Inter Cultural Operations: Crop planning, crop rotation and diversification
Training on Intercultural operation, Crop planning & Diversification

Learning methods: Group discussion and field experimentation

Materials required: Marker pen, flip chart, note books, pen

Time allocation: 360 minutes

Session plan

<table>
<thead>
<tr>
<th>Day</th>
<th>Topic</th>
<th>Duration</th>
<th>Methodology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day - IX</td>
<td>Weeding and intercultural operations</td>
<td>90 minutes</td>
<td>Power point presentation</td>
</tr>
<tr>
<td>Day - IX</td>
<td>Understanding crop planning Types of Cropping Systems in Odisha</td>
<td>90 minutes</td>
<td>Power point presentation &amp; group discussion</td>
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<tr>
<td>Day - IX</td>
<td>Agricultural crop diversification</td>
<td>90 minutes</td>
<td>Power point presentation</td>
</tr>
<tr>
<td>Day - IX</td>
<td>Threat &amp; opportunity for crop diversification</td>
<td>90 minutes</td>
<td>Power point presentation</td>
</tr>
</tbody>
</table>

Introduction

Weed Control

The field should be kept weed-free, especially in the initial stage of plant growth, as weeds compete with the crop and reduce the yield drastically. Being closely planted and a shallow rooted crop, hand weeding particularly when crop is in full vegetative stage, is difficult and expensive. It is recommended to use weedicide along with one hand weeding at critical stage. Application of Fluchloralin or Oxyfluorfen @ 15ml/10 litres of water 3 days after transplanting followed by one hand weeding 45 days after transplanting effectively controls the weed population. Alternatively, application of
Pendimethalin (3.5 litres/ha) immediately after transplanting and before the first irrigation coupled with one hand weeding gives the best results

**Weeding and intercultural operations**

- Initial flush of weeds must be controlled effectively so as to ensure a weed free environment to young plants.
- The weeding and hoeing cycles should be so arranged as to keep the field free from weeds.
- The prescribed schedule of all inter-cultural operations such as weeding, hoeing, topping, nipping of buds, pruning, shading and earthing up etc., must be adhered to in a manner to optimize the overall productivity.
- Use of herbicides should be avoided as far as possible. In case of their inevitable usage, available evidence of safety to the target crop should be considered adequately.

**Crop protection**

- Comprehensive preventive and control measures enumerated in the agronomic protocol should be used for disease, insect and pest management to minimize loss of the final crop and its quality.
- In general crop protection plans should be limited to the use of bio-control agents and bio-pesticides.
- Under compulsive circumstances care should be taken to use smallest effective dosage of pesticides on the basis of crop protection protocols prescribed for the target species.
- When chemical pesticides are used for crop protection, residue analysis should be carried out through appropriate testing agencies following standard procedures.

**Intercultural Operation Equipment**

**Intercultural equipments**

All the lighter and finer operations carried out on the soil, between sowing had harvesting are termed as intercultural operations. They include weeding, fertilizer
application, mulching, etc.

The machineries and implements used for this purpose are called as inter cultural equipments.

**Weeders**

**(i) Hand Hoe**

- This is the weeding tool used widely in most of the farms to carry out the weeding operation and also as harvesting tool to bring the produce from inside the root zone.
- This tool has a short handle made of country wood and a small shovel attached at its end.
- The width of cut is not a standard one and depends on the village artisan who makes it and the demand of the farmer who uses it.

**(ii) Long Handled Weeder**

The drudgery to the human is more and the working efficiency is low with the hand held hoes, which makes the operator to bend / sit down work on the soil.

To reduce this problem, long handled weeders were developed. Some of the long handled weeders are long handled hoe, paddy weeder, star type and peg type dry land weeders.

**A) Long handled hoe**

This tool has a long bamboo / wooden stick of about 1.2 m length. At the end a double end shovel is fixed rigidly, with different cutting widths. Weeding can be done easily by using this tool.
B) Paddy weeder

Paddy weeder does the weeding operation when the seedlings are transplanted in rows. The implement has an inclined long handle. At the foot of it two conical cylinders with serrated lugs on its periphery are fixed. These two conical serrated cylinders can rotate freely about it axis and placed in opposite sides. A steel plate has been into the loose soil and assists in easy operations. In operation, the serrated lugs cut and bury the weeds and some of the weeds are wound on the surface of the cylinders, which can be removed manually.

C) Dry land/garden land weeder

This can be classified into star type and peg type depending upon the shape of the roller attached at the foot of the long handle, to facilitate easy movement of the weeder and to have sufficient grip on the soil. The star type is suitable for clay loam and black cotton soils. The cutting blade is fixed on vertical and positioned appropriately depending upon the height of the operator. The weeding operation is done by smooth and short reciprocating motion. The peg tooth of the peg type permits the movement of roller without clogging due to reduced contact area.

