



Intercropping: A Strategy for Enhancing Food Security

(*Manisha, Bas Kaur, Sahil Boora and Shikha Bhukal)

Chaudhary Charan Singh Haryana Agricultural University, Hisar, Haryana

*Corresponding Author's email: mnishakadian@gmail.com

An economically viable agriculture production system demands a supply of sufficient quantity of inputs. The success of green revolution (GR) in the second half of the previous century greatly focused on the supply of essential inputs and so green revolution technologies (GRTs) were more commonly known as supply-driven technologies. As per the concepts of GRTs, important inputs used in agriculture are high-yielding varieties (HYVs), fossil fuel-based high-energy chemical fertilizers, assured irrigation, use of sufficient plant protection chemicals and so on and interestingly all these inputs need high energy. On the other hand, intercropping systems need comparatively fewer energy inputs like fertilizer, plant protection chemical requirements are less, and diversification of crops is greater creating functional diversity resulting in less pest-disease incidence. Moreover, there is the creation of soothing microclimate with less evaporation. Combination of deep-rooted and shallow-rooted crops create the options of bio-irrigation and after all, legume crops in association with non-legumes favour adjustments of nutrients by benefitting non-legumes in the form of nitrogen fixation. The legumes, furthermore, create a congenial environment for harbouring different beneficial microorganisms favouring higher ecosystem services. The cumulative impacts of all factors are reflected in the intercropping system and thus the intercropping system can be considered as a low input agriculture practice with higher output in terms of higher farm output and agricultural sustainability.

Concept and Goal of Intercropping

Cultivation of two or more crop species concurrently as they coexist for a significant part of the crop cycle is known as intercropping and it is also sometimes termed as polyculture or mixed cropping. The component crops are neither seeded at the same time nor harvested, but they remain simultaneously in the field for a major portion of the growth periods of component crops. Intercropping is, in general, comprised of the main crop and one or more companion crops, where the production of the main crop is the prime goal. Intercropping is actually the value addition of the cropping system which can ensure higher productivity, efficient use of resources, and more income.

In intercropping, basic ecological principles are observed in the form of above and belowground diversity, competition, and facilitation, for production of crops. Generally, if the polyculture system of crops is chosen with proper prerequisites, the yield output appears higher than pure stands of individual crops. Moreover, in the intercropping system, different resources are better used by crops from a common pool compared to pure stands of the respective crops which result in greater productivity. An intercropping system assures more coverage of the ground area by the canopy of crops, more transpiration takes place by the foliage which may create a cooler microclimate, and this facilitates the ability to minimize the soil temperature. Under moisture stress conditions, in intercropping systems, crops use available water in the form of soil moisture and this microclimate provides a soothing effect

at the canopy level of crops. Generally, in intercropping, morphologically dissimilar crops are chosen with different growth habits, so available resources are efficiently utilized and the ultimate gain is the conversion into the crop dry-matter production or crop yield. Different factors like choice of crops and cultivars, sown proportions and agronomic management including water and nutrients and the competitive ability of crops can affect the performance as well as the success of intercropping systems.

Types of Intercropping

Intercropping is the raising of two or more crops together as they coexist for some time on the same land. The spatial and temporal crop intensification is done in intercropping and it may be of different combinations of annual and perennial crops as per the choice of the farmers and suitability to the growing conditions. Furthermore, in intercropping, competition is noted among the component species grown during the entire crop period or a part of growing duration for available resources. Different types of intercropping systems are adopted in various countries which can be grouped into the following.

- **Row Intercropping:** The row intercropping is raising of one or more crops sown in regular rows, and growing intercrops in a row or without row at the same time. The row intercropping is a usual practice targeting maximum and judicious use of resources and optimization of productivity.
- **Mixed Intercropping:** In mixed intercropping, two or more crops are grown together without any definite row proportion. Sometimes it is also referred to as mixed cropping. In pasture-based cropping system, grass-legume intercropping is an ideal example of mixed intercropping. The mixed intercropping is commonly observed to fulfil the requirement of food and forage where the land resource is a limiting factor. Furthermore, a review work clearly described perennial polycultures as an agro ecological strategy in cropping system with enough potential for the sustainable intensification of agricultural systems spatially and temporally.
- **Strip-Intercropping:** The strip-intercropping is a type of intercropping where two or more crops are cultivated together in strips on sloppy lands. Strip intercropping is known to enhance greater radiation use efficiency in marginal and poor lands. A combination of soil conserving and depleting crops are taken in alternate strips running perpendicular to the slope of the land or the direction of prevailing winds. An important objective of strip cropping is the reduction of soil erosion and harvesting of yield output from poor lands.
- **Relay Intercropping:** Relay intercropping is raising two or more crops at a time during a portion of the growing period of each. In this system, the second crop is seeded when the first crop completes a major part of its life cycle and reaches reproductive stage or close to maturity but before harvest. The areas with limitation of time and soil moisture are more appropriate for relay cropping. Before harvesting of the preceding crop, the next crop is sown and both the crops remain in the field for some period of their cycle. However, the succeeding crop yields less compared to normal sowing in sequential cropping and more seeds of the succeeding crop are required to obtain a good stand.

