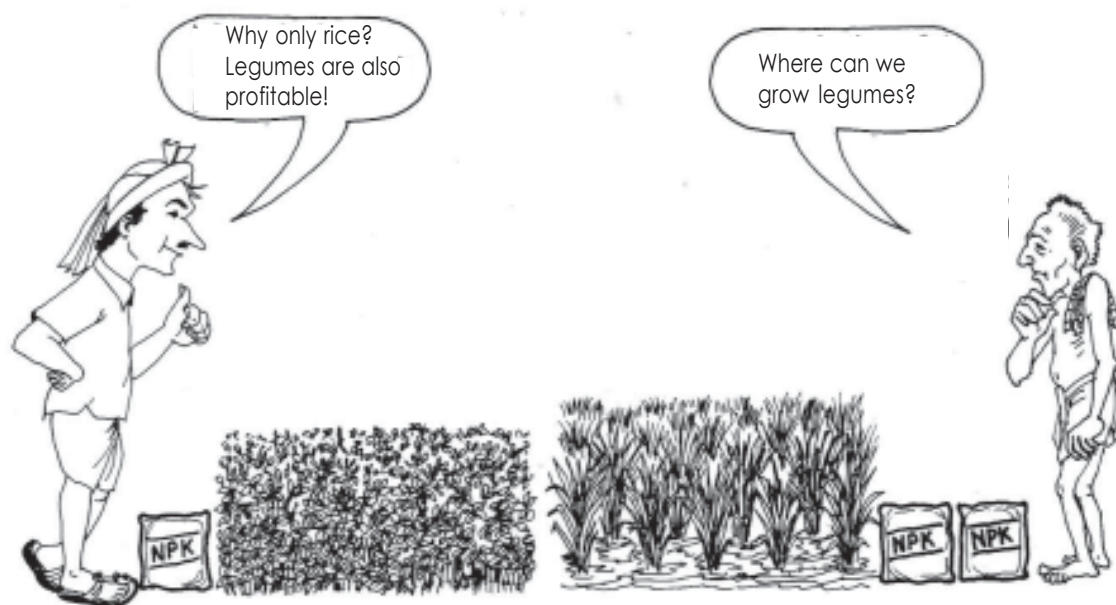


# Socioeconomic Constraints to Legumes Production in Rice-Wheat Cropping Systems of India



The major problem of the rice-wheat system in the Indo-Gangetic Plain (IGP) of India is the stagnating or declining yields of rice and wheat. Also, the soil nutrient status and groundwater level are deteriorating. Crop diversification through legumes can address these problems as legumes complement cereals in both production and consumption. In the production process, legumes improve soil fertility status, require less water than cereals, and their rotation with cereals helps control diseases and pests. On the consumption side, legumes are the cheapest source of protein in the vegetarian diet and supplement mineral and vitamin requirements. Despite their value in production and consumption, area under legumes in the rice-wheat system has declined after the introduction of improved technologies during the mid-1960s. Several socioeconomic factors constrain legumes production in the rice-wheat system, and these issues are examined.

## Reasons for Decline in Legumes Area

- Government's focus of support onto other cereals
- Lack of superior technology for legumes
- Biotic constraints (diseases and pests) in legumes
- Abiotic constraints (soil salinity, waterlogging and frost)
- Low productivity of cultivars



## Data Collection and Analysis

The analysis is based on both secondary and primary data. The secondary data were collected from published sources on area, production, yield, and prices of legumes, rice, and wheat. To collect primary data, Karnal district in Haryana was selected as rice-wheat is the predominant system. Conclusions derived from this district may be relevant for other regions in Punjab and Uttar Pradesh, which practice intensive rice-wheat system and have similar agroclimatic features.

## Legumes in the Existing Cropping System

The cropping pattern followed by the selected sample farmers in 1996/97 indicated that rice and wheat were the major crops of the study area and occupied 81% of the total cropped area. Although legumes area in this predominantly rice-wheat system was less than 10%, it was much higher than the area of other crops. Thus, legumes were preferred besides rice and wheat.

