



Components of Integrated Farming System



Practical Manual

on Integrated Farming System

Prepared by :-

Dr. G.P. Pali

Dr. Rama Mohan Savu

Dr. Shrikant Chitale

Dr. G.S. Tomar

Dr. Ashok Pal



Department of Agronomy

College of Agriculture

INDIRA GANDHI KRISHI VISHWAVIDYALAYA

Raipur (Chhattisgarh) 492 012

Practical Manual
on
Integrated Farming System

Prepared by:

Dr. G.P. Pali

Dr. Rama Mohan Savu

Dr. Shrikant Chitale

Dr. G.S. Tomar

Dr. Ashok Pal



Department of Agronomy
College of Agriculture
INDIRA GANDHI KRISHI VISHWAVIDYALAYA
Raipur (Chhattisgarh) 492 012

Citation: Pali, G.P., Rama Mohan Savu, Shrikant Chitale, G.S. Tomar and Ashok Pal. 2014.
Practical Manual on Integrated Farming System . Pages : 38 .

Inspired by

Dr. S.K. Patil
Hon'ble Vice Chancellor
IGKV, Raipur (C.G.)

Guidance by

Dr. S.R. Patel
Dean,
College of Agriculture, Raipur (C.G.)

Prepared by

Dr. G.P. Pali
Dr. Rama Mohan Savu
Dr. Shrikant Chitale
Dr. G.S. Tomar
Dr. Ashok Pal

Course No. ACP 424

Course title: Integrated Farming System

Published by :

College of Agriculture, IGKV, Raipur (C.G.)

Processes by :

Dr. G.K. Das
Dr. N. Lakpale

Publication year: 2014

No. of copies printed: 2500

Course No. :

Credit

Course Name :

Name of Students

CERTIFICATE

This is to certify that Shri./Ku.
Enrolment No./ID No..... has completed the practical of Course No.
..... as per the syllabus of B.Sc. (Ag.) year..... semester in
the respective lab/field of College.

Date:

Course Teacher

Content

S. No.	Title of the Practical	Page No.
	Introduction to integrated farming system	1-7
1.	Preparation of cropping scheme for irrigated and rainfed condition.	8-15
2.	Evaluation of multiple cropping systems and their sustainability through indices	16-18
3.	Introduction to the existing farming systems of Chhattisgarh state	19-22
4.	Evaluation of suggested integrated farming system models different situations	23
5.	Farming system model for different climatic zones of Chhattisgarh	24-38
6.	Visit of existing farming system in near- by villages	

INTRODUCTION TO INTEGRATED FARMING SYSTEM

What is a System?

A system is a group of interacting components, operating together for a common purpose, capable of reacting as a whole to external stimuli.

Farming system is a complex inter-related matrix of soil, plants, animals implements, power, labour, capital and other inputs controlled in part by farm families and influenced by varying degrees of political, economic, institutional and social forces that operate at many levels.

It is a resource management strategy to achieve economic and sustained production to meet diverse requirement of farm household while preserving resource base and maintaining a high level of environmental quality. **Integrated farming system** is a commonly and broadly used word to explain a more integrated approach to farming as compared to monoculture approaches. It refers to agricultural systems that integrate livestock and crop production.

In this system an inter-related set of enterprises used so that the “waste” from one component becomes an input for another part of the system, which reduces cost and improves production and/or income.

Integration of Enterprises

In agriculture, crop production is the main activity. The income obtained from crops may hardly be sufficient to sustain the farm family throughout the year. Assured regular cash flow is possible when the crop is combined with other enterprises. Judicious combination of enterprises, keeping in view of the environmental conditions of a locality will pay greater dividends. At the same time, it will also promote effective recycling of residues/wastes.

Choice of Enterprise

Livestock is the best complimentary enterprise with cropping. Installation of bio-digester in crop-livestock system will make use of the wastes, at the same time provides valuable gas for cooking and lighting.

Components in IFS

The components of IFS include crops, fish farming, poultry, pigs, cattle, sheep and goat, fodder production, kitchen gardening.

Integrated farming system has revolutionized conventional farming of livestock, aquaculture, horticulture, agro-industry and allied activities. It could be crop-fish integration, livestock-fish integration, crop-fish-livestock integration or combinations of crop, livestock, fish and other enterprises.

The integrated farming system approach introduces a change in the farming techniques for maximum production in the cropping pattern and takes care of optimal utilization of resources. The farm wastes are better recycled for productive purposes in the integrated system. A judicious mix of agricultural enterprises like dairy, poultry, piggery, fishery, sericulture etc. suited to the given agro-climatic conditions and socio-economic status of the farmers would bring prosperity in the farming. An integrated farming system allows us to use some of the advantages of nature, and ecology, as opposed to relying on chemistry to solve all our production issues.

Goals of IFS

The Goals of this Integrated Farming Systems Manual (IFS) are to:

- Provide a steady and stable income rejuvenation/amelioration of the system's productivity and
- Achieve agro-ecological equilibrium through the reduction in the build-up of pests and diseases, through natural cropping system management and the reduction in the use of chemicals (in-organic fertilizers and pesticides).

Advantages of IFS

- It improves space utilization and increase productivity per unit area
- It provides diversified products
- Improves soil fertility and soil physical structure from appropriate crop rotation and using cover crop and organic compost
- Reduce weeds, insect pests and diseases from appropriate crop rotation
- Utilization of crop residues and livestock wastes
- Less reliance to outside inputs – fertilizers, agrochemicals, feeds, energy, etc

- Higher net returns to land and labour resources of the farming family

Scope of farming system

Farming enterprises include crop, livestock, poultry, fish, tree crops, plantation crops, etc. A combination of one or more enterprises with cropping, when carefully chosen, planned and executed, gives greater dividends than a single enterprise, especially for small and marginal farmers. Farm as a unit is to be considered and planned for effective integration of the enterprises to be combined with crop production activity. Integration of farm enterprises to be combined on many factors such as:

- Soil and climatic features of the selected area.
- Availability of resources, land, labour and capital.
- Present level of utilization of resources.
- Economics of proposed integrated farming system.
- Managerial skill of the farmer.

Determinants of farming system

There are three major groups of factors, which in combination determine the type of farming system employed by framers in a given region. These factors are discussed below.

- Factor A represent the physical and biological elements which set limits to the type of agricultural produce to be produced in the given region. The physical elements include land, soil quality, topography, climate, water, location, distance etc. The biological elements include crops and livestock physiology, diseases etc., which determine the potential farm enterprises. These elements can be altered by limited intervention by the farmers and scientists. For instance scientists can evolve improved production technology and farmers can adopt it partially or in full package.
- Factor B represent endogenous human elements, which greatly influence the type of farming system adopted in a particular region. The system revolves around the farmer whose family and means of livelihood are intricately linked. The farm family has available resources under their control in terms of land, labour, capital and management.

The quantity and quality of these resources are conditioned by the characteristics of the family (size, age etc), education and management skills, available labour, capital, power, attitudes and goals of the family.

The farmers goals and attitudes are initial factors that determine the nature of farming system specially where there is a range of alternative operations and enterprises to increase productivity consistent with existing technical elements. The farmer could combine available resources in a manner that will maximize the goals of the family.

- Factor C represents the exogenous human variables, which govern the allocation of available resources by the farmers. Farm producers need incentives to change their farming methods and production patterns in desirable directions.

Objectives of Farming System

1. Productivity

Farming system provides an opportunity to increase economic yield per unit area per unit time by virtue of intensification of crop and allied enterprises. Time concept by crop intensification and space concept by building up to vertical dimension through crops and allied enterprises are the ways to increase productivity.

2. Profitability

The system as a whole provides opportunity to make use of the produce/waste material of one component as input on another component enterprise at the least cost. Thus, by reduction of cost of production of component, the net income and benefit cost ratio for the farm as a whole are increased.

3. Sustainability

To produce more within the land area available to meet the requirement of additional population recorded at 22% every year huge quantum of in organic fertilizers, inorganic pesticides, fungicides, herbicides, etc., are dumped. Thus there is every likelihood of soil and environment becoming polluted. In turn, the productivity of the soil would automatically be reduced in the years to come. In farming system, organic supplementation through effective utilization of manures is possible and thus, it will certainly provide an opportunity to sustain the potentiality of the production base *viz*, soil for much longer period.

4. Balanced food

In farming system, we link components of varied nature enabling to produce different sources of nutrition viz., protein, carbohydrate, fat, minerals, vitamins, etc., from the same unit area. This will provide an opportunity to solve the malnutrition problem that exists in the diet of the Indian farmers.

5. Pollution from environment

Some of the organics left as waste will pollute the environment on decomposition. Similarly application of huge quantity of fertilizer, pesticide, fungicide and herbicide pollute the soil, water and environment to an alarming level. In the case of integrated farming system, waste materials are effectively utilized by linking appropriate components.

6. Recycling

Farming system establishes its stability due to effective recycling of produce/waste material of anyone of the component as input in the other component linked in the programme.

7. Monetary return round the year

Unlike conventional crop activity where the money is expected only at the time of disposal of the economic produce received after five to fifteen months depending upon the duration of the crop, the farming system provides flow of money to the farmer round the year by way of disposal of eggs, milk, edible mushroom, honey, cocoons of silkworm, etc. This will help the resource poor farmer to get out from the clutches of money lenders and from other financing agencies.

8. Adoption of new Technology

Most of the big farmers are fully aware of the impact of new technologies included in the package. But more than 80 per cent of the farmers who have been grouped under small and marginal category are not able to execute the advanced technology proposed for want of money. But under farming system approach because of the linkage of dairy unit/ mushroom / poultry /duckers/fishery/ fruit crops/ vegetable crops/ flower cultivation, etc. Cash available round the year gives a short of inducement to the small and marginal farmers to go for the adoption technologies like fertilizer application pesticides and herbicide application, etc., given in the package which otherwise is not possible under conventional farming due to paucity of funds.

