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Pulses: Sustainability Food Source for Growing Population

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INTRODUCTION

Over the last several decades, Western agri-food systems have created externalities affecting the ecosystem and human health. These externalities have been caused by the lack of crop diversity and by intensive livestock production systems (Weiner, 2017). These systems were shaped by consumer preferences and path-dependency mechanisms that led to the lock-in of agricultural and food systems. In particular, cereals' increasing returns to adoption marginalized minor crops such as pulses despite their environmental and nutritional benefits (Magrini *et al.,* 2016).

First, for agricultural systems, cereals are the major crops in European farming systems (around 50% of EU-28 arable cropland), whereas pulses account for around 2%. Europe is the top producer of wheat in the world, with France and Germany accounting for almost 50%. Increasing competitiveness between major species, such as wheat, and minor crops, like pulses, has pushed farmers to exclude the latter from cropping systems (Zander *et al.,* 2016). This trend has been also reinforced by scientific research, in which pulses have received less funding than major crops.

Pulses have been given the status of Wonder Crops for numerous reasons as they are unique gift bestowed by the Mother Nature to the mankind. They are important for natural resource management, environmental security, crop diversify and consequently for viable agriculture. Pulses are distinctively relevant to address the sustainable food production system that progressively improve land and soil physical condition. Incorporating pulses to cereal based agro-system can enhance sustainability by strengthening all components like environmental, economic and social for large, small as well as marginal farmers. They are indeed pivotal for the sustainability of agriculture, soils, poor and marginal farmers, consumers and livestock. Mostly pulses harvested as dry seed are rich in protein, micronutrients, fibres and vitamins.

With increase in daily dietary intake, pulses are important substitute to meat for the Indian vegetarian population as a source of proteins. Rather they are best known as poor man's meat and constitute the major source of dietary protein of the large section of vegetarian population. Pulses being highly nutritious and palatable is fodder of choice for livestock also. With decreasing per capita land availability and increasing demand for food production, there is a strong need to increase production and productivity of pulses.

Versatile qualities of pulses provide them pivotal position among the food grains. They are a major source of protein not only for human beings but also for livestock. Consumption of pulses also reduces risks of obesity, heart disease, diabetes, diseases of digestion and cancer. In fact, these are among the top "super foods". Besides significant health advantages, pulses have a distinct "green" advantage. Unlike most grain crops, pulses leave a much smaller carbon footprint. Rather than consuming nitrogenous fertilizers, they actually fix nitrogen into the soil through symbiosis with *Rhizobium* making them essential for sustainable and environment friendly agriculture. Growing legumes improves soil quality by enhancing its biological, chemical and physical properties.Their production becomes more crucial in India, where the majority population is vegetarian and depends on pulses for protein supplement in their diet.

Zimberoff (2019) wrote in Time magazine that the arguments over taste no longer matter because they are being formulated into so many products and they're unavoidable, because Mintel, the market research firm, reported that 757 new pulses-related foods hit the shelves last year. Further, almost any doctor will posit that a plant-based diet is healthier than one high in animal protein and also agree that eating a plate of peas is better than eating processed foods made from fractions of peas. As a crop, it has risen and fallen in favour, but today everyone seems to agree that it checks the box against the biggest problems plaguing the Earth: climate, food and health. From a sustainability standpoint, the legume family, do everything wheat, corn and soybean don't. They require less water, are drought tolerant, reduce the need for nitrogen fertilizers because they take nitrogen gas from the air and store it in their roots, and make an ideal candidate for crop rotation.

Besides having numerous advantages, there is a huge gap in demand and supply of pulses. Although India is the leading producer of pulses but at the same time it is the foremost consumer also. The declining per capita availability and rising prices have forced us to revolutionize the pulses production. Of the various possibilities of growing grain legumes, offers the greatest potentials it is a multi-functional crop that can be used as green forage, forage dry matter, forage meal, silage, haylage, immature grain, mature grain, straw and green manure (Mihailovic & Mikic, 2010).

The legumes generally used in our diets are red gram (pigeon pea), black gram (urd), Bengal gram (chick pea) and green gram (moong). All these legumes provide 18 to 23 percent of protein. Nowadays soybean is gaining importance which has 40 percent of protein content and it is an ideal supplement for 'Protein Calorie Malnutrition' because of its high protein and fat contents. Pulses form an important part of the diet in the underdeveloped and the developing countries like India where population is mostly vegetarian. Practically all legumes are consumed only after they have been subjected to some form of processing such as heating, roasting, soaking sprouting, boiling and pressure cooking usually to increase their digestibility and nutritive value. All these methods are known to improve their palatability and digestibility, decrease anti-nutritional factors and convert vital constituents of the pulse into simpler compounds which are ultimately beneficial nutritionally. Reduction or elimination of anti

nutritional factors would make grain legumes more acceptable as a source of inexpensive nutritious proteins and maximize their utilization in human food.

CONCLUSION

Breaking agricultural and food systems (i.e., the agri-food system) out of lock-in requires new increasing returns to adoption that foster crop and food alternatives such as pulses. This article has explored various innovation paths regarding pulses, both upstream and downstream of supply chains, to get insights on the alignments that are possible. We have considered this alignment as the condition needed to trigger a sustainable agri-food transition in favor of pulses. In this article, we have stressed the importance of a co-evolution involving technologies, ecosystem, institutions, private actors, and research, in order to understand how innovations in one area can trigger changes in another.

The main conclusion is that public institutions have a major role in supporting this transition because the simultaneous evolution of the downstream and the upstream of the system is complex. In particular, public institutions need to: support investment in new storage facilities upstream and new processing technologies downstream; foster the sharing of information and knowledge on innovative cropping systems that include pulses (especially in agricultural advising) upstream, and the benefits of consuming pulses downstream. That is, to successfully accomplish the agri-food transition on pulses, policy makers need to view agricultural, and food policies as strongly interconnected.

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