## Profitability of Legumes

Profitability was the most important criterion for allocating area to alternative crop choices and this was largely influenced by cost of production, crop yields and output prices. Despite low cost of cultivation of legumes, the profitability of different legumes did not consistently match that of rice and wheat. However, berseem was more profitable than wheat but it was solely grown for fodder and its area expansion was restricted due to lack of market demand.

Lower net profit of legumes when compared with that of rice and wheat was mainly due to their poor yield performance. However, output prices of all legumes were much higher than those of rice and wheat. Yields of legumes were so low that higher output prices could not make them more profitable than rice and wheat. The output price of pigeonpea was double that of rice whereas the yield of rice was four times higher than that of pigeonpea. Similarly, the output price of chickpea was double that of wheat, but wheat yield was 60% higher than chickpea yield.

Crops Grown in Selected Villages of Karnal District in Haryana, India, 1996/97		
Crop group	Crop	Area (%)
Cereals (grain)	Rice	43.0
	Wheat	38.0
	Others (maize)	0.2
Cereals (fodder crops)	Sorghum, maize during rainy season)	3.4
Legumes (grain)	Pigeonpea, chickpea, lentil, mung bean, black gram	3.1
Legumes (fodder crops)	Berseem, lucerne during winter)	3.5
Legumes (summer)	Sesbania spp.	2.2
Oilseeds	Mustard, toria, and sunflower	2.8
Commercial crops	Sugarcane	3.2
Others	Others	0.6

Historical trends in the prices of legumes, rice and wheat indicated that the minimum procurement prices of all legumes announced by the government were always kept higher than those of rice and wheat. During the past three decades, yields of legumes were always substantially lower than those of rice and wheat in the states of Haryana, Punjab and Uttar Pradesh. Yields of rice and wheat increased much faster than legumes in these states. A yield breakthrough in legumes was not realized as in rice and wheat. Although several improved cultivars of various legumes were developed, they were not widely disseminated due to lack of knowledge of the farmers.



#### **Legumes Cultivation: A Risk to Farmers?**

Farmers considered production of legumes as relatively more risky than rice or wheat. The price and yield risks of legumes were much higher than those of rice and wheat. The coefficients of variation in yields of chickpea and pigeonpea were greater than wheat and rice in most districts in the Indian states of IGP. This suggests that legumes were more prone to risk due to crop failure (low yields) when compared with rice and wheat. Similarly, price fluctuations (post- and preharvest) in chickpea and pigeonpea were higher than rice and wheat. Thus yield and price risks were hindering adoption of legumes in the rice-wheat system.

## **Profitability of Alternative Cropping Sequences**

The profitability of the rice-wheat cropping sequence was compared with other alternative cropping sequences under three options: (1) existing prices of fertilizers and electricity charges paid by the farmers for irrigation; (2) without electricity subsidy for extraction of groundwater for irrigation; and (3) without fertilizer and electricity subsidy for irrigation. The most profitable crop sequence was rice-wheat-black gram followed by rice-berseem and rice-wheat-mungbean. The adoption of these three crop sequences was limited in the study area due to resources and market constraints.

Cultivation of black gram and mungbean requires much water after the harvest of wheat, whereas berseem area expansion was restricted due to limited market determined by livestock population. Profitability of rice-wheat, the most popular cropping sequence in the study area, was higher than that of rice-chickpea and pigeonpea-wheat. Even if the existing subsidies on fertilizer and electricity for irrigation were withdrawn, the rice-wheat rotation was still the most profitable crop sequence. Therefore, farmers allocated area for rice-wheat sequence. Substitution of legumes for rice or wheat means loss in earnings of farmers. To introduce legumes in the rice-wheat system, profitability of legumes needs to be raised substantially. This is possible through a substantial increase in their yield levels, which could be attained through dissemination of appropriate technologies to farmers.

## Trade-off Between Legumes and Competing Crops

Five criteria were assessed to examine the trade-off due to inclusion of legumes in the rice-wheat cropping systems. These were:

1. profit;
2. food grain production;
3. fixed assets (farm implements and machinery);
4. groundwater; and
5. soil nutrients (nitrogen).

