RAMA UNIVERSITY

www.ramauniversity.ac.in

FACULTY OF AGRICULTURE SCIENCE AND ALLIED INDUSTRIES

Control of weeds, diseases and insect pest management, biological agents and pheromones, bio-pesticides

Farming system:-

A system is a group of interacting components, operating together for a common purpose, capable of reacting as a whole to external stimuli: it is unaffected directly by its own outputs and has a specified boundary based on the inclusion of all significant feedbacks. For example, the human body is a system-it has a boundary (e.g., the skin) enclosing a number of components(heart, lungs) that interact (the heart pumps blood to the lungs)for a common purpose (to maintain and operate the living body).Collection of unrelated items does not constitute a system. A bag of marbles is not a system: if a marble is added or subtracted, a bag of marbles remains and may be almost completely unaffected by the change. The marbles only behaves a whole if the whole bag is influenced, for example by dropping it, but if it bursts the constituent parts go their own ways. It is the properties of the system that chiefly matter and they may be summarized in the phrase 'behavior as a whole in response to stimuli to any part'.

Systems approach:-

In system approach all the components and activities are linked, they affect each other. It is not sensible to look at one component by itself without recognizing that what it does and what happens to it will affect other parts of the system. For example consider what happens when you stub your toe: the whole body may react and different parts may respond differently. Eyes may water, the voice may make appropriate sounds, the pulse rate may increase and hands may try to rub the damaged toe. It would be very rash to alter any component of a system without regard to the consequences and reactions elsewhere.

You cannot, for example, improve a car (system) by doing research on one wheel and then making it rather bigger than the rest. Or increase the power and size of the engine without regard to the ability of the chassis to support it. These things are common sense in such familiar contexts- they also apply to biological and agricultural systems.

In agriculture, management practices were usually formulated for individual corp. However, farmers are cultivating different crops in different seasons based on their adaptability to a particular season, domestic needs and profitability. Therefore, production technology or management practices should be developed in view all the crops grown in a year or more than one than one year if any sequence or rotation extends beyond one year. Such a package of management practices for all crops leads to efficient use of costly inputs, besides reduction in production cost. For instance, residual effect of manures and fertilizers applied and nitrogen fixed can considerably bring down the production cost if all the crops are considered than individual crops.

Farming system:-

Farming system is a complex inter-related matrix of soil, plants, animal's 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. In other words it is defined as unique and reasonably stable arrangement of farm enterprises that the household manages according to its physical, biological, economic and socio-cultural environment in accordance with the household's goals, preferences and resources. Conceptually it refers to a set of elements or components that are interrelated which interact among themselves. At the center of the interactions the farmer exercising control and choice regarding the type and result of interaction.

It is a resource management strategy to achieve economic and sustained production to meet diverse requirement of farmhouse hold while preserving resource base and maintaining a high-level of environmental quality. For example it represents integration of farm enterprises such as cropping systems, animal husbandry, fisheries, forestry, sericulture, poultry etc for optimal utilization of resources bringing prosperity to the farmer. The farm products other than the economic products, for which the crops are grown, can be better utilized for productive purposes in the farming systems approach.

Farming systems concept:-

In farming system, the farm is viewed in a holistic manner. Farming enterprises include crops, dairying, poultry, fishery, sericulture, and piggery, apiary tree 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, such that the end-products and wastes of one enterprise are utilized effectively as inputs in other enterprise. For example the wastes of dairying viz., dung, urine, refuse etc are used in preparation of FYM or compost which serves as an input in cropping system. Likewise the straw obtained from crops (maize, rice, sorghum etc) is used as a fodder for dairy cattle. Further, in sericulture the leaves of mulberry crop as a feeding material for silkworms, grain from maize crop are used as a feed in poultry etc.
Sustainability is the objective of the farming system where production process is optimized through efficient utilization of inputs without infringing on the quality of environment with which it interacts on one hand and attempt to meet the national goals on the other. The concept has an undefined time dimension. The magnitude oftime dimension depends upon ones objectives, being shorter for economic gains and longer for Concerns pertaining to environment, soil productivity and land degradation.

