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Wheat Value Chain: Bangladesh

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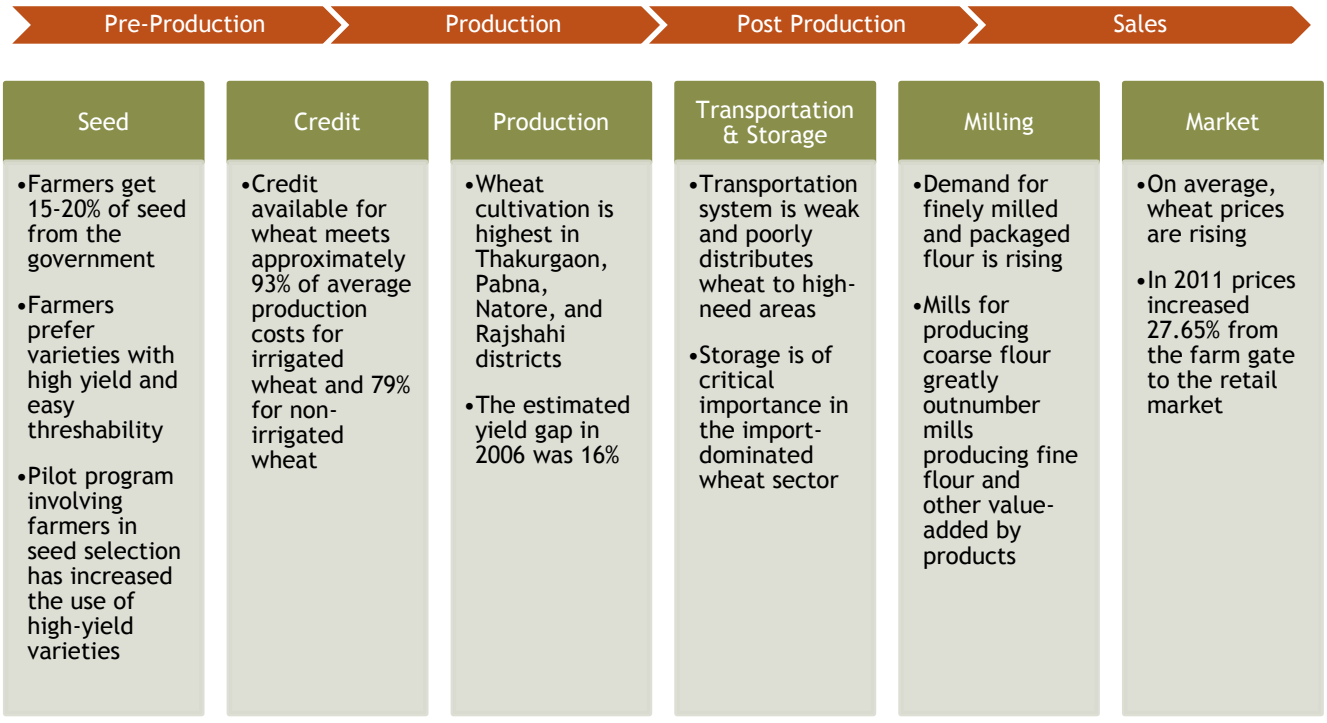
Bangladesh Wheat Value Chain Highlights

This brief provides a general overview of the wheat market in Bangladesh. The first section describes trends in wheat production and consumption over the past twenty years and summarizes recent trade policy related to wheat. The second section presents the findings of a literature review of the wheat value chain in Bangladesh, beginning with seed selection and ending with sales. Finally, wheat consumption in Bangladesh is discussed in more depth, including nutritional information about wheat, substitute grain markets, and projected consumption in 2030.

Key Takeaways

- Wheat production in Bangladesh has been volatile and continues to reflect significant yield gaps
- Wheat consumption has increased, but rice is the most important crop and food grain
- Increased demand by private traders for higher quality wheat for processing has fueled rising import levels
- The gap between domestic supply and demand is projected to grow to over 4 million tons by 2030

The below figure summarizes major findings along the different stages of the wheat value chain in Bangladesh.



Overview of Data Discrepancies

Estimates of wheat production, area harvested, and therefore yields vary substantially across the USDA Foreign Agricultural Service (FAS), FAO, the Bangladesh Ministry of Agriculture (MOA), and various other sources. This variation likely results from the use of different methods for collecting and reporting data. The USDA FAS compiles projections for the current season in progress from multiple sources, including official government sources, and reports on a marketing year basis (October-September). While the USDA uses official statistics reported by countries when available, they also supplement from additional sources when needed. The FAO releases data after the season ends, uses member country statistics collected from the relevant country's MOA or Bureau of Statistics, and uses a calendar year. To the extent possible, substantive differences between the reported estimates will be cited in the text or footnotes.

