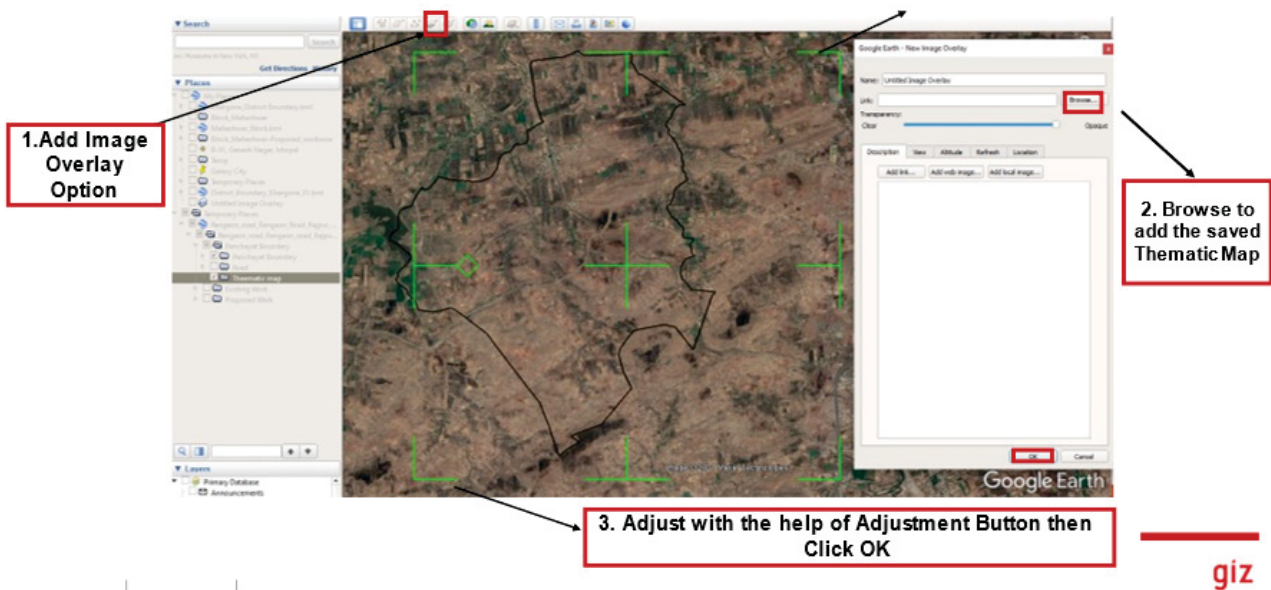
Various thematic data sets are overlayed on the digital platform to interpret the location suitability of the CNG site. The various thematic layers, the data sources and the required parameters for the site suitability are listed below.

List of Thematic Data Sets and their sources

Sl. No.	Thematic Data sets	Data Source	Parameters
1	Drainage	https://bhuvan-app1.nrsc.gov.in/bhuvan2d/bhuvan/bhuvan2d.php	For 1st order Stream The distance can be 500m and for 2nd order & 3rd order <1 kms
2	Water body	Cartosat Data(https://bhuvan-app3.nrsc.gov.in/data/download/index.php)/Visual Interpretation	Round the year Water source should be available at a distance not more than 300 m.
3	Lineament	https://bhuvan-app1.nrsc.gov.in/state/MP	Potential Site for Groundwater Recharge
4	Wasteland	https://bhuvan-app1.nrsc.gov.in/state/MP	Preferably more than 50 Ha available. Used for Identifying the scrub lands of the GP.
5	LULC	https://bhuvan-app1.nrsc.gov.in/state/MP	Used for Identifying the scrub lands of the GP.
6	Habitation	LULC map and Visual Interpretation	Habitation should be within a range of 400- 500m
7	Soil Data (Type of Soil, Soil Productivity, Soil Texture, Soil Slope, Soil Depth)	Soil Type: https://geoportal.mp.gov.in/wrd/home.aspx Soil Depth, Soil Productivity, soil texture: https://indiawris.gov.in/wris/#/Geoviewer (Data available at very large scale)	Soil texture: Loamy to clayey loam Soil slope: 3-8% Soil Productivity: Medium -High Soil Depth: 0.2 -1meter (SimpleBox 2.0 (Brandes et al., 1996))