9. Solves energy crisis

It is expected that the entire world is going to suffer for want of fossil fuel from 2030 AD. So it becomes inevitable to identify an alternative source to solve our energy crisis within a span of 3 to 4 decades. In farming system by way of effective recycling of organic wastes at least to certain extent the energy crisis anticipated can be solved.

10. Solves fodder crisis

In farming system each and every sq. cm of land area is effectively utilized growing of perennial fodder trees (*leucaena*) in the borders and along water courses is a recommended practice. This practice not only helps in supplementation of legume fodder but also enriches soil nutrient by fixing the atmospheric nitrogen. In the cropped land also the system envisages intensification of cropping by including legume fodder like cowpea either as second tier or as third tier in the system. These practices will certainly relieve the crisis of non-availability of quality fodder to the animal component linked.

11. Solves fuel and timber crisis

The national demand of fuel wood in 2030 AD is 360 million m³. Whereas the current production is only 20 million m³. Similarly, the requirement of industrial wood in 2030 AD is 64.4 million m³, and the current production level is just 12 million m³. The present level of production should be increased by eighteen folds in case of fuel wood and six folds in industrial wood. This could be possible to certain extent by of forestation programme in the shrub jungles and sparse forest areas. In farming system by linking agro-forestry appropriately the production level of fuel-wood and industrial wood can be enhanced without detrimental effect on crop activity in the field level.

12. Avoids degradation of forests

There is a vast gap between the demand and production level as far as fuel wood and timber are concerned. This will naturally induce the users to encroach on the forest area nearby illegally to bridge the gap. Right now our forest area is less than 22 per cent against the prescribed norms of 33 per cent of the geographical area available. When such encroachments are encouraged there is every possibility of our forest area going to be waste land in the years to come. Even in the forest area available at present more than 2/3rd is sparse forest. The statistics on soil erosion indicates that every year 5374 million metric tones of built up soil is eroded in our country. This is four folds higher than the prescribed norms viz., 4 m t h/yr. By linking agro-forestry in farming system, the degradation of forest area could be minimized to certain extent by

supplementation of fuel and timber wood. By way of preserving the natural eco-system in the catchment areas, precious built up soil can also be preserved from erosion danger.

13. Employment generation

Combining crop enterprises with livestock enterprises to take advantage of complementary and supplementary relationships between them, would increase the labour requirements tremendously and can help in solving the problem of under employment to great extent. Farming System provides enough scope to employ family labour round the year.

14. Improves literacy

The farmer, who adopts farming system by combining different components like fishery, sericulture, mushroom cultivation, apiary, spawn production, dairy, poultry, agri-horticulture, agro-forestry-biogas production, etc., becomes an expert in each and every aspects of individual component of long range adoption. This experience will help the farmer to face any challenge in their activity.

15. Provides opportunity for agri-oriented industries

When once the produces of different components linked in farming system are increased to commercial level and if there is glut in the market, leads to the development of side industries for preserving them by products.

16. Increases input efficiency

The farming system provides enough scope to use the inputs on different components very effectively. This again leads to increased benefit cost ratio.

17. Standard of living of the farmer increased

When once provisions are made in the farm level to generate bioenergy, produce edible mushroom, fruits, eggs, mild, honey, vegetable, etc., for family use of the farmer apart from commercial purposes through farming system creates a sort of feeling among the farmers that they are no way inferior to other professionals in the region. When they feel that their stander of living is on par with others, this will act as a booster tonic to continue agricultural profession without any reluctance which exists at present among most of the farmers.

Practical No. 1

Title : Preparation of cropping scheme for rainfed and irrigated condition

Objectives: 1. To workout suitable cropping scheme under rainfed/ irrigated conditions.

2. To determine suitability and economics of cropping scheme in irrigated condition.

Cropping Scheme

The plan according to which crops are adjusted on individual plots of a farm with an objective of getting the maximum returns from each crop without impairing the soil fertility is known as cropping scheme. In other words, cropping scheme is a plan according to which crops are grown on individual plots of a farm during a given period of time with the object of obtaining maximum return from each crop without impairing the soil fertility. Thus, a cropping scheme is related to the most profitable use of resources, land, labour, capital and management so that maximum net income may be obtained from the farm as a whole with proper restoration from the farm as a whole with maintaining the soil fertility.

Principles of cropping and layout

The following points are considered while framing a cropping scheme for a farm.

1. Area under building and layout

A proportionate area is allocated for buildings and layout before distributing the farm area under different plots of crops. The area under buildings is 8-10 per cent of the total area.

2. Number of plots

The number of plots should be either equal to the duration of rotation or a multiple of that e.g. if the total duration of rotations in a cropping scheme is 5 years, then the number of plots must be either five or ten, fifteen, twenty etc, so that each of the crop in the rotation could be grown in equal acreage.

3. Selection of crops

Selection of crops depends upon the situation of the farm. Given below are the suitable crops which may be grown according to the farm situation or location for maximum profit.

- *Near a city*: If the farm is near a city, the farmer should grow vegetables on at least 60 per cent of his net cultivated area. In the remaining area, he should grow fodder crops on at least 10-15 per cent of his net cultivated area.
- *Near a sugar factory*: If the farm is situated near a sugar factory then the farmer should put at least 60 per cent of his net cultivated area under sugarcane or sugar beet. On the remaining area, he should grow vegetables and grain crops for local supply.
- *Near a canning factory*: In such a locality, the farmer should grow vegetables e.g. peas, tomato, etc., on at least 60 per cent of his net cultivated area. On the remaining area, he could have orchards.
- *Near a dairy farm*: If the farm is located near a dairy farm, the owner should go for fodder cultivation. Apart from fodder, he can raise oil seeds and pulses on 10-15 per cent of his net cultivated area in order to supply concentrates to the dairy cattle along with fodder.
- *Near a highway or railway station*: If the farm is situated near a railway station, port or highway, the owner can go for the cultivation of perishable crops like vegetables, etc. In such cases, the farm is considered to be within the proximity of a city area.

4. Facilities available on the farm

Selection of crops also depends upon the facilities available for power, irrigation, inputs, labour, transport, etc. If these facilities are available, the farmer should adopt an intensive cropping scheme in order to maximize profits. Under an intensive cropping scheme, vegetables are grown because they fetch higher prices.

5. Area under individual plots

The area of individual plots should be equal unless topography, soil conditions, or any other reason compel the farmer to lay out his farm into uneven plot sizes.

6. Area allotted to crops for calculation of cropping intensity

If the farmer takes crop mixtures then the relative area under different crops has to be considered, so that none of them are adversely affected due to their mutual competition. It is, therefore, essential that the ratio of main and sub crops are worked out properly before the crops are grown. For the purpose of calculation, both crops are considered to be one crop only.

7. A crop planning which can utilize inputs and other resources available on the farm without wastage should be adopted by the farmer. Apart from this, the domestic needs are to be fulfilled.
8. The farmer should include at least one leguminous crop a year in his crop rotation for proper maintenance of soil fertility and other physico-chemical properties.

Cropping intensity:

Cropping intensity is the ratio of total cropped area to net cultivated area which is multiplied by 100 and represented in percentage.

$$\text{Cropping intensity} = \frac{\text{Total cropped area}}{\text{Net cultivated area}} \times 100$$

Multiple cropping and crop rotation

Mix cropping is the outstanding feature of cropping system in which variety of crops are grown simultaneously or at different time on the same land. In every season, care should be taken to maintain at least 40% legume cropping. Mix cropping promotes photosynthesis and avoids the competition for nutrients because different plants draw their nutrients from different depth of soil. Legumes fix atmospheric nitrogen and make available for companion or succeeding crops. Deep rooted plants drew nutrient from deeper layer of soil and bring them to the surface of soil through their leaf fall. So, the nutrients leached down to lower strata are further brought back to upper layer by these deep rooted plants. Also, help in protecting soil from soil erosion. Farmers should select the crops combination according to their needs and season. In selecting crop combinations, only compatible crops should be planted, for e.g. maize gets along well with beans and cucumber, tomatoes go well with onions and marigold.

Entire farm should have at least 8-10 types of crops at all the times. Each field/plot should have at least 2-4 types of crops out of which one should be legume. In case, if only one crop is taken in one plot then adjacent plots should have different crops. For maintenance of diversity and pest control randomly plant vegetable seedlings 50-150/ acre for home consumption and 100 plants/acre of marigold (Genda) in all crop fields. Even high nutrient demanding crops such as sugarcane can also be grown with suitable combination of various legume and vegetable crops with optimum productivity.

Crop rotation

Crop rotation is the back bone of farming practices. To keep the soil healthy and to allow the natural microbial systems working, crop rotation is must. Follow legume dominated crop combination. Rotation of pest host and non pest host crops helps in controlling soil born diseases and pest. It also helps in controlling weeds. It will help in improving productivity and fertility of soil. It also helps in improving soil structure through different types of root system. Legumes should be used frequently in rotation with cereal and vegetable crops. Green manure crops should also find place in crop rotations. High nutrient demanding crops should always be followed by legume crops.

