



Shift in Cropping System: Is a Sustainable Means of Improving Crop Production and Maintaining Soil Health?

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Background

- South and Southeast Asia is dominated by rice-wheat cropping system [1], but the cultivation area is declining [2].
- Intensification and diversification of cropping patterns occur in response to changes in external pressures and system-immanent drivers [3].
- Intensive agriculture has increased the productivity. However, its negative impacts on biodiversity, soil health, high inputs/resources demand influenced shift in intensive agriculture towards more sustainable crop production [4].
- Thus, understanding potential effects and trade-offs of system shift on different soil attributes along with its influence in supply demand synchrony is necessary for changed cropping systems and other interventions in agriculture production systems.



Figure 1: Crop intensification in Bangladesh (fallow to pulse-based cropping systems, A and B) and crop diversification (lowland rice to upland rice-based systems, C and D). (Photos: CIMMYT/Bangladesh, kalifah.com, thethirdpole.net)

Materials and Methods

- Undertook an extensive literature review focuses on specific subject matter.
- Followed open ended search strategy that includes search in Scopus and Google Scholar databases through Google.
- Using different keywords (e.g. rice-wheat, cropping system; crop diversification, soil) in Scopus, 13 articles were sorted out of over 5000, whereas 2 articles were from Google scholar.
- Information of those articles were extracted and arranged accordingly.

Summary and Conclusion

- Rice-wheat rotation system is currently changing under the influence of water shortages, changing consumer needs and market prices, and the availability of new technologies.
- Changes in cropping pattern/shifts in cropping systems might be responsible for producing higher yield, since these may improve soil microbial activity and increase nutrient availability.
- To maintain soil health, the selection of right crops and cropping patterns with higher resource use efficiency.
- Based on residual effects, fertilizer should be applied accordingly because most crops utilize a portion/fraction of supplied nutrients and rest non absorbed amount can help following crops.

➤ **Current trend in cropping system shift, which might be triggered by replacement of high water demanding anaerobic to water saving aerobic production or high value crops can replace low value cereals.**



Photos: CIMMYT/Bangladesh

"It is necessary to arrange crops in the best sequence which allows them efficient use of available resources to improve soil productivity [5]."

Factors and drivers towards system shift

- Multi-level socioecological factors i.e. micro-level (land size, mechanization, farmers experience, salinity, soil condition); meso-level (market status, communication systems, labour issues, access to extension) and macro-level (density of population) [6].
- Current issues and changes (water shortages and economic drivers as well as urbanization, eating behavior, choice of individuals and dropped price of grains) [3].
- Climate change [7].

Is it beneficial for soil health and productivity?

Description	Reference
System shift sustain soil health, supply organic matter, maximize productivity.	[8]
Cause change in soil aeration status that improve mineralization of soil carbon as well as arouse innate soil N.	[9]
Positively related to soil fertility, increase soil cover and reduce soil, water and nutrient loss.	[10]
Exhibit highest growth, yield and nutrient uptake.	[5]

Choice of crops

Preceding crop	Following Crop	Residual properties	Reference
Lentil	Wheat	Soil water and available N	[14]
Maize	Wheat	NPK	[15]
Wheat & vegetables	maize	B & Zn	[12]
Pulses	wheat	N	[11]

Attaining nutrient synchrony

Description	Reference
Applying only macronutrients in crop production creates imbalance in soil fertility.	[11]
The amount of soil water and nutrient availability for subsequent crops are affected by previous crop.	[12], [13]
To improve productivity and quality, supply of required nutrients needs to be balanced with seasonal demand.	[3]

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