Intercropping Benefits

Intercropping is highly beneficial not only to the crop growers but also to everybody in the community. It possesses economic, ecological, health, and other benefits. The following are the general intercropping benefits:

- ✓ **Proper management of land:** Planting many crops in rows and strips helps to manage and use the land effectively. Many crops are planted on just a piece of land. If not for intercropping, the crop grower will need to get two or more lands if he wants to plant more crops at the same time. And the land is a scarce resource that is not easily acquired, especially in the industrialized world.

- ✓ **More profit:** Planting two or more crops together in a row helps to lessen the cost of production. The crop grower uses just a piece of land, the money spent on pesticides and herbicides is also reduced, the crops have more chances to grow well and other resources such as water are also used efficiently. Cumulatively, all these will increase the profit that would be made. Increased profit. They also give protection to cash crops, such as Trap intercropping. This protection will increase the yield of growers by reducing the loss incurred. And this will increase their profit.
- ✓ **Prevention of soil erosion and wind:** Planting crops between rows, bushes and alleys make the crop's root firm. Alley intercropping specifically provides shade to crops, and protection against winds, protection against excessive sunlight, and other adverse weather conditions. Trapping crops also attract useful pests. Trapping crops may also serve as protection to the real crops against wind, erosion, and excessive sunlight.
- ✓ **Improved ecosystem:** Planting crops generally improves the ecosystem and makes the environment safe. Humans need oxygen for respiration. And plants release oxygen to the environment as by-products. Intercropping allows the planting of many more crops than mono-cropping does.
- ✓ **Decreased usage of inorganic substances:** Intercropping provides a natural solution to many planting problems. Problems such as pest invasion, and infertility of land are being solved through this method. Planting different crops in rows and stripes makes the land more fertile. For example, if legumes are planted with cereals, the legume releases Nitrogen into the cereal and the land. The nitrogen released helps to improve the fertility of the soil. It also helps to control weeds and pests. Therefore, the application of this method to farm spares the use of pesticides, herbicides, and fertilizers on the land.
- ✓ **Improved health of consumers:** Some inorganic substances used to control pests and weeds may leave remnants of the crops. These remnants may be toxic when consumed by humans. Since intercropping reduces the usage of inorganic substances in the crops, it is also improving the health of consumers of food products.
- ✓ **Management of other natural resources:** Natural resources like water, air, and energy are used effectively with this system. The energy used by humans to plow, plant, and harvest is also a resource. Intercropping helps to save the energy of not only humans but also machines used.

Intercropping Disadvantages

Although, intercropping is very beneficial to agriculture. It still has some drawbacks. Some of the disadvantages of intercropping are.

- ❖ **Makes cultivation and harvesting difficult:** It takes a lot of effort to make the rows and stripes arrangement. The planter must be careful not to disarrange those rows while planting. Also, harvesting brings about some difficulties. The crops may be destroyed if care is not taken.
- ❖ **Inadequate planning and practices may incur a huge loss on the farmer:** Intercropping is delicate and it requires proper and thorough planning for it to be successful. Inadequate planning may cause the crops not to grow or make them die as a result of inadequate nutrients. And this will incur a huge loss on the crop grower.
- ❖ **Consumes more time:** Making rows, strips and even planting between trees is time-consuming. It takes a lot of time to cultivate and harvest.
- ❖ **Difficult to practice on a large scale:** intercropping is more difficult to practice on large-scale farming. It is easier to practice on a small piece of land than to practice on a large piece of land.

Conclusion

Food and environmental security as well as enhancement of input use efficiency are global concerns in agriculture. Both the developed and developing nations are in a quest for a low carbon footprint in agriculture and thus there is an urgent need for a reduction of high energy chemical fertilizers, plant protection chemicals and energy use in farm mechanization. Furthermore, intensive agriculture caused a gradual degradation of natural resources and the enhancement of farm productivity is a tough job for all targeting future demand. Intensification of crops can be undertaken spatially and temporally by the adoption of the intercropping system. Intercropping ensures multiple benefits like enhancement of yield, environmental security, income as well as production sustainability and some ecosystem services. intercropping is a very important concept in agriculture. It provides a natural solution to many agricultural problems. It helps to ensure proper management of land, water, energy, pests, weeds, energy, and other resources. Apart from these benefits, it also helps to boost the profits of farmers and also improve the ecosystem. However, intercropping is not possible without proper planning and practice.