Under Network Project on Organic Farming (NPOF of ICAR), important cropping systems, which were found economically better or at par with conventional system at different experimental stations in the country have been identified, which are as follows:

- Tomato/Cabbage- cauliflower – pea and maize – garlic
- Rice- wheat/potato/mustard/ lentil
- Groundnut – rabi Sorghum, soybean – durum wheat, potato – chick pea, chilli + Cotton and maize – chick pea
- Soybean – durum wheat/mustard/ chick pea/isabgol
- Rice-durum wheat/berseem, rice-potato- Okra and rice- garlic, sorghum- berseem, maize-berseem, maize + cowpea and sorghum + cluster bean –oats-cowpea
- Maize – cotton, chillies- onion and brinjal – sunflower
- Sorghum – pea – okra
- Carrot/rice (prekharif) – rice (kharif), potato/rice (prekharif) – rice (kharif), tomato/rice (prekharif) – rice (kharif), French bean / rice (prekharif) – rice (kharif)

Examples of cropping schemes

Example 1.: Suggest a suitable cropping scheme for a farm of 10 hectares which is suited near a sugar mill. The farmer has a tube well to irrigate his land. Calculate the cropping intensity and rotational intensity of the farm.

Solution: Under such cases we have to assume some of the things before we solve the problem.

Assumptions:

- 10 per cent of the farm area would go under building and layout because the question says that the farm has a gross area of 10 hectares this deduction would not have been made.
- The farmer has all the required inputs for cropping.

- The farmer will grow sugarcane on 60 per cent of his net cultivated area.

Methodology for calculation of cropping scheme

Table 1. Cropping Scheme

Plat No.	Area in ha.	1 st Year			2 nd Year			3 rd Year		
		Kharif	Rabi	Summer	Kharif	Rabi	Summer	Kharif	Rabi	Summer
1.	1.0	Maize	Potato	Sugar cane	-	-	Ratoon	-	-	Moong
2.	1.0		Sugarcane	-	-	Ratoon	Moong	Maize	Potato	Sugarcane
3.	1.0	Ratoon	-	Moong	Maize	Potato	Sugarcane			Ratoon
4.	1.0	Paddy-lehi	Potato	Urid	-	-	-	-	-	-
5.	1.0	M.P. Chari	Berseem	Lobia		-	-	-	-	-
6.	1.0	Maize	Sugarcane & Potato	-	-	-	Ratoon & Mustard		Urd	-
7.	1.0	-	Sugarcane	-	Ratoon	Mustard	Urd	Maize	Sugarcane & Potato	-
8.	1.0	-	Ratoon & Mustard	Urid	Maize	Sugarcane & Potato	-	-	Ratoon & Mustard	-
9.	1.0	Cucurbit	Cauliflower - Onion	Leafy vegetables	-	-	-	-	-	-
Tot	9.0	-	-	-	-	-	-	-	-	-

Rotational Intensity

This is calculated by counting the number of crops grown in a rotation and is multiplied by 100 and then divided by the duration of the rotation.

$$\text{Rotational intensity} = \frac{\text{No. of crops grown in rotation}}{\text{Duration of the rotation}} \times 100$$

This can be explained by the following example:

Maize-Early potato-Late potato-Moong-1 year

Paddy-Early potato-wheat-Urd-1 year

$$\text{Rotational intensity} = \frac{8}{2} \times 100 = 400\%$$

Table 2: Cropped area

Name of crops	Area in hectare	Name of crops	Area in hectare	Name of crops	Area in hectare
Maize (grain)	2.0	Paddy	1.00	M.P. Chari	1.00
Potato	2.50	Mustard & lahi	1.50	Berseem	1.00
Sugarcane	4.00	-	-	-	-
Moong	1.00	Urd	2.00	Lobia	0.50
Cucurbit	1.00	Cauliflower	1.00	Onion	1.00
Leafy vegetable	1.00	Maize (fodder)	0.5		
Total	09				

$$\text{Cropping intensity} = \frac{21}{9} \times 100 = 233\%$$

Rotational intensity of the farm

$$\text{Rotational Intensity} = \frac{\text{Total no. of crops}}{\text{Duration of the rotations}} \times 100$$

Rotation No.	No. of crops	Duration of the rotation in years	Intensity in percentage	Explanation	Remark
1.	5	3	166.7	$\frac{5}{3} \times 100$	
2.	4	1	400.0	$\frac{4}{1} \times 100$	
3.	3	1	300.0	$\frac{3}{1} \times 100$	
4.	4	3	133.3	$\frac{4}{3} \times 100$	
5.	4	1	400.0	$\frac{4}{1} \times 100$	
Total	20	1	222.2	$\frac{20}{9} \times 100$	

Crop rotations

- | | |
|---|---------|
| i. Maize-Potato-Sugarcane-ratoon-Moong | 3 years |
| ii Paddy-Lahi-Potato-Urd | 1 year |
| iii M.P. Chari-Berseem-Maize &Lobia | 1 year |
| iv Maize-Sugarcane &Potato-ratoon & Mustard-Urd | 3 years |
| v Cucurbits-Cauliflower-Onion-Leafy vegetable's | 1 year |

Number of plots=9 (because the total duration of all the rotation is 9 years)

Example 2.Suggest a suitable cropping scheme for a 10 hectare's farm which has all the facilities for intensive cropping. Farmer has to supply green folder to a neighboring dairy farm. Find out the cropping intensity.

Assumption

- Ten percent *i.e.* one hectare area is under building and layout. Thus, the net cultivated area remains nine hectares.
- Farmer has all the input facilities.
- Crop rotations be adopted:
 - Maize-Berseem-M.P. Chari- 1year
 - Jowar-Lucerne-Maize& Lobia-1 year
 - Napier &Gaur- Napier&Berseem- Napier- 1 year
 - Paddy – Wheat- Moong-1 year
 - Bhindi - Early potato- Late potato- Cucurbit-1 year
- Total numbers of plots are five.

Cropping scheme

Plot No.	Area in hectare	Kharif	Rabi	Zaid	Remarks
1.	2.0	Maize	Berseem	M.P. Chari	
2.	2.0	Jowar	Lucerne	Maize &Lobia	
3.	2.0	Napier & Guar	Napier &Berseem	Napier	
4.	2.0	Paddy	Wheat	Moong	
5.	1.0	Bhindi	E. potato L. potato	Cucurbit	
	9 hectares				

Cropped area

Maize-3	Guar-1	Lobia-1
Berseem-3	Pady-2	Napier-2
M.P. Chari-2	Wheat-2	Potato-2
Jowar-2	Mung-2	Cucurbit-1
Lucerne-2	Bhindi-1	
Total cropped area is 26		

$$\text{Cropping intensity} = \frac{26}{9} \times 100 = 288.8 \text{ per cent.}$$

Exercise for student

1. To prepare cropping for (12ha.) land scheme for rainfed up land midland, lowland farming situation.
2. To prepared cropping scheme for (1 acre) Badi farming situation (Homestead)for small & marginal farmers.
3. To prepared cropping scheme for 10 ha land irrigated condition in different farming situation viz, upland midland & lowland farming situation.

Observation to be recorded:

1. Suitability and sustainability of the cropping scheme.
2. Net profit of the systems
3. Employment generation man days and income/family/year

Practical No. 2

Title : Evaluation of multiple cropping systems and their sustainability through indices.

Objectives : 1. Introduction to different indices used under multiple cropping systems
2. To find out the efficiency and sustainability of different multiple cropping systems by using various indices

Calculation of various indices used in different multiple cropping systems

- $Harvest\ index\ (HI) = \frac{Economic\ yield}{oriological\ yield} \times 100$
- $Cropping\ intensity = \frac{Total\ cropped\ area}{Total\ orapped\ X\ W\ sown\ area} \times 100$
- $Real\ value = (Rv) = \frac{Puri\ 熟\ \% \times Germination\ \%}{100}$
- $Water\ productivity = \frac{Grain\ yield\ kg/ha}{Irrigation\ water\ use} kg/ha/cm.\ of\ water$
- = $\frac{Yield\ of\ cropping\ system}{Total\ water\ use}$
- $Profiability = \frac{Net\ return\ of\ cropping\ system}{365\ days} Rs/ha/day$
- $Production\ efficiency = \frac{Total\ productivity\ system\ (equivalent\ yield)}{Total\ duration\ (Hj\ system)} kg./ha/day$
- $Land\ use\ efficiency = \frac{Cropping\ system\ duration\ (No\ of\ days\ of\ system)}{365\ days}$
- $Nutrient\ use\ productivity = \frac{Yield\ (Total\ productivity)}{Kg\ of\ nutrient\ use} kg\ gram/unit\ of\ nutrient\ use$
- $Relative\ Economic\ efficiency = \frac{B-A}{A} \times 100$

A= Net return of existing system
B= Net return of diversified system
- $Employment\ 礦\ generation\ efficiency\ (EGE) = \frac{Man\ days\ employmet\ for\ system}{365\ days} \times 100$

- $Stability\ Index = \frac{\bar{Y}-S}{Y_{max}}$

\bar{Y} = Mean of total yield of cropping system in (two or more year) over the year

S= Standard deviation of yield

Y max = Maximum yield of a cropping sequences

- LAI = Leaf area Index (LAI)

$$LAI = \frac{Leaf\ area\ (m^2)}{Land\ area\ (m^2)}$$

$$LAI = \frac{Leaf\ area\ plant-1(m^2)}{Land\ area\ occupied\ by\ single\ plant\ (cm^2)}$$

- Leaf area duration (LAD) $LAD = \frac{Li+(Li+1)}{2} \times (t_2 - t_1)$

LAD = Leaf area duration in days

Li = Leaf area index at i^k stage

Li+1 = Leaf area index at (i+1)th stage in days

T2-p1 = Time improved between i k and (i+1)th stage in days

$$Land\ Equivalent\ Ratio\ (LER) = \sum_{i=1}^m \frac{Y_i}{Y_{ij}}$$

Y_i = Yield of the component from a unit area grown as intercrop

Y_{ij} = Yield of ith component grown as sole crop over the same area

Relative Crowding Coefficient (RCC): It is used in replacement series of intercropping. It indicates whether a crop, when grown in mixed population, has produced more or less yield than expected.

$$K_{ab} = \frac{Y_{ab}}{Y_{aa}} - \frac{Y_{ab}}{Y_{aa}} \times \frac{Z_{ba}}{Z_{ab}}$$

Where, K_{ab}=RCC of crop a intercropped with crop b,

Y_{ab}=Yield per unit area of crop a intercropped with crop b,

Y_{aa}= Yield per unit of sole crop a .