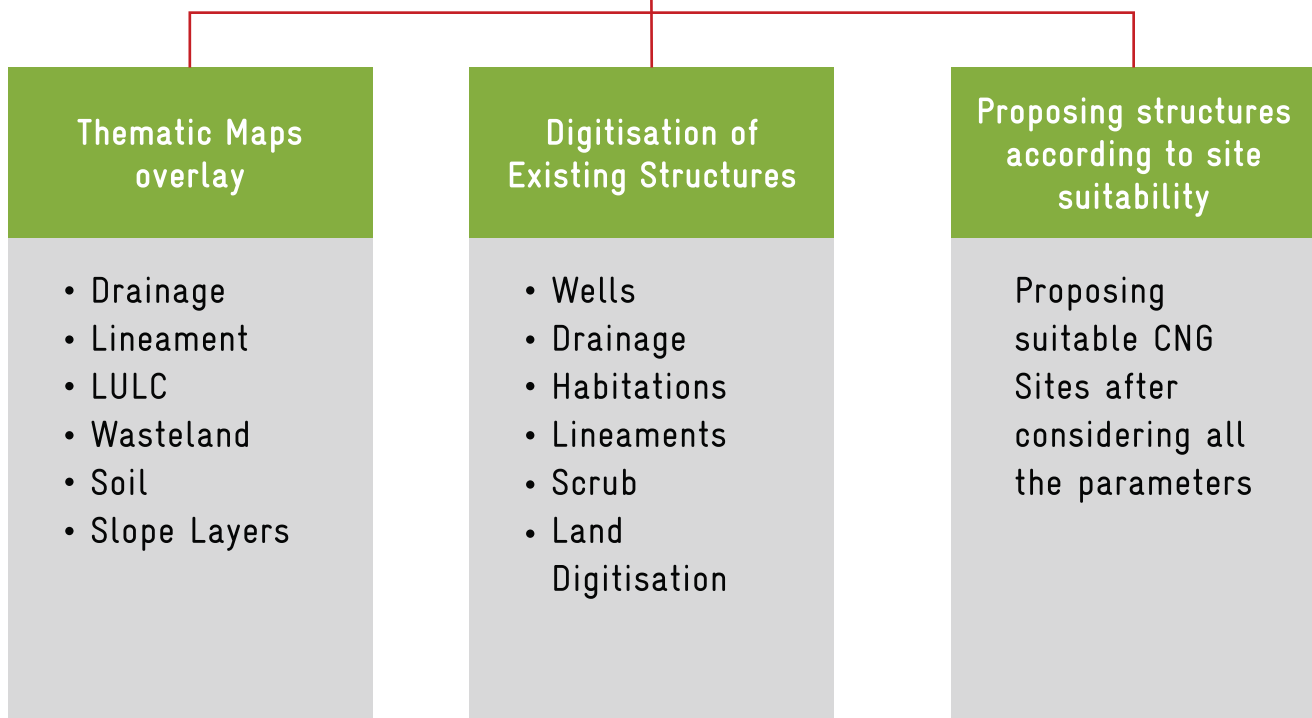
The above mentioned layers are clipped using the Snipping Tool, the required area of interest is cropped out with maximum zoom in mode to achieve the best resolution of the thematic data set. This is then overlaid on the boundary of the Gram Panchayat and georeferenced by the adjustment buttons present in Google Earth Platform.

Adding the clipped image to Google Earth



Further the various other features are digitised using the point, line and polygon tool in Google Earth. Various existing features are digitised using the thematic data sets to have the knowledge of where to propose the required structures. Keeping this in mind various plantation sites are denoted over the scrub land area and water harvesting or recharge structures are proposed.

CNG site selection through GIS



7.7 SHG GRADING FORMAT

Name of SHG □□□

Village □□□□..

GP Name □□□□..

Sl. No.	Grading Indicators	Formula / Basis of Grading	Maximum Marks	Score
1	No of Members	* 10-12, * >13	1 2	
2	Group homogeneity	Uniform Economic status Different Economic Status	2 1	
3	Meeting Frequency	Every Week 15 Days 1 Month	3 2 1	
4	Attendance Regularity (Last 3 Months)	>90 % 75-89 % 60-74 % <59 %	3 2 1 0	
5	Inter-loaning	All Members avail Loan at least once Less than 100% to 50 % members avail loan	2 1	
6	Loan Repayment (Timely)	More than 90% More than 70% Less than 70%	3 2 1	
7	Internal Account Management	Record Update till Last meeting Not updated	2 0	
8	Bank Linkages Status	2 Linkages 1 Linkages 0 Linkages	3 2 0	
9	Landless members	All are landless More than 50 % members	20 10	
10	Have any experience of Vegetable and Plantation cultivation	Members more than 50% Less than 50 %	10 5	

Note: Total Marks will be 50

SRLM representative details:

Process conducted by:

Name Designation Place Date.....

Village Organization Representative

1) Name Designation SHG

2) Name Designation SHG

3) Name Designation SHG

7.8 MGNREGS LETTERS

For the successful roll-out of community nutrition gardens in Madhya Pradesh, following letters have been issued by MGNREGS.