III) Sweep

The sweep consists of ‘V’ shaped shovels with bevel edged wings. Shovels are held by tynes fixed to a frame work by means of clamps. By just skimming under the soil at a shallow depth of 2 to 3 cm, the sweep break the continuity of proper and provides a good soil mulch.

- During intercultural operation, the spacing can be adjusted to cut the row spacing.
  If necessary, half sweep can be used.
- The sweep consists of ‘V’ shaped shovels with bevel edged wings. The shovels are held by the tynes fixed to a frame work by means of countersunk bolts nuts.
- When the sweep is used for secondary tillage, five or six tynes may be clamped with the shovels in at line having no gap in between them.
- By just skimming under the soil at a shallow depth of 2 to 3 cm, the sweep breaks the capillarity in the soil pores and provides soil mulch.
- When the sweep is used for intercultural operations, the space between the shovels is adjusted to suit the row spacing of the crop and with different sizes of blades.

**Crop planning**

In organic crop planning and production farmers must recognize that the whole environment in which plants grow is much more than the sum of its individual parts, and that all living things are inter-related and inter-dependent.

Specifically, an organic farmer must understand crop production through the following guidelines:

- Treating the soil and growing environment as a resource to be husbanded for future generations, rather than mined for short term gain.

- Providing plants with a balanced food supply by feeding the many soil living creatures that live with composts, manures and other organic materials.

- Choosing renewable resources, thereby creating a sustainable future.

- Reducing pollution of the environment, by recycling farm and other wastes, rather than dumping or burning them.

- Combating pests and diseases without using pesticides that may prove harmful to human health and that of domestic and wild animals and vegetation.

- Encouraging and protecting wildlife, by creating suitable habitats and by minimizing use of harmful pesticides.

- Creating a safe and pleasant environment in which to work and play.
• Moving with the times — taking new scientific discoveries and ideas into account, as well as the best traditional knowledge.

• Recognizing the importance of genetic diversity and hence the preservation of threatened plant varieties.

**Types of Cropping Systems**

There are a variety of cropping systems that a farmer can choose in his or her crop production plan. The main factor to remember when choosing the right cropping systems for your farm is to keep it diverse. It is important to implement a variety of different cropping systems into your plan that promote many ecologically environments. For many small farmers this is key when choosing to grow and sell organic crops. Here are major cropping systems you will need to think about when constructing your crop production plan:

**Intercropping system** (companion planting): Planting two or more crops together in a single field. Strip intercropping system: Planting a single crop in one row and then a different crop in the next row or strip. Hedgerows/ Buffer Vegetation system: Planting trees or shrubs around the perimeter of fields, along pathways of a farm, or to mark boundaries. They can provide protection from the wind, can produce an array of tree products, and serve as habitat for birds and other wildlife

**Cover cropping system**: Planting a crop species from which you do not intend to harvest a commodity in order to cover the fields in between cropping cycles and to provide soil cover. Cover crops enhance soil organic matter, stimulate soil biological activity and diversity of the soil organisms, trap nutrients in the soil, reduce soil erosion, increase soil nitrogen, and provide an alternate host for beneficial insects. Popular cover crops include a number of annual legumes and cereal crops.

**Rotation systems**: Planting different crops one season after another or in “succession” in a particular field year after year. As crops grow they introduce chemicals into the soil that can either produce a positive or negative effect on the crops that are grown in the same spot next season. Therefore, knowing which crops to grow in rotational cycles can help guard against pest, disease and even common weed problems. Crop rotation can also improve soil fertility, reduce soil erosion and maintain soil organic matter. A
common crop rotation is beans one year and corn the following year. The corn takes advantage of the additional nitrogen in the soil after the bean crop.

**Fallow cropping system:** Land is fallow when the soil is kept bare for a period, and not even weeds are allowed to grow; can be done with herbicides, or via frequent cultivation.

**Reduced or Minimum tillage system:** Reducing the intensity of soil cultivation and leaving residues on the surface with little disturbance to the soil. This system can increase earthworm abundance and activity, organic matter, nutrient holding capacity and cycling, and improve soil structure.

High Organic Matter Input system: Introducing composts, incorporating crop residues into the soil, cover cropping, diversifying crops, biofertilizers, etc.

**Integration of Livestock and pollinators systems:** Integrating animals and bees into the production field. Grazing, trampling, scratching, and manure deposits from pigs, chickens, sheep, goats and cattle can alter aspects of the soil structure and fertility. Bee pollination can also help increase seed production and overall crop yields.