Z_{ab}=Proportion of intercropped area initially allocated to crop, a

Z_{ba}=Proportion of intercropped area initially allocated to crop b

RCC > 1 means yield advantage

RCC = 1 no difference

RCC < 1 yield disadvantage

Aggressivity: It is the mixture of how much the relative yield increase in component is greater than that for b.

$$Aab = Yab / (Yaa \times Zab) - Yba / (Ybb \times Zba)$$

Aab = Zero mean component crops are equally competitive,

Aab = Negative means dominated,

Aab = Bigger value either positive or negative means bigger difference in competitive abilities.

Competition Index: It is a measure to find out the yield of various crops when grown together as well as separately. It represents the yield per plant of different crops in mixture and their respective pure stand on unit area basis.

$$CI = (Yaa - Yab) \times (Ybb - Yba) / Yaa \times Ybb$$

Yab- mixture yield of a crop grown with b

Yba- mixture yield of b crop grown with a

Yaa-yield in pure stand of crop a

Ybb-yield in pure stand of crop b

Competition coefficient: Ratio of the RCC of any given spp. In the mixture

$$CC = \text{RCC of a given spp.} / \text{Total RCC of all crops in mixture}$$

Rotational Intensity: This is calculated by counting the number of crops grown in a rotation and is multiplied by 100 and then divided by the duration of rotation.

Practical No. -3

Title : Introduction to the existing farming systems of Chhattisgarh state

Objective: 1. To study in detail about farming situation existing in different zones of Chhattisgarh state
2. To study suitable integrated farming system model for different land/farming situations

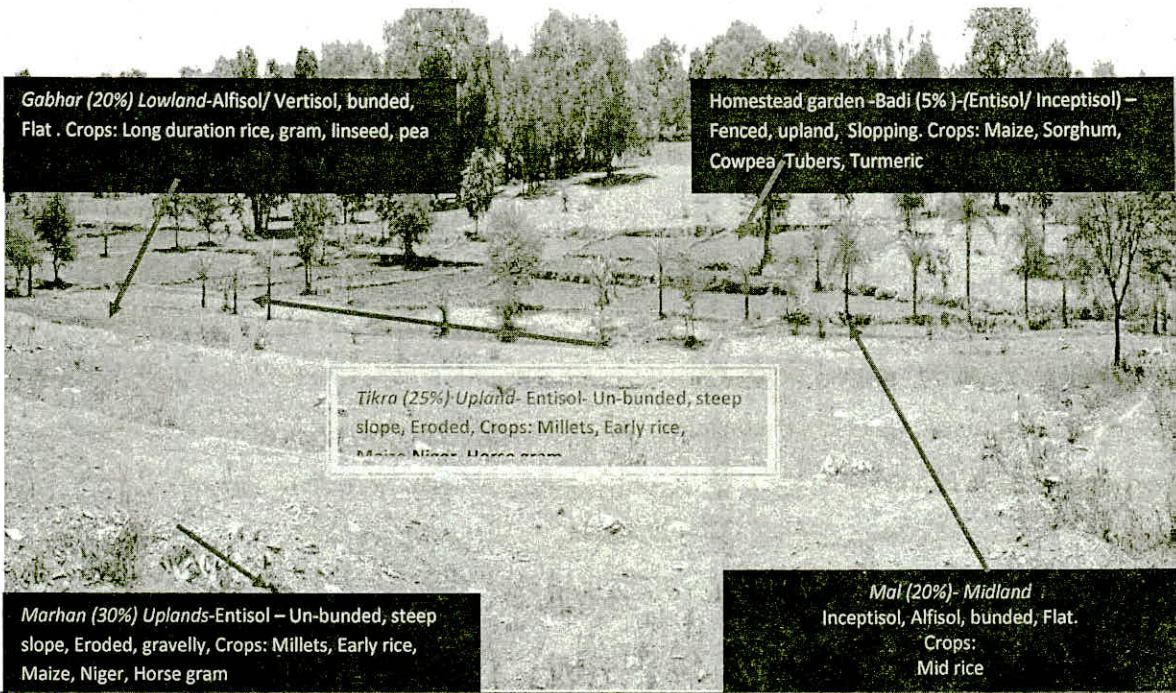
Introduction

Chhattisgarh state is one of the most backward states of the country. People are very poor and the livelihood depends on subsistence agriculture, collection of non-timber forest produce (NTFP), labour and small ruminants. It has typical socio economic problems and is one of the most backward and poor region of the country. Reducing natural resources, degrading land due to high erosion, exploitation by middle man and naxal activities are seriously affecting livelihood in rural areas in this region. A holistic integrated farming system approach can greatly help in decreasing the disparity in society as well as fighting the problems of social evils.

Farming situations

The landscape is hummocky having five distinct farming situations on topo-sequence. The farms will be classified according to different farming situation in three agro climatic zones, Bhata, Matasi, Dorsa, Kanhar for plains agro climatic zones. Badi, Marhan, Tikra, Mal, Gabhar for Bastar plateau and Goda, Chawar, Bahra for Northern hills zones. Badi exists on top most situations followed by upper upland & lower uplands, midland and lowland. Topography & high rainfall varies from place to place. High rainfall (1200-1400 mm) is responsible for severe soil erosion and land degradation.

Farming Situation in Bastar



Observation to be recorded

Prepare well label map of farming situation existing in adopted / selected village

1. Write the different characteristics of farming situation.
2. Record crops grown in farming situation, no. of livestock and source of water body, taken/pond/nala/river available in these farming situations. (Detail information).

Different integrated farming system model for small & marginal farmers according to farming situations

(A) Farming system models for Badi (Homes had garden):

- Drip in Badi (Home stead) for vegetable cultivation.
- Background poultry unit.
- Background Goatry unit.
- Background piggery unit.
- Background mushroom cultivation
- Background vermicomposting unit.

(B) Farming system model for upland

- Utilization of upland fallow through dry land crops, viz, maize millets, sesame urd, mung and nizer.
- Intercropping of maize vegetables in uplands.
 - Like, maize + Cowpea
 - Maize + Bhindi
 - Maize + Bean
- Moisture conservation techniques in upland farming situation
 - Through-Trenching
 - Through - raised and sunken bed technique
- Rainwater harvesting through embagement type farm pond.
- Pasture development in upland farming situation.

(C) Farming system model for midland.

- Rainwater management and recycling for post rice vegetable cultivation.
- Enhanced the productivity of rainfed rice through line seeding technology.

- Seed production through community approach
- Drudgery reduction in farm women through small improved Agricultural implement.

(D) Farming system model for lowland farming situation.

- Rainwater harvesting for drought alleviation through dugout farm ponds, small ditches, and shallow dug wells.
- Integrated paddy –cum fish cultivation.
- Integrated paddy fish-duck-vegetable system.
- Rice-vegetable + water harvesting system.

(E) Post rice crop establishment.

- Cultivation of wheat, chickpea, maize and linseed in zero tillage technology.
- Community approach for utilization of natural resource water through lift irrigation.
- Livelihood security through lac cultivation
- Livelihood improvement through collection, primary processing and marketing of Tamarind / Mahua

Observation to be recorded:

- Sustainability and profitability of the model
- Employment generation and income of house hold
- Total productivity of the system
- Suitability & sustainability of the model
- Income & employment generation
- Cost of cultivation
- Net-income / unit
- Employment generation mean days/year/house hold.
- Suitability & feasibility of the system
- Impact of innovation

Practical No.-4

Title : Evaluation of suggested integrated farming system models different situations

Objective: 1. To identify the suitable sustainable models for the resource poor farmers of C.G. Sate.