- Letter no. L-13060/03/2020-RE-VII of MoRD, GoI dated 4th May 2020
- Letter no. 494/MGNREGS-MP/NR-3/2021 dated 24/05/2021
- Letter no. 1675/F-/NR-1/MGNREGS-MP/2021 dated 20/07/2021
- Letter no. 5165/ NR-1/MGNREGS-MP/2022 dated 20/09/2022

7.9 CONTRACT FORMAT

इकरार नामा (प्रारूप)

(वृक्ष उपयोगी हक के लिए भूमिहीन महिला एवं स्वयं सहायता समूह एवं ग्राम पंचायत के मध्य अनुबंध शर्तें)

पक्ष क्रमांक 1. ग्राम पंचायत (सरपंच / सचिव ग्राम पंचायत)

पक्ष क्रमांक 2. अध्यक्ष महिला स्वयं सहायता समूह एवं महिला समूह की अन्य सदस्य ।

कलेक्टर / जिला कार्यक्रम समन्वयक (महात्मा गांधी नरेगा) द्वारा ग्राम सभा के प्रस्ताव दिनांक से भूमि खसरा नंबर कुल रकबा एकड़

ग्राम पंचायत जनपद पंचायत जिला पर सामुदायिक पोषण वाटिका कार्य स्वीकृत की गई है । नरेगा सॉफ्ट के अनुसार कार्य का कोड है ।

उक्त सामुदायिक पोषण वाटिका से अर्जित देने वाली आय तथा अनुबंध अवधि में पौधों पर उपयोगिता हक देने के संबंध में भूमिहीन महिला एवं स्वयं सहायता समूह एवं ग्राम पंचायत के मध्य दिनांक को अनुबंध निष्पादित किया जाता है ।

—अनुबंध की शर्तें—

- यह कि महिला स्वयं सहायता समूह एवं ग्राम पंचायत के मध्य निष्पादित अनुबंध की अवधि न्यूनतम 5 वर्ष से 9 वर्ष तक होगी । परियोजना के प्रथम 5 वर्ष में बेहतर क्रियान्वयन के आधार पर आगामी 04 वर्ष तक अनुबंध अवधि बढ़ाई जा सकेगी । इस प्रकार एक समूह के साथ अधिकतम अनुबंध अवधि 9 वर्ष होगी ।
- अनुबंध अवधि में पोषण वाटिका में रोपित पौधों पर वृक्ष उपयोगिता हक महिला स्वयं सहायता समूह का होगा । समूह में न्यूनतम दस भूमिहीन महिलाओं का होना अनिवार्य है । समूह की भूमिहीन महिलाओं में मध्याह्न भोजन में संलग्न तथा कुपोषित बच्चों के परिवार की महिलाओं को प्राथमिकता दी जायेगी ।
- महिला स्वयं सहायता समूह की सदस्या जिनके साथ यह अनुबंध निष्पादित किया गया है, यदि वह स्वैच्छा से समूह की सदस्यता छोड़ती है, तो सदस्या को 15 दिवस पूर्व ग्राम पंचायत को सूचना देना अनिवार्य होगा ।
- यह कि अनुबंध अवधि में स्वीकृत कार्य पर विकसित की जाने वाली सामुदायिक वाटिका पर देखरेख, संधारण एवं पौधों की कम से कम 80 प्रतिशत उत्तर जीवितता की सम्पूर्ण जिम्मेदारी महिला स्वयं सहायता समूह के सदस्यों की होगी ।
- पोषण वाटिका से अर्जित आय शत-प्रतिशत महिला स्वयं सहायता समूह की होगी जिसे स्वयं सहायता समूह की सभी सदस्यों की बराबरी की भागीदारी होगी ।
- पोषण वाटिका पर नियमानुसार व्यय महात्मा गांधी नरेगा अंतर्गत किया जा सकेगा । पोषण वाटिका के संधारण तथा भुगतान के संबंध में मध्यप्रदेश शासन, पंचायत एवं ग्रामीण विकास विभाग द्वारा समय-समय पर जारी आदेश बन्धनकारी होंगे ।

8. किसी भी स्थिति में भूमि का अधिपत्य समूह का नहीं होगा। उन्हें बिना सक्षम अनुमति के किसी प्रकार के पक्के निर्माण की अनुमति नहीं होगी।

पक्ष क्र. 1	पक्ष क्र. 2
सरपंच/सचिव.....	महिला स्वयं सहायता समूह
ग्राम पंचायत	(अध्यक्ष एवं समस्त सदस्य)

गवाह :

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