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Maize-based Diversified Cropping System for Higher Productivity and Profitability

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Abstract

Maize is a staple crop with significant economic and nutritional value, making it a crucial component of global agriculture. However, continuous monocropping can lead to soil degradation, pest infestations, and declining yields. Diversified cropping systems, which integrate maize with complementary crops, offer a sustainable approach to improving productivity and profitability. This system enhances soil fertility, optimizes resource utilization, and mitigates risks associated with climate variability and market fluctuations. By incorporating legumes, oilseeds, or vegetables alongside maize, farmers can achieve higher land-use efficiency and better income stability. Additionally, crop diversification reduces dependency on chemical inputs, promoting ecological balance and long-term sustainability.

1. Introduction

Continuous cultivation of the rice-wheat cropping system in India has led to yield stagnation, and declining factor productivity raising the need for diversification (Kumar et al., 2019). Maize (*Zea mays*) ranking third after wheat and rice, is an important cereal crop, for diversification having the highest genetic yield potential (queen of cereals) and serving as a staple food, fodder, and industrial raw material. However, to maximize productivity and profitability, adopting an efficient maize-based cropping system is essential. Single cross hybrids maize development has increased the scope of diversification. Maize being a widely spaced crop can be integrated with suitable crops in intercropping, or in sequential/rotational systems can enhance soil fertility, improve resource utilization, enhance resilience to environmental stresses, better economic returns, and reduce the risks associated with monocropping (Babu et al., 2020b).

Additionally, such systems contribute to sustainable farming by minimizing pest infestations, optimizing water and nutrient use, and increasing overall farm income. By strategically selecting

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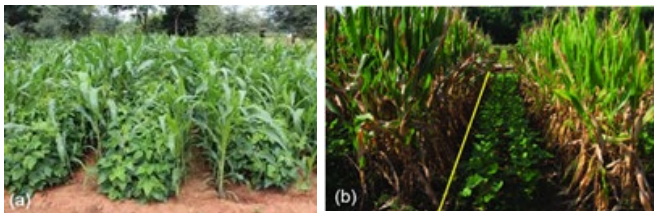

Figure 1: (a) Maize+cowpea, (b) Maize+soybean intercropping system

complementary crops, based on climatic conditions, soil type, and market demand, farmers can achieve better economic returns while maintaining long-term soil health and productivity. Implementing a maize-based diversified cropping system can be a viable strategy to achieve higher productivity and profitability while ensuring long-term agricultural sustainability.

2. Maize-based Cropping System

Maize can be effectively integrated with pulses (greengram, mungbean, chickpea, cowpea), cereals (pearlmillet, sorghum, barley, wheat, rice, sweet corn), oilseed (mustard, groundnut, safflower), and vegetable crops (potato, onion) in cropping system either in sequential/rotational cropping system or in intercropping pattern in rainfed or irrigated ecologies (Table 1). Its ability to grow under diverse soil and climatic conditions makes it a viable option for diversification. The crop selection should be based on agro-climatic conditions, soil type, input availability, consumer demand, and market availability.

Intercropping maize with legumes like soybean or cowpea enhances soil fertility through biological nitrogen fixation while reducing weed competition and pest pressure. Crop rotation, where maize is alternated with crops such as legumes, root crops, or oilseeds, helps break pest and disease cycles, improves soil structure, and enhances nutrient availability. Speciality corn such as sweet corn and baby corn are now being promoted in peri-urban areas, have higher export potential and yield more profits simultaneously providing green fodder to the livestock (Bajpai and Goswami, 2018). The inclusion of pulses and oilseed yielded higher profits. Maize-french bean cropping system recorded higher system productivity, gross and net returns (Babu et al., 2020) (Table 2).

Table 1: Major maize-based cropping system

Rainfed	Irrigated
Sequential cropping systems	
Maize-mustard	Maize-wheat
Maize-wheat	Maize-wheat-greengram
Maize-maize-pearlmillet	Maize-potato-wheat
Sorghum-maize	Rice-maize
Maize-barley	Maize-wheat-vegetables
Maize-groundnut	Maize-mustard
Maize-sorghum-Pulses	Maize-potato-sunflower
Rice-maize	Maize-potato-mungbean
Maize-potato-groundnut	Maize-wheat-urdbean
Rice-maize-urdbean	Rice-maize-pearlmillet
Maize-safflower	Maize-potato-onion
Maize-legumes	Maize-chickpea
Intercropping systems	
Maize+Mungbean	Baby corn+vegetables
Maize+Pigeon pea	Maize+high value vegetables
Maize+Soybean	Sweet corn+vegetables
Maize+Urdbean	Maize+flowers
Maize+Cowpea	Maize+Sugarcane

Table 2: System productivity, gross return, net returns, and B: C ratio of different maize-based cropping system

Cropping system	System productivity (Mg ha^{-1})	System gross return (US$)	System net returns (US$ ha^{-1})	B: C ratio
Maize-fallow	3.74	1565.51	643.15	1.70
Maize-soybean	7.07	2959.40	1502.18	2.03
Maize-black gram	5.65	2670.22	1339.95	2.01
Maize-green gram	5.57	2625.23	1295.79	1.97
Maize-french bean	11.41	3764.48	2282.22	2.54
Maize-toria	4.97	2199.90	971.51	1.79
LSD (p=0.5)	1.39	146.37	116.32	0.06

Source: Babu et al. (2020)

3. Benefits of Maize–based Cropping System

- **Enhanced Soil Fertility**: Legume-based intercropping and rotation improve nitrogen availability and organic matter content, reducing dependency on synthetic fertilizers.

• **Pest and Disease Management**: Diversified cropping disrupts pest cycles, reducing the prevalence of crop-specific pests and diseases.

• **Efficient Resource Utilization**: Different rooting depths and growth habits of intercropped species ensure optimal use of soil nutrients, water, and sunlight.

• **Increased Yield and Profitability**: Diversification reduces production risks and enhances farmers' income by providing multiple harvests from the same land.

• **Sustainability and Climate Resilience**: Diverse cropping systems enhance ecosystem stability, reduce soil erosion, and mitigate the impacts of climate variability.

4. Conclusion

A well-planned maize-based cropping system offers a sustainable approach to improving productivity, profitability, and soil health. Integrating maize with legumes, oilseeds, or vegetables through intercropping and rotational systems enhances soil fertility, optimizes resource utilization, and reduces pest and disease pressure. These systems not only increase yield potential but also ensure economic stability by diversifying income sources and reducing reliance on synthetic inputs. Moreover, they contribute to climate resilience and long-term agricultural sustainability. By adopting suitable maize-based cropping patterns based on local agro-climatic conditions and market demand, farmers can achieve higher returns while promoting environmentally friendly farming practices.

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