These models are given below

- Rice-Fish-Poultry farming system model
- Rice-Fish-Vegetable farming system model
- Rice-Pig- Fish-Vegetable farming system model
- Fish-livestock-Horti farming system model
- Fish + Duck + Pig based farming system model
- Breed improvement approach through quality breeds in Goat, Pig and Poultry.
- Livelihood security through lac cultivation.
- Rainwater management for drought alleviations crop diversification.
- Integrated Rice-fish-duck-vegetable farming system model
- Paddy cum fish cultivation farming system model

Observation to recorded:

1. Total productivity of the system
2. Suitability & sustainability of the model
3. Income & employment generation
4. Cost of cultivation
5. Net-income / unit
6. Employment generation mean days/year/house hold.
7. Suitability & feasibility of the system
8. Impact of innovation

Practical No. 5

Title : Farming system model for different climatic zones of Chhattisgarh

Objective: 1. To study different models for different agro climatic zones of Chhattisgarh for small and marginal farmers

2. To study the suitable enterprises for different farming system model for small and marginal farmers

1. Farming system models for Bastar plateau

Land Situation	Category of farmer		
	Marginal (upto 2.5 acre)	Small (2.5-5.0 acre)	Medium (5.0-10 acre)
Rainfed upland (3)	Maize/minor millet (Finger millet/dodo)+ oilseed (Niger) + pulse (argar/kulthi) + vegetables/tuber crop (leafy) vegetable/radish/kochai/Casava/sweet potato/cucurbits/diascorea-yam/footyam) + flower (marigold/ rajnigandha) + fruit/timber plants (mango/lemon/drumstic/guava/jackfruit/khamar) + vetiver strips/bund + green fodder stylo/giricidia + dug well + cow (2) +Goat (20) + Poultry birds (30) + duck (20) Nadep pit.	Maize/minor millet (Finger mille/kodo) +Oilseed (niger)+pulse (arhar/kulthi) +vegetables/tuber crop (leafy) vegetable/radish/ kochai/Casava/sweet potato/cucurbits/diascorea-yam/ footyam) +flower (marigold/rajnigandha) + fruit/timber plants(mango/lemon/drumstick/guava/jackfru it/giricida + shallow dug well +vetiver strips/bund +dug well +Cow (2) + Goat (15) + duck (20) +poultry birds (30) +Nadep pit + Biogas plant	Maize/minor millet (Finger millet/kodo) + oilseed (niger) + pulse (arhar/kulthi) + vegetable/tuber crop (leafy vegetable/radish/ kochai/cassava/sweet potato/cucurbits/diascorea-yam/ footyam) +flower (marigold/rajnigandha) + fruit/timber plants (mango/lemon/drumstic/guava/jackfruit/khamar) + green fodder-stylo/giricidia + shallow dug well + vetiver strips/bund + Cow (2) + Goat (10) + duck (20) + poultry birds (30) + Nadep pit + Biogas plant
Irrigated upland (3)	Maize + oilseed (sesame) + pulse (arhar) + vegetables (chill /tomato/brinjal/ cauliflower/cabbage/cucurbits) + flower (o bund marigold/ rajnigandha) + fruit/timber trees (on bunds- mango / lemon/drumstick/ guava /jackfruit/khamar) + green fodder (maize/sorghum) + vetiver strips/bund + tube well anddrip irrigation + cow (2) + Goat (5) +Poultry birds (30) + duck (20) Nadep pit + vermiculture + Biogas plant	Maize + oilseed (sesame) + pulse (arhar) + vegetables(chili/tomato / brinjal/cauliflower / cabbage/cucurbits) + flower (bund-marigold/ rajnigandha) + fruit/timber trees (on bonds- mango/lemon/drumstick/guava/ jackfruit/khamar) + green fodder (Maize/sorghum) + vetiver strips/bund + tube well and drip irrigation + Cows (2) + Goat (10) + Poultry birds (30) + duck (20) + Nadep pit + vermiculture + Biogas plant.	Maize + oilseed (sesame) + pulse (arhar) + vegetables (chili/ tomato/ brinjal/ cauliflower /cabbage/ cucurbits) + flower (bund -marigold/ rajnigandha) +fruit/timberplants (on bund- mango/lemon/drumstick/guava/jackfruit/khamar) + green fodder (maize/sorghum) + vetiver strips/bund + tube well and drip irrigation Cow (4) duck (20) + poultry birds (30) + vermiculture + Biogas plant

Land Situation	Category of farmer		
	Marginal (upto 2.5 acre)	Small (2.5-5.0 acre)	Medium (5.0-10 acre)
Rainfed midland (3)	Rice-pulse + vegetables (leafy vegetable/ radish/ cucurbits/ tomato/chili/ brinjal) + flower (marigold/ rajnigandha) + fruit/timber plants (mango/lemon/ drumstick/ guava/ jackfruit/ khamar) + green fodder- on bund/ gliricidia + pond + Dug well + cow (2) + Goat (20) + duck (20) + fish + poultry birds (30)+Nadep pit	Rice-pulse +vegetable (leafy vegetable/radish/cucurbits/tomato/chili/brinjal) + flower (marigold) + fruit/timber plants(mango/lemon/drumstick/guava/jackfruit/khamar) + green fodder- maize/cowpea/gliricidia + pond shallow dug well + Cow (2) + Goat (15) poultry birds (30) + duck (20)+fish+Nadep pit+ vermin compost+ Biogas plant	Rice-pulse + vegetables (leafy vegetable/radish/cucurbits/tomato/chili/brinjal) + flower (marigold) + fruit/timber plants (mango/lemon/drumstick/guava/jackfruit/ khamar) + green fodder- maize/cowpea /gliricidia + pond + shallow dug well + Cow (2) + Goat (15)+ Poultry birds (30) + duck (20) + fish + Nadep pit + vermicompost + Biogas plant
Irrigated midland (3)	Rice-pulse + vegetables (cowpea/ ladyfinger/ tomato/chili/brinjal) + flower (marigold/ rajnigandha) + fruit/ timber plants (mango /lemon/drumstick/guava/jackfruit/ khamar) + green fodder-on bund gliricidia + tube well and drip irrigation + cow (2) + Goat (15) + poultry birds (30) + duck 20 + fish + Nadep pit vermin culture + biogas	Rice- pulse + vegetables (tomato /chili /brinjal/cowpea) + flower (marigold/ rajnigandha) + fruit/timber plants (mango /lemon/ drumstick/ guava/ jackfruit/ khamar) + green fodder- maize/ sorghum /cowpea/gliricidia + pond + tube well and drip system + Cow (2) + Goat (10) + poultry birds (30) +duck (20) +fish + Nadep pit + vermicompost + biogas plant	Rice-pulse+vegetables(tomato/ chili/rinjal /cowpea/ladyfinger) + flower (marigold/ rajnigandha) + fruit/timber plants (mango /lamon/drumstick /guava/ jackfruit/ kahamar) + green fodder- maize/ cowpea/ gliricidia + pond +tube well and drip system + Cow (2) + Goat (10) + poultry birds (30) +duck (20) +fish + Nadep pit + vermicompost + biogas plant
Rainfed low land (3)	Rice- pulse +vegetables (leafy vegetable/ radish/cucurbits/ tomato/ chili/ brinjal) + flower (marigold/rajnigandha) + fruit/timber plants (mango/lemon/drumstick/guava/ jackfruit/ khamar) + green fodder- on bund gliricidia + pond +Dug well + duck cum fish + cow (2) + Goat (10) + poultry birds (30) +duck (20) +fish + Nadep pit + vermicompost + biogas plant	Rice- pulse +vegetables (leafy vegetable/ radish/cucurbits/ tomato/ chili/ brinjal) + fruit/ timber plants (mango/ lemon/ khamar) + green fodder- maize/cowpea/gliricidia + pond + shallow dug well + Cow (2) + Goat (10) + poultry birds (30) +duck (20) +fish + Nadep pit + vermicompost + biogas plant	Rice- pulse +vegetables (leafy vegetable/ radish/cucurbits/tomato/ chili/ brinjal) + flower (marigold/ chili/brinjal) + fruit/ timber plants (mango/ lemon/ drumstick/guava/ jackfruit/ khamar) + green fodder- maize/cowpea/gliricidia + pond + shallow dug well + Cow (2) + Goat (10) + poultry birds (30) +duck (20) +fish + Nadep pit + vermicompost + biogas plant

Land Situation	Category of farmer		
	Marginal (upto 2.5 acre)	Small (2.5-5.0 acre)	Medium (5.0-10 acre)
Irrigated lowland (3)	Rice-pulse +vegetables (cowpea / ladyfinger/ tomato/ chili/ brinjal) + flower (marigold/chili/brinjal) + fruit/timber (marigold /rajnigandha) + fruit/timber plants (mango/lemon/drumstick/guava/ jackfruit/ khamar) + green fodder- on bund gliricidia + tube well and drip irrigation + cow (3)+ poultry birds (30) + duck (20) + fish + Nadep pit vermin-culture + biogas	Rice-pulse+vegetables (tomato/ chili/ brinjal/ cowpea) + flower (marigold /rajnigandha) + fruit/timber plants (mango/lemon/ drumstick/ guava/ jackfruit/khamar) + green fodder-maize/ sorghum/cowpea/ gliricidia + pond + tube well and drip system + Cow (3) + poultry birds (30) duck (20)+fish +Nadep pit + vermin compost +biogas plant	Rice-pulse+vegetables (tomato/ chili/ brinjal/ cowpea+ ladyfinger) + flower (marigold /rajnigandha) + fruit/timber plants (mango/lemon/ drumstick/ guava/ jackfruit/khamar) + green fodder-maize/ sorghum/cowpea/ gliricidia + pond + tube well and drip system + Cow (3) + poultry birds (30) duck (20)+fish +Nadep pit + vermin compost +biogas plant
Rainfed Badi system (1)	Tuber crop/maize/ vegetables (leafy vegetable/cabbage/ cauliflower/ chilli/ potato/ cucurbits/ diascorea-yam/ footyam) + flower (marigold) + fruit/timber plants (mango/lemon/ banana/ khamar) + poultry birds (30) + Nadep pit + Biogas plant	Rice-pulse+vegetable/cabbage/ cauliflower/ chilli/ brinjal/radish sem/kochai/ cassava/ sweet potato/ cucurbits/ diascorea-yam/ footyam) + flower (marigold) + fruit/timber plants (mango/lemon/ drumstick/ guava/ jackfruit/ banana/ khamar) + poultry birds (30) + Nadep pit + Biogas plant	brinjal/radish sem/kochai/ cassava/ sweet potato/ jackfruit/ guava/ jackfruit/
Irrigated Badi system (1)	Vegetables (chili/tomato/ brinjal/cauliflower/ cowpea/cabbage/cucurbits/ sem) + flower (marigold/gladiolus/ rajnigandha) + fruit timber trees (on boundary-mango/lemon/ drumstick/ guava/jackfruit/ khamar) shallow dug well/tube well and drip irrigation poultry birds (30) +duck (10) + Nadep pit + vermiculture + biogas plant	Vegetables (chili/tomato/ brinjal/cauliflower/ cowpea/cabbage/cucurbits/ sem) + flower (marigold/gladiolus/ rajnigandha) + fruit timber trees (on boundary-mango/lemon/ drumstick/ guava/jackfruit/ khamar) shallow dug well/tube well and drip irrigation poultry birds (30) +duck (10) + Nadep pit + vermiculture + biogas plant	Vegetables (chili/tomato/ brinjal/cauliflower/ cowpea/cabbage/cucurbits/ sem) + flower (marigold/gladiolus/ rajnigandha) + fruit timber trees (on boundary-mango/lemon/ drumstick/ guava/jackfruit/ khamar) shallow dug well/tube well and drip irrigation poultry birds (30) +duck (10) + Nadep pit + vermiculture + biogas plant