Methods of Cropping:-

Mono-cropping/Sole Cropping: One crop or variety is grown alone in pure stands at normal density season after season or year after year in the same field.

Multiple Cropping: Cultivation of two or more crops on the same piece of land in a year. The intensification of cropping is in terms of time and space dimensions. Multiple cropping systems can be classified as follows.

A. Sequential cropping
B. Intercropping
C. Mixed cropping

Principles of farming system:-

- Minimization of risk
- Recycling of wastes and residues
- Integration of two or more enterprises
- Optimum utilization of all resources
- Maximum productivity and profitability
- Ecological balance
- Generation of employment potential
- Increased input use efficiency
- Use of end products from one enterprise as input in other Enterprise

Characteristics of farming system:-

1. Farmer oriented & holistic approach
2. Effective farmer's participation
3. Unique problem solving system
4. Dynamic system
5. Gender sensitive
6. Responsible to society
7. Environmental sustainability
8. Location specificity of technology
9. Diversified farming enterprises to avoid risks due to Environmental constraints
10. Provides feedback from farmers

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 of vertical dimension through crops and allied enterprises.

2. **Profitability -** The system as a whole provides an opportunity to make use of produce/waste material of one enterprise as an input in another enterprise at low/no cost. Thus by reducing the cost of production the profitability and benefit cost ratio works out to be high.

3. **Potentiality –** Soil health, a key factor for sustainability is getting deteriorated and polluted due to faulty agricultural management practices viz.,excessive use of inorganic fertilizers, pesticides, herbicides, high intensity irrigation etc. In farming system, organic supplementation through effective use of manures and waste recycling is done, thus providing an opportunity to sustain potentiality of production base for much longer time.

4. **Balanced food-** In farming system, diverse enterprises are involved and they produce different sources of nutrition namely proteins, carbohydrates, fats & minerals etc form the same unit land, which helps in solving the malnutrition problem prevalent among the marginal and sub-marginal farming households.

5. **Environmental safety-** The very nature of farming system is to make use or conserve the byproduct/waste product of one component as input in another component and use of bio-control measures for pest &disease control. These eco-friendly practices bring down the application of huge quantities of fertilizers, pesticides and herbicides, which pollute the soil water and environment to an alarming level. Whereas IFS will greatly reduces environmental pollution.

6. **Income/cash flow round the year**- Unlike conventional single enterprise crop activity where the income is expected only at the time of disposal of economic produce after several months depending upon the duration of the crop, the IFS enables cash flow round the year by way of sale of products from different enterprises viz., eggs from poultry, milk from dairy, fish from fisheries, silkworm cocoons from sericulture, honey from apiculture etc. This not only enhances the purchasing power of the farmer but also provides an opportunity to invest in improved technologies for enhanced production.

7. **Saving energy**- Availability of fossil fuel has been declining at a rapid rate leading to a situation where in the whole world may suffer for want of fossil fuel by
2030 AD. In farming system, effective recycling of organic wastes to generate energy from biogas plant scan mitigates to certain extent this energy crisis.

8. **Meeting fodder crises**- In IFS every inch of land area is effectively utilized. Alley cropping or

Growing fodder legume along the border or water courses, intensification of cropping including fodder legumes in cropping systems helps to produce the required fodder and greatly relieve the problem of non availability of fodder to livestock component of the farming system.

9. **Solving timber and fuel crises**- The current production level of 20 million m3 of fuel wood and 11million m3 of timber wood is no match for the demand estimated or 360 m3 of fuel and 64,4 million m3 of timber wood in 2000 AD. Hence the current production needs to be stepped up several-fold. A forestation programmes besides introduction of agro-forestry component in farming system without detrimental effect on crop yield will greatly reduce deforestation, preserving our natural ecosystem.

