

Crop Rotation Planning in Organic Agriculture

Kawade. A. A.¹, Panchal. V. V.¹ and Patil R. L.²

¹Assistant Professor, Shri Vaishnav Institute of Agriculture, Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore (M.P.)

²Assistant Professor, Government College of Agri-business Management, Kashti Malegaon, Dist. Nashik (M.S.)

SUMMARY

In many traditional agricultural systems a diversity of crops in time or space can be found. Knowing that different plants have different requirements for nutrients, a good crop planning and management is required to optimise the use of nutrient in the soil. Crop rotation, intercropping, cover crops and green manures represent the main alternatives to the farmers to manage soil health and fertility.

INTRODUCTION

With insufficient agricultural supplies, meeting the population's ever-increasing food demand is a tremendous challenge on a national and global scale. Due to increased food demand and lower crop yields as a result of population growth, the agricultural sector is critical in resolving the productivity crisis. In terms of agricultural efficiency, soil texture or fertility is critical to maintaining a healthy environment. In future, rising food demand and a scarcity of agricultural land will necessitate greater crop yield and soil productivity. In recent years, experts have become increasingly concerned about soil depletion caused by intensive farming. Since the 1950s, almost 60% of soil depletion has been attributed to various degrees of soil ecological processes, with farming practices becoming one of the major contributors. One of the approaches of sustainable farm management is aimed at growing soil organic matter and reducing soil erosion by crop rotation. Crop rotation disrupts insect and pathogen reproduction and hence their life cycle. Plant nutrients are restored when certain plant species are included in crop rotation, requiring less chemical fertilizer. Crop rotation is a useful technique in the practice of sustainable agriculture. In contrast to monocultures or double farmed rotations, diversified crop rotations (DCR) refer to a set or multiple rotations of three or more crops. Carefully selecting a crop rotation scheme has the potential to reduce trade-offs between crop viability and environmental impacts, maintain long-term soil fertility, and disrupt the weed and disease cycle process through intrinsic nutrient recycling. Diverse cropping systems are also used as a promising option for more productive agriculture and this diversified crop rotation method offers many benefits for soil quality by strengthening soil conditions and increasing system production around the world. The DCR helps in soil erosion management and crop production enhancement and significantly improves the soil properties and uses water and nutrients in the soil profile to sustain productivity.

Crop Rotation

Crop rotation is the practice of growing a series of different types of crops in the same area across a sequence of growing seasons. It reduces reliance on one set of nutrients, pest and weed pressure, and the probability of developing resistant pests and weeds. Growing the same crop in the same place for many years in a row, known as monocropping, gradually depletes the soil of certain nutrients and selects for a highly competitive pest and weed community. Without balancing nutrient use and diversifying pest and weed communities, the productivity of monocultures is highly dependent on external inputs. Conversely, a well-designed crop rotation can reduce the need for synthetic fertilizers and herbicides by better using ecosystem services from a diverse set of crops.

Advantages of Crop Rotation

It improves soil structure: some crops have strong, deep roots. They can break up hardpans and tap moisture and nutrients from deep in the soil. Others have many fine, shallow roots. They tap nutrients near the surface and bind the soil. They form many tiny holes so that air and water can get into the soil.

It increases soil fertility: legumes (such as groundnuts and beans) fix nitrogen in the soil. When their green parts and roots rot, this nitrogen can be used by other crops such as maize. The result is higher, more stable yields, without the need to apply expensive inorganic fertilizer.

It helps control weeds, pests and diseases: planting the same crop season after season encourages certain weeds, insects and diseases. Planting different crops breaks their life cycle and prevents them from multiplying.

It produces different types of output: growing a mix of grain, beans, vegetables and fodder means a more varied diet and more types of produce to sell. In some ways, crop rotation takes the place of ploughing the soil: it helps aerate the soil, recycles nutrients, and helps control weeds, pests and diseases. Intercropping, strip cropping and relay cropping bring many of the same advantages as rotation.

Criteria for Crop Rotation

Questions to ask before crop selection

What to produce?

Crops produce many different things such as food, fodder, firewood, fence poles, thatch and medicines. Farmers grow some crops (such as cotton) only for cash. For other crops, such as cereals or vegetables, you may be able to sell what you do not use yourself. If your objective is marketing, make sure that there is a market of your main output or rotation crop.

Will it grow well?

This depends on many factors such as the amount of rain or moisture in the soil, the season (some crops and varieties do not grow well at certain times of year), the soil fertility, among others.

What are the roots like?

Tall cereals (millet, maize, sorghum), finger millets and some legumes (e.g., pigeonpea and sunn hemp) have strong roots that penetrate deep into the soil-up to 1.2 m for tall cereals. Their roots improve the soil structure and porosity, so are a good choice if the soil is compacted.

Does it improve soil fertility?

Legumes improve soil fertility by fixing nitrogen from the air. They use part of it for their own needs and leave the rest in the soil. Cereals and other plants can use this nitrogen if they are intercropped with the legume, or if they are grown as the next crop in the rotation.

Does it cover the soil well?

Tall cereals do not cover the soil well because they have upright leaves and they are planted far apart. Short grasses and many legumes (lablab, groundnut, cowpea, beans) cover the ground very quickly after they are planted. When their main use is indeed to provide cover, we call them cover crops. If their main use is to provide food, we call them food legumes (beans, groundnuts).