Name of enterprise their description and purpose in the One-Acre-One-lakh Farming models

Enterprise	Details	Purpose	Percent area of model
1. Cereals crops	Rice line sowing (dry/wet), maize (Hyb/ sweet/babi con), minor millets (ragi/kodo/) during kharif season and gram, summer maize, and vegetables during rabi season	Food for farm family and excess for marketing to earn cash	30-35
2. Oilseed crop	Soybean/till in upper areas during rainy season and niger, rai, mustard during rabi season and niger, ragi, mustard during rabi season after kharif pulses	To meet out oil requirement of family and excess for marketing to earn cash	5-10
3. Pulse crop	Urid, mung and Arhar in upper areas and arhar on field bunds during kharif season and maize, kulthi and cucurbits during rabi season after pulsed	To meet out pulse requirement of family and excess for marketing to earn cash	5-10
4. Vegetable	Ladyfinger, brinjal and tomato, chilli, cucurbits, potato during kharif and rabi season. Karonda, Sem, foot yam on outer fencing bund of farm	To meet out pulse requirement of family and excess for marketing to earn cash	5-10
5. Flower	Marigold, gladiolus, rajnigandha on bunds	To earn cash and ethics	2-3
6. Fruit crops	Ber, aonla, guava, mango, papaya, banana. Custard apple, drumstick on field, bunds of field, pond and near animal shed	Nutritious food in food basket and earn cash	5-8
7. Timber plantation	Few plants (5-10) of Khamar, bamboo, semialata, teak etc. on bund	Agricultural implement and fuel as well as for lac culture	1
8. Green fodder	Multi-cut sorghum, maize/cowpea/ berseem/ stylo on bunds of field and pond	Green fodder to milch animals	10-15
9. Farm pond & shallow dug /tube well	Pond of 1200-2000m ³ capacity will be constructed at suitable place to collect runoff and inter and base flow will be collected in well or tube well to be constructed in down valley of the pond	Water harvesting and recycling for water requirement of crops and other enterprises including domestic need of family	10-15
10. Cow	Breed-local/sahiwal/gir/cross HF, Green and dry fodder produced on farm will be fed. Lactation period of both the cows should be different. Cows no. may be increased from 2 nd year	Nutritious food in food basket and regular cash earning	Area of pond bund will be utilized for construction
11. Goat	Breed-mixed blak Bengal/ Jamunapari, oper grazing	Meet requirement and regular cash earning	of sheds for these structure
12. Poultry & duck	Local breed reared as back yard poultry	Meet and egg requirement and regular cash earning	

13. Apiculture		Boxes will be kept on pond bund & near animal & farm shed	Medicine and cash earning	
14. Fish and duck		Fish and duck rearing in pond. Farm waste and cow dung including urine will be used as feed	Meet requirement and regular cash earning	Including farm hut, animal, mushroom shed, biogas plant and organic manure
15. Mushroom & spawn production		Mushroom and spawn production near farm and store hut. For spawn production simple method using cooker and inoculated chamber will be used without much investment	Nutritious food and cash earning	
16. Lac culture		Lac culture on semialata, ber and perennial arhar on bunds	To earn cash	
17. Nadeb pit & Vermiculture		Nadeb pit and vermin-culture near animal shed	Production of organic manure for improving soil health and substitution of chemical fertilizer	
18. Biogas plant		Biogas plant near animal shed and farm hut	For fuel and illumination to the farm	

Note:

1. For upland and midland situation, rice need to be taken in area by which family food requirement can be met out by adopting recommended package of practices. While in lowland situation rice should be grown by adopting recommended package of practices during kharif season.
2. Number of animals need to be more in rainfed farming system over irrigated system.
3. Reduce number of crops as per outcome during 1st year and suitability in the ecosystem.
4. Basic concept of model to meet out food requirement, regular income and employment round the year on farm to farm family.

2. Farming system models for Chhattisgarh plain

Land Situation	Category of farmer		
	Marginal (upto 2.5 acre)	Small (2.5-5.0 acre)	Medium (5.0-10 acre)
Rainfed upland (3)	Oilseed + pulse + vegetables + flower + fruit/timber plants + vetiver strip/bund + green fodder/bund stylo/ grilicidia + dug well + Cow (2) + Goat (20) + Poultry girds (30) + duck (20) + Nadep pit + Biogase plant	Oilseed + pulse + vegetables + flower + fruit/timber plants + green fodder-stylo/grilicidia + dug well + Cow (2) + Goat (15) + poultry birds (30) + duck (20) + Nadeppitand vermin-culture + Biogas plant	Oilseed + pulse + vegetables + flower + fruit/timber plants + green fodder-stylo/grilicidia + dug well + Cow (2) + Goat (10)+ poultry birds (30) + duck (20) + Nadep pit and vermin-culture + Biogas plant.
Irrigated upland (3)	Vegetables + On bunds (oilseed/pulse/flower/fruit & timber plants/grilicidia) + green fodder + tube well &dripsystem + Cow (2) + Goat (20) poultry birds (20) + Duck (20) + Nadep pit and vermin-culture + Biogas plant	Vegetables + On bunds (oilseed/pulse/flower/fruit & timber plants/grilicidia) + green fodder + tube well &dripsystem + Cow (2) + Goat (15) poultry birds (20) + Duck (20) + Nadep pit and vermin-culture + Biogas plant	Vegetables + On bunds (oilseed/pulse/flower/fruit & timber plants/grilicidia) + green fodder + tube well &dripsystem + Cow (2) + Goat (10) poultry birds (20) + Duck (20) + Nadep pit and vermin-culture + Biogas plant
Rainfed midland (3)	Cereal/ pulse/oilseed + pulse (on bud) + vegetables + flower + fruit/timber plants + green fodder (chari/maize/on bund-grilicidia) + pond + dug well + Cow (2) + Goat (20) + poultry birds (30) + Fish & duck (20) + Nadep pit and verim-culture + Biogas plant	Cereal/ pulse/oilseed + pulse (on bud) + vegetables + flower + fruit/timber plants + green fodder (chari/maize/on bund-grilicidia) + pond + dug well + Cow (2) + Goat (15) + poultry birds (30) + Fish & duck (20) + Nadep pit and verim-culture + Biogas plant	Cereal/ pulse/oilseed + pulse (on bud) + vegetables + flower + fruit/timber plants + green fodder (chari/maize/on bund-grilicidia) + pond + dug well + Cow (2) + Goat (10) + poultry birds (30) + Fish & duck (20) + Nadep pit and verim-culture + Biogas plant
Irrigated midland (3)	Cereal- vegetables + on bunds-oilseed/pulse/ flower/fruit & timber plants/grilicidia + green fodder + Farm pond + tube well &dirp system + Cow (2) + Goat (20) + Poultry birds (20) + Fish & duck (20) + Nadep pit and vermin-culture + Biogas plant	Cereal- vegetables + on bunds-oilseed/pulse/ flower/fruit & timber plants/grilicidia + green fodder + Farm pond + tube well &dirp system + Cow (2) + Goat (15) + Poultry birds (20) + Fish & duck (20) + Nadep pit and vermin-culture + Biogas plant	Cereal- vegetables + on bunds-oilseed/pulse/ flower/fruit & timber plants/grilicidia + green fodder + Farm pond + tube well &dirp system + Cow (2) + Goat (10) + Poultry birds (20) + Fish & duck (20) + Nadep pit and vermin-culture + Biogas plant
Rainfed lowland (3)	Cereal-pulse-oilseed + vegetables + flower +fruit/timber plants + green fodder (chari/maize) + farm pond + dug well + Cow (2) + Goat (20) + poultry birds (30) + Fish & duck (20) + Nadep pit and Vermi-culture + Biogas plant	Cereal-pulse-oilseed + vegetables + flower +fruit/timber plants + green fodder (chari/maize) + farm pond + dug well + Cow (2) + Goat (15) + poultry birds (30) + Fish & duck (20) + Nadep pit and Vermi-culture + Biogas plant	Cereal-pulse-oilseed + vegetables + flower +fruit/timber plants + green fodder (chari/maize) + farm pond + dug well + Cow (2) + Goat (10) + poultry birds (30) + Fish & duck (30) + Nadep pit and Vermi-culture + Biogas plant

