Agri Articles
(e-Magazine for Agricultural Articles)
Volume: 04, Issue: 01 (JAN-FEB, 2024)
Available online at http://www.agriarticles.com
©Agri Articles, ISSN: 2582-9882

Unlocking Multiple Advantages: The Potential of Intercropping in Modern Agriculture

(A.R. Ninama, *Raghuveer Choudhary, Keval Ram and B.P. Solanki)
Department of Agronomy, College of Agriculture,
Junagadh Agricultural University, Junagadh, Gujarat
*Corresponding Author's email: raghuveerbajya63458@gmail.com

A sustainable farming method called intercropping is growing two or more crops at the same time on the same field. Numerous advantages come with this creative method, from improved soil health and pest control to higher output and resource efficiency. In this piece, we examine the many benefits of intercropping and consider how it might transform contemporary agriculture and improve food security worldwide. Furthermore, having a comprehensive awareness of the various benefits of intercropping in terms of resource use efficiency—such as light, nutrients, and spaces—helps practitioners boost crop output and efficiency. In contrast to other cropping strategies like monoculture, intercropping increases crop competitiveness, maximises the use of resources in a particular farming area, and uses resources like water, solar energy, and soil nutrients efficiently. Due to biological nitrogen fixation, the legume component of the intercropping system may consistently supply nitrogen to the soil, which is lacking in sub-Saharan African soils. More research has been done on intercropping, both in tropical agricultural systems and abroad, and it appears that it can increase yield compared to monoculture without requiring more external inputs. The optimum cropping technique may be intercropping because of its improved production, adaptability to climate change, and better use of the resources that are available.

Keywords: Cropping, intercropping, light use efficiency, production, water use efficiency

Crop morphophysiology under intercropping

Reports of morphophysiological changes included longer stems, more lodging, smaller leaves and a lower ratio of chlorophyll a/b, enhanced soybean photosynthetic efficiency, and greater specific leaf weight. According to findings from another study, soybean sowing density and row spacing significantly affect the intraspecific and interspecific competition of plants for soil resources, especially water and nutrients. They also cause morphological changes in plants, specifically in the areas of height, branch length, and number of pods, which are the main factors influencing yield. Research suggests that the intense shading of maize under the maize-soy bean intercropping system causes soybean plants to grow vegetatively from germination to maturity. This increases the height of the seedlings and makes them more susceptible to lodging as the shade intensity increases. Yield can be impacted by changes in the leaf surface, the leaf area index (LAI), light absorption, canopy photosynthesis, and sowing density.

Resource use under intercropping

By utilising the complementary relationships between crops, intercropping offers a special way to maximise land utilisation. Plants that are geographically and temporally diversified have less competition for resources, which means that sunshine, water, and nutrients are used more effectively. When compared to monoculture systems, this synergy frequently delivers higher total yields. Intercropping has gained recognition as a potentially useful crop production method. Intercropping is primarily used to boost yield on a specific piece of land by efficiently utilising resources that would not be needed for a single crop. Numerous research have demonstrated how intercropping can improve resource utilisation effectiveness. In contrast to other cropping strategies like monocropping, intercropping increases crop competitiveness, maximises the use of resources on a particular farming area, and uses resources like water, solar energy, and soil nutrients efficiently. Crops grown under intercropping frequently have different nutritional requirements, rooting capacities, heights, canopy structures, and complimentary uses of growth resources. Component crops use resources differently when grown together as opposed to separately, particularly when they have different growth and maturity cycles, which raises their demand for resources at different times and increases productivity.

Light use under intercropping

Sufficient leaf area index (LAI) is necessary to maximise the amount of solar radiation that reaches the soil in the initial stages of growth. The amount of radiation received by crop canopies is determined by LAI and the spatial distribution of leaf area. The rates of PAR interception and nutrient uptake vary amongst the component crops. In short-duration crops, the maximum solar radiation is usually utilised at a particular LAI, and this time period is usually rather brief. Several crops enable more efficient use of energy. When compared to solitary cropping, the intercropped maize and peanut showed different chloroplast compositions and photosynthetic properties. Weak light was used in the peanut while strong light was used in the maize. One of the longest-lasting obstacles in the maize-soybean intercropping system is lodging, which seriously jeopardises the expansion and sustainability of the farming industry.

Nitrogen uses under intercropping

Increased nitrogen uptake in intercropping environments can occur both temporally and geographically. Crops in an intercropping system gain from the timing of when the peak nutrient demands are at different times, even though the expanding root mass can increase nutrient uptake in terms of space. It has been observed that in species with different rooting and uptake patterns—like those grown in cereal-legume intercropping systems—there is greater N-uptake in the intercrop as opposed to mono-cropping. According to reports, intercropping lowers the quantity of nitrate leaching. Grain legumes can be added to pasture intercrops to create more sustainable supplies of nitrogen through biological N fixation.

Fu *et al*. (2019) discovered that maize soybean intercropping outperformed maize mono-cropping in terms of the N uptake of maize grain. Plant P absorption increased in maize-soybean intercropping as a result of a change in the microbial community's makeup.