Does it work with other crops?

Try to find combinations of crops that complement each other well. For example, cereals grow well with legume: the cereals benefit from the nitrogen fixed by the legume. Two different legumes or two different cereals do not usually work well together. It may be more difficult to find the right combination of crops for your situation. You and your neighbours can try out new combinations to see which ones work. Or you can check with extension workers, researchers or farmers in other villages to see what they suggest.

Choosing the right varieties

Farmers all know that not all sorghum are the same. Some varieties grow quickly and produce a yield in a short time. Others take longer until harvest. Some are taller than others or produce more leaves. Some demand more or less nutrients, some are more tolerant to drought or Striga. The same is true for other crops. Choose a variety that has the characteristics you want. Make sure you get the right seed. If you find a variety that you like, consider producing your own seed to sow in the future.

Choosing a crop rotation

What crops should you plant next year, and the year after that? That depends on many factors. Knowing the family where your crops belong to helps you to decide what to plant in the next cropping season, by planting a crop that belongs to a different family to the previous one. Also, make a list of the crops you want to grow, considering the subsequent recommendations.

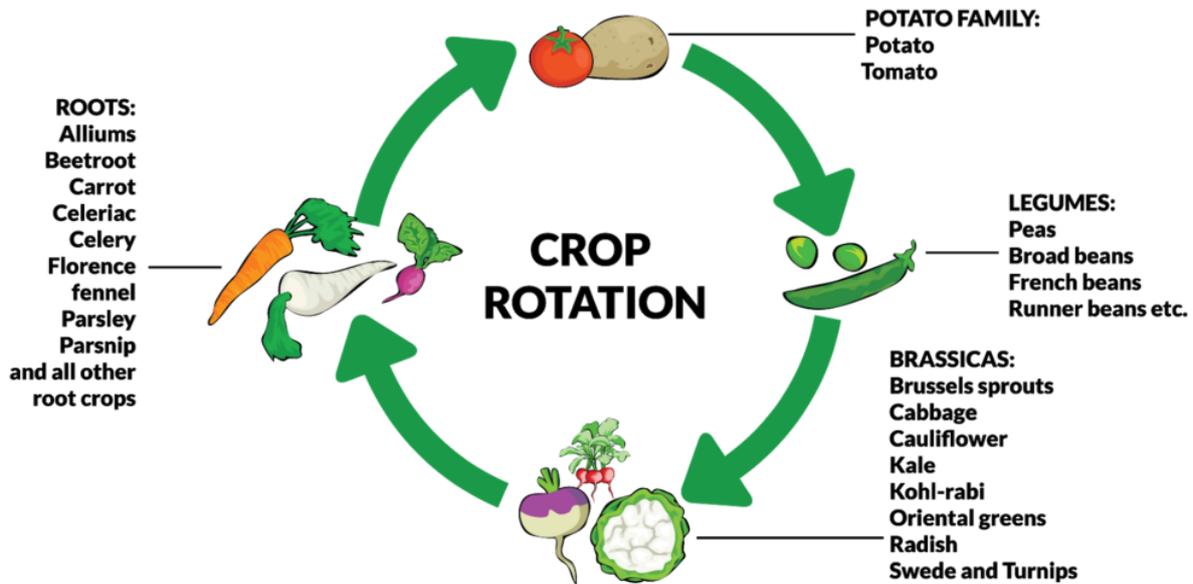


Figure no 1: Systematic representation of crop rotation.

General Recommendations

- Never grow same crop in single rotation.
- Avoid the crop combination in rotation with same host for various diseases and pest.
- If your objective is marketing, ensure that there is a market for your main output and rotation crops.
- In addition, it is important to check the source of seeds and the price of the output before you decide which crops to plant.
- Grow tomatoes after peas, lettuce, or spinach, because tomatoes need a considerable amount of nutrients.
- Grow lettuce before potatoes, because it is a light feeder and an above ground crop.
- Grow legume cover crops before potatoes or corn, so that they can feed the crops.
- Avoid growing potatoes before corn, because both are heavy feeders.
- Be cautious when growing bell pepper before another vegetable crop, because of diseases.
- Avoid planting potatoes after corn, because of wireworm problems.
- Grow beans after corn to rebuild nitrogen.
- Avoid growing legumes before small grains to prevent lodging.
- Use a summer fallow after onions, in order to break weed cycle.
- Grow a root crop like beets after lettuce or cabbage.

CONCLUSION

There are numerous factors that must be taken into consideration when planning a crop rotation. Planning an effective rotation requires weighing fixed and fluctuating production circumstances: market, farm size, labor supply, climate, soil type, growing practices, etc. There is no limit to the number of crops that can be used in a rotation, or the amount of time a rotation takes to complete. Crop rotation helps to maintain the organic matter content and fertility of soil. Availability of abundance organic matter in soil help for less dependence on external nutrient source thus, keeping the agricultural land organic and safe.

REFERENCES

- Sharma, A. K., A Handbook of organic farming. Dr. Updesh Purohit for Agrobios, Jodhpur. India. 2018.
- D. G. Bullock. 1992. "Crop rotation," *Critical Reviews in Plant Sciences*. 11(04): 309–326.
- D. Tanaka, A. Bauer, and A. Black, "Annual legume cover crops in spring wheat-fallow systems," *Journal of Production Agriculture*, vol. 10, pp. 251–255, 1997.