Land Situation	Category of farmer		
	Marginal (upto 2.5 acre)	Small (2.5-5.0 acre)	Medium (5.0-10 acre)
Irrigated Lowland (3)	Cereal-vegetables + On bunds-oilseed/ pulse/ flower/fruit & timber plants/grilicidia + green fodder + farm pond + tube well + Coe (2) + Goat (20)+ poultry birds (20)+ Fish & duck (20) + Nadep pit and Vermi-culture + Biogas plant	Cereal-vegetables + On bunds-oilseed/ pulse/ flower/fruit & timber plants/grilicidia + green fodder + farm pond + tube well + Coe (2) + Goat (15)+ poultry birds (20)+ Fish & duck (20) + Nadep pit and Vermi-culture + Biogas plant	Cereal-vegetables + On bunds-oilseed/ pulse/ flower/fruit & timber plants/grilicidia + green fodder + farm pond + tube well + Coe (2) + Goat (10)+ poultry birds (20)+ Fish & duck (20) + Nadep pit and Vermi-culture + Biogas plant
Rainfed Badi system (1)	Vegetables (Seafy vegetable/cabbage/cowpea/ cauliflower/ chilli / brinjal/ radish/ sem / bottle guard/ cucurbits/ footyam) + flower (margigold) + fruit/timber plants on boundary (mango/lemon/drumstick/ guava/ jackfruit/ banana/ khamar) + Poultry birds (30) + Nadep pit + Biogas plant		
Irrigated Badi system (1)	Vegetables (chili/tomato/ brinjal/ cauliflower cowpea cabbage/cucurbits/ sem) + flower (marigold/ gladiolus/ ranigandha0 + fruit/timber trees (on boundary- mango/ lemon/ drumstick/ guava/jackfruit/khamar) shallow dug well/ tube well and drip irrigation + Poultry birds (30)+duck(10) Nadep pit + vermin-culture + Biogas plant		

Enterprise	Details	purpose	Percent area of model
Cereals crops	Rice line sowing (dry/wet), maize (Hyb/babi corn), minor millets (Ragi/kodo) during kharif season and gram, summer maize and vegetables during rabi season	Food for farm family and excess for marketing to earn cash	30-35
Oilseed crop	Soybean/till in upper areas during rainy season and niger, rai, mustard during rabi season after kharif pulses	To meet out oil requirement of family and excess for marketing to earn cash	5-10
Pulse crop	Urid, mung and Arhar in upper areas and arhar on field bunds during kharif season and maize, kulthi and cucurbibits during rabi season after pulses.	To meet out pulse requirement of family and excess for marketing to earn cash	5-10
Vegetable	Ladyfinger, brinjal and tomato, chilli, cucurbits, potato during kharif and rabi season. KarondsSem, foot yam, on outer fencing bund of farm	To meet out pulse requirement of family and excess for marketing to earn cash	5-10

Flower	Marigold, gladiolus, rajnigandha on bunds	To earn cash and ethics	2-3
Fruit crops	Ber, aonla, guava, mango, papaya, banana, custard apple, drumstick on field and on bunds of field and pond and near animal shed	Nutritious food in food basket and earn cash	5-8
Timber plantation	Few plants (5-10) of khamar, bamboo, semialata, teak etc. on bund	Agricultural implements and fuel as well as for lac culture.	1
Green fodder	Multi-cut gorghum/ maize/cowpea/berseem/ stylo on bunds of field and pond	Green fodder to milch animals	10-15
Farm pond & shallow dug well/tube well	A pond of 1200-2000m ³ capacity will be constructed at suitable place to collect runoff water. Inter and base flow will be collected in well or tube well to be constructed in down valley of the pond	Water harvesting and recycling for irrigating crops and other enterprises including domestic need of family.	10-15
Cow	Breed- leal/sahiwal/gir/cross HF, Green and dry fodder produced on farm will be fed. Lactation period of both the cows should be different. Cows no may be increased from 2 nd year.	Nutritious food basket and regular cash earning	Pond bund will be utilized for construction of sheds including hut, animal, mushroom shed, biogas plant and organic manure
Goat	Breed-mixed balck Bengal/Jamunapari, open grazing	Meet requirement and regular cash earning	-
Poultry & duck	Local breed reared as backyard poultry	Meet and egg requirement and regular cash earning	-
Apiculture	Boxes will be kept on pond bund and near animal and farm shed	Medicine and cash earning	-
Fish and duck	Fish and duck rearing in pond. Farm waste and cow dung including urine will be used as feed	Meet requirement and regular cash earning	-
Mushroom & spawn production	Mushroom and spawn production near farm, and store hut. For spawn production simple method using cooker and inoculated chamber will be used without much investment	Nutritious food and cash earning	-
Lac culture	Lac culture on semialata, ber and perennial arhar grown on bunds	To earn cash	-
Nadep pit & Vermiculature	Nadep pit and verim-culture near animal shed	Production of organic namure for improving soil health and substitution of chemical fertilize	-
Biogass	Biogas plant near animal shed and farm hut	For fuel and illumination to the farm	-

Note:

1. For upland and midland situation, rice need to be taken in area by which family food requirement can be meet out by adopting recommended package of practices. While in lowland situation rice should be grown by adopting recommended package of practices during kharif season.
2. Number of animals need to be more in rainfed farming system over irrigated system.
3. Reduce number of crops as per outcome during 1st year and suitability in the ecosystem.
4. Basic concept of model to meet out food requirement, regular income and employment round the year on farm to farm family.

3. Farming system models for northern hill region of Chhattisgarh

Land Situation	Category of farmer		
	Marginal (upto 2.5 acre)	Small (2.5-5.0 acre)	Medium (5.0-10 acre)
Rainfed upland (3)	Maize + oilseed (niger) + pulse (arhar/hulthi) + vegetables / tuber crop (leafy vegetable/ radish/kochai/ cucurbits) + fruit/ cucurbits) + flower (marigold) + fruit/timber plants (mango/lemon/ drumstick / guava/ jackfruit/khamar) +vetiver strips/bund + green fodder-stylo/ gliricidia + dug well + Cow (2) + Goat (20) + Pig (10) + Poultry birds (30) + Nadep pit.	Maize + oilseed (niger) + pulse (arhar/hulthi) + vegetables/ tuber crop (leafy vegetable/ radish/kochai/ cucurbits) + flower (marigold) + fruit/timber plants (mango/lemon/ drumstick / guava/ jackfruit /khamar) + green fodder-stylo/ gliricidia + dug well + vetiver strips/bund + Cow (2) + Goat (10) + pig (10) + Poultry birds (30) + Nadep pit + Biogas plant	Maize + oilseed (niger) + pulse (arhar/hulthi) + vegetables/ tuber crop (leafy vegetable/ radish/kochai/ cucurbits) + flower (marigold) + fruit/timber plants (mango/lemon/ drumstick / guava/ jackfruit/khamar) + green fodder-stylo/ gliricidia + dug well + vetiver strips/bund + Cow (2) + Goat (10) + pig (10) + Poultry birds (30) + Nadep pit + Biogas plant
Irrigated upland (3)	Maize + oilseed - pulse (on bund) + vegetables (chili/ tomato/ brinjal/ cualliflower/cabbage/ cucurbits) + flower (on bund - marigold) + fruit/timber trees (on bunds-mango/lemon/drumstick/ guava/jackfruit/ khamar) + green fodder (maize/ sorghum) + vetiver strips/bund + pond + tube well and drip irrigation + cow (2) + Goat/pig (15) + poultry birds (30) + fish & duck (20) _ Nadep pit + vermiculture + Biogas plant	Maize + oilseed - pulse (on bund) + vegetables (chili/ tomato/ brinjal/ cualliflower/ cabbage/ cucurbits) + flower (on bund - marigold) + fruit/timber trees (on bunds -mango/lemon/drumstick/ guava/jackfruit/ khamar) + green fodder (maize/ sorghum) + vetiver strips/bund + pond + tube well and drip irrigation + cow (2) + Goat/pig (10) + poultry birds (30) + fish & duck (20) _ Nadep pit + vermiculture + Biogas plant	Maize + oilseed - pulse (on bund) + vegetables (chili/ tomato/ brinjal/ cualliflower/ cabbage/ cucurbits) + flower (on bund - marigold) + fruit/timber trees (on bunds-mango/lemon/drumstick/ guava/jackfruit/ khamar) + green fodder (maize/ sorghum) + vetiver strips/bund + pond + tube well and drip irrigation + cow (4) + Goat/pig (15) + poultry birds (30) + fish & duck (20) _ Nadep pit + vermiculture + Biogas plant
Rainfed midland (3)	Rice - pulse + vegetables (leafy vegetable/ radish/ cucurbits/tomato/ chili/ brinjal) + fruit (marigold) + fruit /timber plant (mango/lemon/drumstick/ guava/ jackfruit/ khamar) + green fodder- maize/sorghum/on bund + Dug well + cow (2) + Pig (10) + Poultry birds (30) + fish & duck (20) + veri-compost + Nadep pit + biogas	Rice - pulse + vegetables (leafy vegetable/ radish/ cucurbits/tomato/ chili/ brinjal) + fruit /timber plant (mango/lemon/drumstick/ guava/ jackfruit/ khamar) + green fodder- maize/sorghum/on bund + Dug well + cow (2) + Pig (15) + Poultry birds (30) + fish & duck (15) + veri-compost + Nadep pit + biogas	Rice - pulse + vegetables (leafy vegetable/ radish/ cucurbits/tomato/ chili/ brinjal) + flower (marigold) + fruit /timber plant (mango/lemon/drumstick/ guava/ jackfruit/ khamar) + green fodder- maize/sorghum/on bund + Dug well + cow (2) + Pig (10) + Poultry birds (30) + fish & duck (10) + veri-compost + Nadep pit + biogas