Most farmers maximize profit, food grain production and utilize fixed resources.

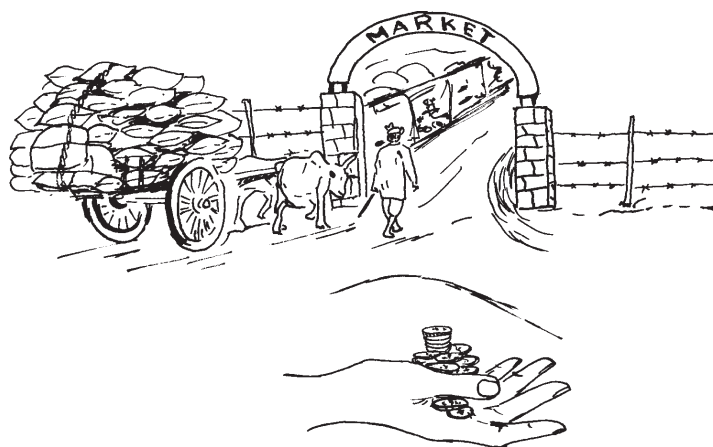
Trade-off (percentage change) in Replacing Rice or Wheat with Legumes in Karnal District, 1996/97*				
Indicator	Pigeonpea	Chickpea	Lentil	Berseem
Profit	-49	-19	-41	+2
Food grain	-76	-64	-76	
Fixed resources	-57	-49	-61	-43
Groundwater	+95	+85	+83	-125
Soil nutrients	+65	+73	+75	+56

\*In rice-wheat system, rice was substituted by pigeonpea and wheat by chickpea, lentil, or berseem

The trade-off values for replacing rice by pigeonpea indicated that farmers would lose 49% profit. The region would need to sacrifice 76% food grain production and 57% of the fixed resources would remain unutilized. However, the region would save about 95% of the groundwater and 65% of the nitrogenous fertilizer. Similarly, trade-off was also observed when wheat was substituted by chickpea or lentil. But the trade-off between wheat and berseem (a fodder legume) indicated negligible loss in profit, despite more groundwater being used for berseem than wheat. Thus substitution of wheat by this fodder legume would mean further over-exploitation of groundwater. When food grain legumes substituted rice and wheat, there was a loss in profit, food grain production, and use of fixed resources. However, there were substantial gains in conserving groundwater and nitrogenous fertilizers.

## Lack of Adequate Markets

Markets for legumes were thin and fragmented in comparison with rice and wheat, which have assured markets. Government procurement system for legumes was ineffective. Often, farmers were not able to get the minimum prices announced by the government.



The price spread (or the market margin) for legumes was much higher than for rice and wheat due to higher post-harvest costs. The share of farmer's returns in consumer price was much lower for legumes than for rice and wheat. The price spread for pigeonpea dal was Rs 15 per kg, while it was less than Rs 1 per kg for rice. For chickpea, it was Rs 3.20 per kg whereas it was only Rs 1.20 per kg for wheat. Farmers' share in consumer rupee was 40% for pigeonpea and 85% for rice; for chickpea, it was 35% and for wheat it was high at 91%. These estimates indicated that farmers were not really benefited by higher market prices of legumes. To encourage legumes production in rice-wheat system, similar mechanisms for their procurement as for rice and wheat need to be evolved.

## The Prime Needs

The existing low yield levels of legumes will displace them from the rice-wheat system. Therefore, more resources should be allocated for research to break yield barriers, and design innovative policies on risk and resource management. If pigeonpea should compete with rice, its yield must be increased from 1 to 2 tons per ha. Similarly, lentil yields must be raised from less than 1 to 1.4 tons per ha and chickpea yields from 1.5 to 1.6 tons per ha to compete with wheat. Although chickpea is now competitive with wheat with respect to yield, the risk factor due to diseases and insect pests in chickpea remains high and needs due attention.

### Strategies to Reduce Legumes Production Risk

- Develop high-yielding varieties
- Create assured output markets
- Reduce post-harvest losses and costs
- Develop appropriate crop production technologies

#### Adapted from:

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