Water use efficiency under Intercropping

With concerns over water scarcity on the increasing, intercropping appears as a water-efficient alternative. Companion crops have different root depths and development patterns, which increase water absorption and decrease runoff. In addition to preserving water supplies, this strengthens agriculture's resistance to climate change. By using intercropping systems, it may be possible to improve water storage in the root zone, enable plant roots to fully use farmland water, reduce inter-row evaporation, control excessive transpiration, and create a special microclimate that is conducive to plant growth and development. Throughout the whole growth period, intercropping consumes more water than monoculture does, although the difference is smaller than the weighted mean value of the corresponding water uses in solo cropping.

Using the right management strategies to reduce soil evaporation is essential since it greatly increases the total quantity of water used by agricultural systems. Cereal-legume intercropping, especially that of maize and soybean, has been shown to be more productive than each monoculture when grown in dry seasons and in areas with limited water resources.

Intercropping for soil fertility and soil health

An intercropping system improves soil fertility and structure because various crops have different root systems and need varying amounts of nutrients. When combined, nitrogen-fixing legumes provide vital nutrients to the soil. This kind of sustainable soil management promotes agricultural productivity over the long run. Intercropping is a successful and visually appealing way to improve soil health and quality, yield, fertiliser use efficiency, and long-term agricultural output. In addition to increasing the amount of nitrogen that was taken in through grain, the intercropping of soybeans and maize improved the soil's readily available nutrients. It is commonly recognised that pulses can improve soil fertility. Pulses have a number of distinguishing properties, including deep roots, the power to fix nitrogen, the capacity to shed their leaves, and the ability to mobilize insoluble soil nutrients. By improving soil conditions on a chemical, biological, and physical level, pulses can reverse the trend of declining production in the continuous cereal-cereal system. A viable alternative for enhancing soil health, safeguarding natural resources, and guaranteeing the sustainability of agriculture is cereal-legume intercropping.

Nutrient use efficiency under intercropping

One method that intercropping with legumes can especially improve soil fertility is through the ability of rhizobacteria to fix nitrogen (N) in the soil, which allows for more fixed N to stay in the upper soil layers and be available to plants. Increased crop utilisation of available nutrients, both macro- and micronutrients, is facilitated by intercropping. Compared to stands of traditional, non-intercropped crops, this can lead to an improvement in nutrient utilisation efficiency and a decrease in the requirement for fertiliser on the main crops.

Intercropping in crop microclimate

Crop growth and yield are greatly influenced by the microclimate in farming, which consists of temperature, relative humidity (RH), and light intensity. The microenvironment is changed by intercropping, particularly in terms of temperature, relative humidity, and light intensity. Previous research found that relative humidity was declining and that there were fewer hours per day with relative humidity below 92% in intercropping. Furthermore, intercropping can improve the amount of light absorbed by crops per unit planting area, resulting in higher agricultural productivity and more efficient use of radiation. Microclimate modifications involving high inputs, such as the use of artificial shade materials, are impractical in the tropics, where capital can be a major barrier to agricultural production; on the other hand, microclimate modifications involving low inputs, such as intercropping, may be both acceptable and affordable.

Intercropping for crop productivity and intercropping efficiency

In addition to promoting the prudent and equitable use of land resources and agricultural inputs such as labour, the main objective of intercropping is to raise overall productivity per unit of time and area. When comparing productivity per unit area, intercropping systems clearly outperform single crops. Research indicates that intercropping, which makes better use of natural resources, can yield production benefits over solitary crops without increasing external inputs. It has garnered increased interest in tropical agricultural systems and worldwide. It has been found that intercropping systems with both replacement and additive series offer yield improvements. Cereal-legume intercropping systems have been shown to increase productivity.

Conclusion

In conclusion, intercropping stands as a beacon of hope for sustainable and productive agriculture. By strategically combining crops, farmers can harness a multitude of benefits, addressing challenges related to yield, resource utilization, and environmental impact. As we navigate an era of evolving agricultural practices, embracing the potential of intercropping is not merely a choice but a necessity for building resilient and sustainable food systems worldwide. Intercropping is the growing of two or more crops simultaneously on the same ground and is a cropping technique with various advantages. The microenvironment is changed by intercropping, particularly in terms of temperature, relative humidity, and light intensity. Research indicates that intercropping in tropical agricultural systems can improve productivity and create a system that is resilient to climate change. This practice has drawn increased attention in recent years. When it comes to yield per unit area and intercropping efficiency, it offers definite advantages over solo crops. One could get the conclusion that intercropping is preferable to monocropping systems in tropical regions based on the results of many studies.

References

1. Melkamu Dugassa. Intercropping as a multiple advantage cropping system: Review. *Int J Res Agron* 2023;6(1):44-50.
2. Fu Zd. et al., Effects of maize-soybean relay intercropping on crop nutrient uptake and soil bacterial community. *Journal of Integrative Agriculture*. 2019;18(9):2006-2018