Land Situation	Category of farmer		
	Marginal (upto 2.5 acre)	Small (2.5-5.0 acre)	Medium (5.0-10 acre)
Irrigated midland	Rice - pulse/cereal + vegetables (cowpea/ ladyfinger/tomato/chili/brinjal) + flower (marigold) + fruit /timber plant (mango/lemon/ drumstick/ guava/ jackfruit/ khamar) + green fodder- maize/sorghum-cowpea/ on bund gliricidia + pond + tube well and drip irrigation + cow (2) + Goat (15) + poultry birds (30) + duck cum fish + Nadep pit-vermiculture + biogas	Rice - pulse/cereal + vegetables (tomato/chili/brinjal/ cowpea) + flower (marigold) + fruit /timber plant (mango/ lemon/ drumstick/ guava/ jackfruit/ khamar) + green fodder- maize/sorghum-cowpea/ on bund gliricidia + pond + tube well and drip system + cow (2) + Goat (10) + poultry birds (30) + duck cum fish + Nadep pit-vermiculture + biogas plant	Rice - pulse / cereal + vegetables (tomato chili/brinjal/cowpea/ladyfinger) + flower (marigold) + fruit/timber plants (mango/lemon/ drumstick/ guava/ jackfruit/ khamar) + green fodder- maize/cowpea/ gliricidia + pond + tube well and drip system + Cwo (2) + Goat/pig (10) + poltrybrids (30) + duck cum fish + Nadep pit + vermi compost + Biogas plant
Rainfed lowland (3)	Rice - pulse/cereal - vegetables (leafy vegetable/radish/ cucurbits/ tomato/ chili/ brinjal) + flower (marigold) + fruit/timber plants (mango/ lemon/ durmstic/guava/ jackfruit/ khamar) + green fodder- maize/ sorghum/ on bund gliricidia + pond + Dug well + cow (2) + Goat (20) +pig (10) + poultry birds (30) +vericompost + fish & duck (20) +vericompost + Nadep pit + biogas	Rice - pulse/cereal - vegetables (leafy vegetable/cucurbits/ tomato/ chili/ brinjal) + flower (marigold + fruit/ timber plants (mango/ lemon/ durmstic/guava/ jackfruit/ khamar) + green fodder- maize/ sorghum/ on bund gliricidia + pond + Dug well + cow (2) + Goat (15) +pig (10) + poultry birds (30) +fish & duck (15) +vericompost + Nadep pit + biogas	Rice - pulse/cereal - (leafy vegetables vegetable/cucurbits/ tomato/ chili/ brinjal) + flower (marigold + fruit/ timber plants (mango/ lemon/ durmstic/guava/ jackfruit/ khamar) + green fodder- maize/ sorghum/ on bund gliricidia + pond + Dug well + cow (2) + Goat (10) +pig (10) + poultry birds (30) +fish & duck (10) +vericompost + Nadep pit + biogas

Land Situation	Category of farmer		
	Marginal (upto 2.5 acre)	Small (2.5-5.0 acre)	Medium (5.0-10 acre)
Irrigated lowland (3)	Rice - pulse/cereal + vegetables (cowpea/ ladyfinger /tomato/chili/brinjal) + flower (marigold) + fruit / timber plant (mango/ lemon/ drumstick/ guava/ jackfruit/ khamar) + green fodder- maize/sorghum-cowpea/ on bund gliricidia + pond + tube well and drip irrigation + cow (3) + Goat/ Pig (15) + poultry birds (30) + duck cum fish + Nadep pit-vermiculture + biogas	Rice- pulse/cereal + vegetables (cowpea/ ladyfinger /tomato/chili/brinjal) + flower (marigold) + fruit / timber plant (mango/ lemon/ drumstick/ guava/ jackfruit/ khamar) + green fodder- maize/sorghum-cowpea/ on bund gliricidia + pond + tube well and drip irrigation + cow (3) + Goat cum fish + Nadep pit+ vermiculture + biogas plant	Rice- pulse/cereal + vegetables (cowpea/ ladyfinger /tomato/chili/brinjal) + flower (marigold) + fruit / timber plant (mango/ lemon/ drumstick/ guava/ jackfruit/ khamar) + green fodder- maize /sorghum-cowpea/ on bund gliricidia + pond + tube well and drip irrigation + cow (3) + Goat Pig/ (10) + poultry birds (30) + duck cum fish + Nadep pit+ vermiculture + biogas plant

Land Situation	Category of farmer	
	Marginal (upto 2.5 acre)	Small (2.5-5.0 acre)
Rainfed Badi system (1)	Maize-toria /Niger + vegetables (leafy vegetable/cabbage/ cowpea/ cauliflower/ chilli / brinjal/ radish/ sem /bottle gourd/ cucurbits/ footyam) + flower (marigold) fruit/timber plants on boundary (mango/lemon/drumstick/ guava/ jackfruit/ banana khamar) + Poultry birds (30) + Nadep pit + Biogas plant	Small (2.5-5.0 acre)
Irrigated Badi (system) (1)	Maize-toria + vegetables (chili/tomato/brinjal/cauliflower/ cowpea/ cabbage/cucuribits/sem) + flower (marigold/gladiolus/ rajnigandha) + fruit/timber trees (on boundary-mango/lemon/drumstick/guava/jackfruit/ khamar) + shallow dug well/ tube well and drip irrigation + Poultry birds (30) + duck (10) + Nadep pit + vermi-culture + Biogas plant	Medium (5.0-10 acre)

Enterprise	Details	purpose	Percent area of model
Cereals crops	Rice line sowing (dry/wet), maize (Hyb/sweet/babi corn), minor millets (Ragi/kodo) during kharif season and gram, summer maize, and vegetables during rabi season	Food for farm family and excess for marketing to earn cash	30-35
Oilseed crop	Soybean/till in upper areas during rainy season and niger, rai, mustard during rabi season after kharif pulses	To meet out oil requirement of family and excess for marketing to earn cash	5-10
Pulse crop	Urid, mound and Arhar in upper areas and arhar on field bonds during kharif season and maize, kulthi and cucurbits during rabi season after pulses	To meet out pulse requirement of family and excess for marketing to earn cash	5-10
Vegetable	Ladyfinger, brinjal and tomato, chilli, cucurbits, potato during kharif and rabi season. Karondasem, foot yam, on outer fencing bund of farm	To meet out pulse requirement of family and excess for marketing to earn cash	5-10
Flower	Marigold, gladiolus, rajnigandha on bunds	To earn cash and ethics	2-3
Fruit crops	Ber, aonla, guava, mango, papaya, Banana, custard apple, drumstick on field and on bunds of field and pond and near animal shed	Nutritious food in food basket and earn cash	5-8
Timber plantation	Few plants (5-10) of khamar, bamboo, semialata, teak etc. on bund	Agricultural implements and fuel as well as for lac culture	1
Green fodder	Multi-cut sorghum/ maize/cowpea/ berseem/ stylo on bunds of field and pond	Green fodder to milch animals	10-15
Farm and shallow dug well /tube well	A pond of 1200-2000m ³ capacity will be constructed at suitable place to collect runoff water and inter and base flow will be collected in well or tube well to be constructed in down valley of the pond	Water harvesting and recycling for water requirement of crops and other enterprises including adomestic need of family	10-15
Cow	Breed-local/Sahiwal/ gir/ cross HF, Geen and dry fodder produced on farm will be fed. Lactation period of both the cows should be different. Cows no.may be increased from 2 nd year.	Nutritious food in food basket and regular cash earning	Area of pond bund will be utilized for construction of sheds for these structure
Goat	Breed mixed blackBanga/ Jamunapari, open grazing	Meet requirement and regular cash earning	
Poultry & duck	Local breed reared as backyard poultry	Meet and egg requirement and regular cash earning	

Apiculture	Boxes will be kept on pond bund and near animal and farm shed	Medicine and cash earning	including farm hut, animal, mushroom, shed, biogas plant and organic manure
Fish and duck	Fish and duck rearing in pond. Farm waste and cow dung including urine will be used as feed	Meet requirement and regular cash earning	
Mushroom & spawn production	Mushroom and spawn production near farm and store hut. For spawn production simple method using cooker and inoculated chamber will be used without much investment	Nutritious food and cash earning	
Lac culture	Lac culture on semialata, ber and perennial arhar grown on bunds	To earn chas	
Nadep pit & vericulture	Nadep pit and Vermi-culture near animal shed	Production of organic manure for improving soil health and substitution of chemical fertilizer	
Biogas plant	Biogas plant near animal shed and farm hut	For fuel and illumination to the farm	

Note:

1. For upland and midland situation, rice need to be taken in area by which family food requirement can be met out by adopting recommended package of practices. While in lowland situation rice should be grown by adopting recommended package of practices during kharif season.
2. Number of animals need to be more in rainfed farming system over irrigated system.
3. Reduce number of crops as per outcome during 1st year and suitability in the ecosystem.
4. Basic concept of model to meet out food requirement, regular income and employment round the year on farm to farm family.

(Source: Urkurkar *et. al.*, 2014)

Practical Manual

On

Integrated Farming System

Prepared by :

Dr. G.P. Pali

Dr. Rama Mohan Savu

Dr. Shrikant Chitale

Dr. G.S. Tomar

Dr. Ashok Pal

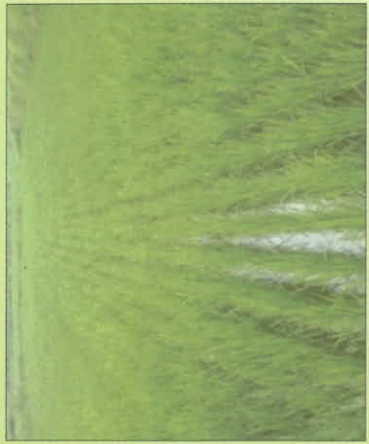


Department of Agronomy

College of Agriculture

INDIRA GANDHI KRISHI VISHWAVIDYALAYA

Raipur (Chhattisgarh) 492 012



Components of Integrated Farming System