10. **Employment generation**- Various farm enterprises viz., crop +livestock or any other allied enterprise in the farming system would increase labour requirement significantly and would help solve the problem of under employment. An IFS provides enough scope to employ family labour round the year.

11. **Scope for establishment of agro- industries-** When once the produce from different components in IFS is increased to a commercial level there will be surplus for value addition in the region leading to the establishment of agro-industries.

12. **Enhancement in input use efficiency** – IFS provides good scope for resource utilization indifferent components leading to greater input use efficiency and benefit- cost ratio.

Crop rotation:-

Growing of different crops alternatively on the same piece of land in a definite sequence or process of growing different crops in succession on a piece of land in a specific period of time with an objective to get maximum profit from least investment without impairing the soil fertility

Principles of Crop Rotation:-

1. The crops with tap roots should be followed by those with fibrous root system. This helps in proper and uniform use of nutrients from the soil.
2. The leguminous crops should be grown after non-leguminous crops. Legumes fix atmospheric nitrogen in the soil and add more organic matter to the soil.
3. More exhaustive crops should be followed by less exhaustive crops.
4. The crop of the same family should not be grown in succession because they act like alternate hosts for pests and diseases.
5. An ideal crop rotation is one which provides maximum employment to the family and farm labour, farm machineries and equipments are efficiently used.
6. Selection of the crop should be demand based.
7. The selection of crops should be problem based.
8. The selection of crops should suit to the farmer's financial conditions.
9. The crops selected should also suit to the soil and climate conditions.

Benefits of Crop Rotation:-

1. Beneficial to succeeding crops.
2. Soil fertility is restored by fixing atmospheric nitrogen.
3. Encourages soil microbial activity.
4. Improves physico-chemical properties of the soil.
5. Avoids accumulation of toxins (HCN etc.).

6. Soil is protected from erosion.
7. Controls pests and diseases.
8. Controls weeds in the fields.
9. The family and farm labour, power, equipment and machineries are well employed.
10. Differential extraction of nutrients and moisture from different depths.
11. Proper utilization of all the resources and inputs.

Limitations of Crop Rotation:-

1. Specialization in one crop is not possible.
2. Requirement of equipments and machineries varies from crop to crop.
3. Allopathic effect of preceding crop.
4. Serves as alternate hosts for pests and diseases.

Multiple and relay cropping system:-

Relay cropping:-

In Relay cropping second crop is planted even before the first crop is harvested. Thus, both crops share some part of the season. In India, Rice –cauliflower – onion-summer gourd is one example of relay cropping.

Relay cropping is essentially a special version of double cropping, where the second crop is planted into the first crop before harvest, rather than waiting until after harvest as in true double-cropping. In this way, both crops share a portion of the growing season, increasing solar radiation and heat available to each

Advantages:-

- Less risk since yields do not depend on one crop alone.
- Better distribution of labor.
- Some diseases and insects appear to spread less rapidly under intercropping.
- Better erosion control due to better ground cover.
- Any legumes involved may add some nitrogen to the soil.

Disadvantages:-

- Mechanization is difficult.
- Management requirements are higher.
- Overall costs per unit of production may be higher due to reduced efficiency in planting, weeding and harvesting

Multiple cropping systems:-

Cultivation of two or more crops on the same piece of land in a year. The intensification of cropping is in terms of time and space dimensions.

Multiple cropping systems can be classified as follows.

A. Sequential cropping
B. Intercropping
C. Mixed cropping

A. **Sequential Cropping:** Growing of two or more crops in sequence on the same piece of land in the same year. The succeeding crop is planted or sown only after harvest of the preceding crop. The crop intensification is only in terms of time dimension. Farmers will manage only one crop at a time.

Types of Sequential Cropping:-

1. Double Cropping: Cultivation of two crops in succession on a piece of land in a year.

2. Triple Cropping: Cultivation of three crops in succession on a piece of land in a year.

3. Quadruple Cropping: Cultivation of four crops in succession on a piece of land in a year.

4. Ratoon Cropping/Ratooning: Cultivation of crop re-growth after its harvest is rationing. It is also a type of sequential cropping. In this, more than one harvest is done from one sowing/planting. Thus, ratooning consists of allowing stubbles of the original crop after harvesting and to raise another crop.