**Crop Rotation**

Crop rotation is a cropping system method that is based on alternating crop families grown in a given field from one growing season to the next. This is done because the alternating crops take different nutrients from the soil, or because one crop might restore particular nutrients that the other one takes away. Crop rotation can also interrupt the life cycles of pests or plant diseases that prey on a particular crop. The following is a common 3-year rotation cycle of (1) a leafy crop (2) a root crop to increase aeration of the soil (3) and a nitrogen fixing legume to improve soil fertility

**Agricultural crop diversification**

In the agricultural context, diversification can be regarded as the re-allocation of some of a farm’s productive resources, such as land, capital, farm equipment and paid labour, into new activities. These can be new crops or livestock products, value-adding activities, provision of services to other farmers and, particularly in richer countries, non-farming activities such as restaurants and shops. Factors leading to
decisions to diversify are many, but include; reducing risk, responding to changing consumer demands or changing government policy, responding to external shocks and, more recently, as a consequence of climate change.

Opportunities

- Changing consumer demand. As consumers in developing countries become richer, food consumption patterns change noticeably. People move away from a diet based on staples to one with a greater content of animal products (meat, eggs, and dairy) and fruits and vegetables. In turn, more dynamic farmers are able to diversify to meet these needs.

- Changing demographics. Rapid urbanization in developing countries has an impact on consumption patterns. Moreover, a smaller number of farmers, in percentage terms at least, have to supply a larger number of consumers. While this may not imply diversification it does require adaptation to new farming techniques to meet higher demand.

- Export potential. Developing country farmers have had considerable success by diversifying into crops that can meet export market demand. While concern about food miles, as well as the cost of complying with supermarket certification requirements such as for GlobalGAP may jeopardize this success in the long run, there remains much potential to diversify to meet export markets.

- Adding value. The pattern witnessed in the West, and now becoming widespread in developing countries, is for consumers to devote less and less time to food preparation. They increasingly require ready-prepared meals and labour-saving packaging, such as pre-cut salads. This provides the opportunity for farmers to diversify into value addition, particularly in countries where supermarkets play a major role in retailing.

- Changing marketing opportunities. The changing of government policies that control the way in which farmers can link to markets can open up new diversification possibilities. For example, in India, policy changes to remove the monopoly of state “regulated markets” to handle all transactions made it possible for farmers to establish direct contracts with buyers for new products.
• Improving nutrition. Diversifying from the monoculture of traditional staples can have important nutritional benefits for farmers in developing countries.

**Threats**

• Urbanization. This is both an opportunity and a threat, in that the expansion of cities places pressure on land resources and puts up the value of the land. If farmers are to remain on the land they need to generate greater income from that land than they could by growing basic staples. This fact, and the proximity of markets, explains why farmers close to urban areas tend to diversify into high-value crops.

• Risk. Farmers face risk from bad weather and from fluctuating prices. Diversification is a logical response to both. For example, some crops are more drought-resistant than others, but may offer poorer economic returns. A diversified portfolio of products should ensure that farmers do not suffer complete ruin when the weather is bad. Similarly, diversification can manage price risk, on the assumption that not all products will suffer low prices at the same time. In fact, farmers often do the opposite of diversification by planting products that have a high price in one year, only to see the price collapse in the next, as explained by the cobweb theory.

• External threats. Farmers who are dependent on exports run the risk that conditions will change in their markets, not because of a change in consumer demand but because of policy changes. A classic example is the Caribbean banana industry, which collapsed as a result of the removal of quota protection on EU markets, necessitating diversification by the region’s farmers.

• Domestic policy threats. Agricultural production is sometimes undertaken as a consequence of government subsidies, rather than because it is inherently profitable. The reduction or removal of those subsidies, whether direct or indirect, can have a major impact on farmers and provide a significant incentive for diversification or, in some cases, for returning to production of crops grown prior to the introduction of subsidies.

• Climate change. The type of crop that can be grown is affected by changes in temperatures and the length of the growing season. Climate change could also modify the availability of water for production. Farmers in several countries, including Canada, India, Kenya, Mozambique, and Sri Lanka have already initiated
diversification as a response to climate change. Government policy in Kenya to promote crop diversification has included the removal of subsidies for some crops, encouraging land-use zoning and introducing differential land tax systems.

**Opportunities for diversification**

In making decisions about diversification farmers need to consider whether income generated by new farm enterprises will be greater than the existing activities, with similar or less risk. While growing new crops or raising animals may be technically possible, these may not be suitable for many farmers in terms of their land, labour and capital resources. Moreover, markets for the products may be lacking. We can promote diversification by small farmers through beekeeping, mushroom farming, milk production, fish ponds and sheep and goats, among others, as diversification possibilities.