B. **Intercropping**: Growing two or more crops simultaneously on the same piece of land. Crop intensification is in terms of both time and space dimensions.

C. Mixed Cropping:-

Growing of two or more crops together on the same piece of land is called as mixed cropping. In this, the seeds of different crops are mixed together and then sown either in lines or they are board casted. This system is not scientific and it causes problem in performing all agricultural operations and harvesting of crops. This system of cropping is generally practiced in areas where climatic hazards such as flood, drought, frost etc. are frequent and common. The farmers always fear that their crops will fail. The time of sowing of all the crops is same; however they may mature either together or at different times

Intercropping in relation to maintenance of soil productivity:-

Intercropping: Growing two or more crops simultaneously on the same piece of land. Crop intensification is in terms of both time and space dimensions.

Main Crop/Base Crop: It is one which is planted at its optimum population in an intercrop situation and the second crop is planted in between the rows of main or base crop, with a view to obtain some extra inter crop yield without sacrificing the main or base crop yield.

Intercrop: The short duration crop is raised in widely spaced crop for getting an additional income from the same piece of land.

Component Crop: It is used to refer either of the individual crops making the intercropping situation.

Benefits of Intercropping:-

1. Better utilization growth resources like light, nutrients and moisture.
2. Economy in space and time.
3. Suppression of weeds.
4. Serves as insurance against failure of any one of the component crops.
5. Reduces soil crust formation.
6. Improves soil fertility

7. Ecological stability.
8. Controlling of soil erosion.
9. Serves as physical support or shading to some crops.
10. Additional yield from unit area.
11. Additional income.
12. Provides farmer's daily needs.
13. Provides employment and distribution of labour.
14. Cultivation practices for main crop supplement the requirement of companion crop.
15. Control of pests and diseases.

Limitations of Intercropping:-

1. Labour intensive.
2. Differential maturity and problem of harvesting.
3. Serves as alternate hosts for pests and diseases.
4. Control of pests, diseases and weeds is difficult.
5. Problem for intercultural operations.
6. Mechanization is difficult.
7. Competitive effects among component crops.
8. Allelopathic effect.

Criteria for Selection of Crops for Intercropping System:-

Care should be taken to select the crops with different growth habits, root growth, duration and families. The following points to be considered while selecting crops for intercropping system.

1. Tall growing crops with short growing crops.
2. Bushy crops with erect growing crops.
3. Fast growing crops with slow growing crops.
4. Deep rooted crops with shallow rooted crops.
5. Short duration crops with long duration crops.
6. Legume crops with non-legume crops.
7. Crops should have least allelopathic effect.
8. Crops selected should be of different families to avoid pests and diseases.

Types of Intercropping:-

1. Mixed Intercropping/Mixed Cropping: Growing of two or more crops simultaneously on the same piece of land with no distinct row arrangement.
2. Row Intercropping: Growing of two or more crops simultaneously on the same piece of land with distinct row arrangement. It is simply referred as 'intercropping'.
3. Patch Intercropping: Growing of two or more crops simultaneously on the same piece of land in patches
4. Strip Intercropping: Growing of two or more crops simultaneously on the same piece of land in strips wide enough to permit independent cultivation.
5. Relay Intercropping/Relay Cropping: Growing of two or more crops simultaneously on the same piece of land during the part of life cycle of each. The second crop is planted after the first crop has reached its reproductive stage of growth but before it is ready for harvest.
6. Parallel Intercropping/Parallel Cropping: Growing of two or more crops which have different growth habits and which have a zero competition between each other and both of them express their full yield potential.
7. Multi Storied Intercropping/Multi Storied Cropping: Growing of two or more crops of different heights on the same field at the same time. It is commonly practiced in orchard and plantation crops.

Error! No text of specified style in document.