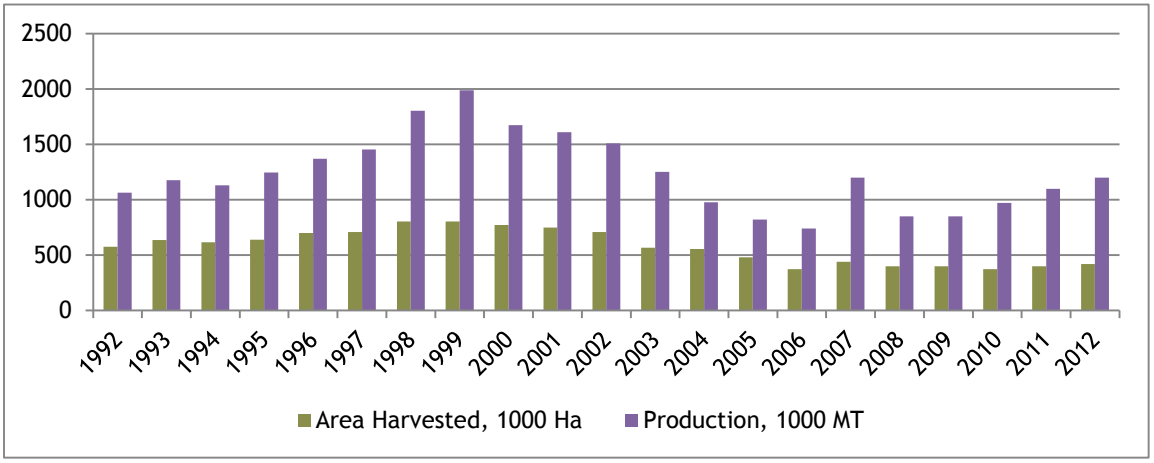
Key Statistics about Wheat in Bangladesh

Production has been Variable, but on the Rise Since 2008

Wheat production in Bangladesh has varied significantly over the last 20 years.

F*igure 1* uses USDA Foreign Agricultural Service (FAS) data to show total wheat production in Bangladesh from 1990 to 2012. The average area harvested over the past five years is approximately 43% less than the average from 1992 to 2002.

F*igure 1*: Domestic Wheat Production



Source: USDA FAS

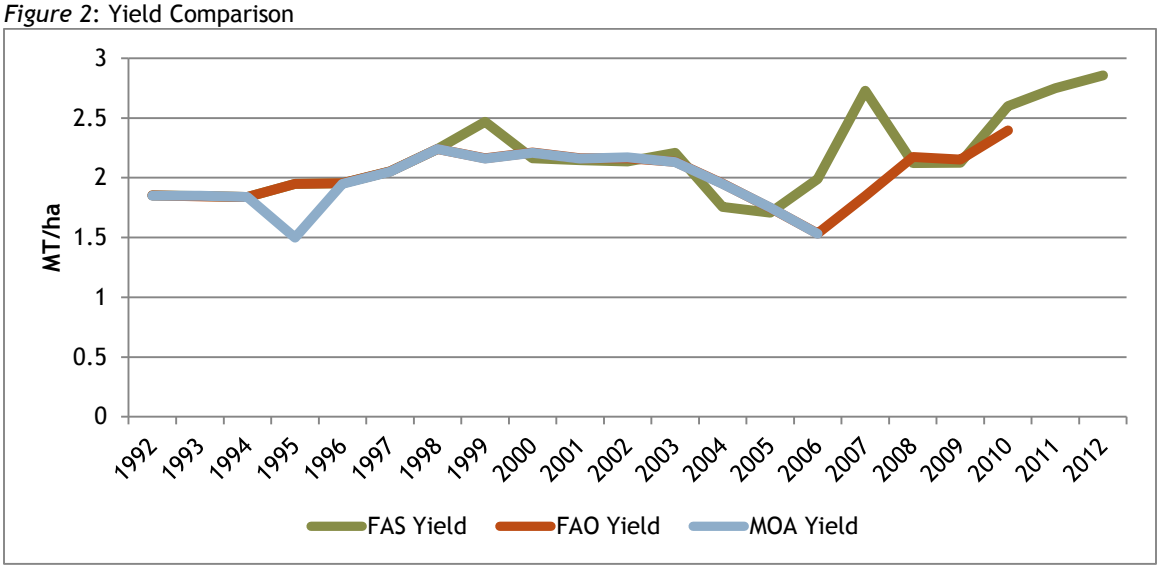
The decrease in wheat production from 1999 to 2006 may have been due to the continued cultivation of low yield, disease-susceptible Kanchan variety wheat.[1] Frustration with these low yields may have prompted some farmers to shift some or all of their resources to other crops, resulting in the decreased area harvested over the same period, while the dissemination of new disease-tolerant and high-yielding varieties is likely related to the increase in production and yield since 2006. However, the available data are insufficient to confirm these hypotheses.

Figure 2 illustrates these improved yields and the variation in yield estimates across different data sources.[a] Yields have increased and reached their highest levels over the past four years. Yield estimates for the year 2010 range from 2.4 MT/ha to 2.6 MT/ha. According to USDA FAS data, the average yield in 2012 is 2.9 MT/ha. Compared to the whole of Southeast Asia, average wheat yields in Bangladesh are high (2.9 MT/ha as compared to 1.76 MT/ha).[2] Increasing yields have allowed

[a] The primary data sources used here are USDA Foreign Agriculture Service (FAS) Production, Supply, and Distribution (PSD) data, FAOStat, and the Bangladesh Ministry of Agriculture (MOA). Discrepancies between these sources, as well as among other minor sources, exist. To the extent possible, these discrepancies will be noted in the text. The reader should be mindful that these variations exist. Data procurement methods may be one source of these variations. USDA FAS PSD data are collected by FAS agricultural attaches at the US Embassy in Dhaka, Bangladesh. FAOStat data are solicited using a survey distributed to the Ministry of Agriculture and Bureau of Statistics. Ministry of Agriculture data typically come from the Bureau of Statistics.

wheat production to keep pace with consumption trends, despite increased competition for land from crops like rice, maize, and potatoes.[3]

Figure 2: Yield Comparison

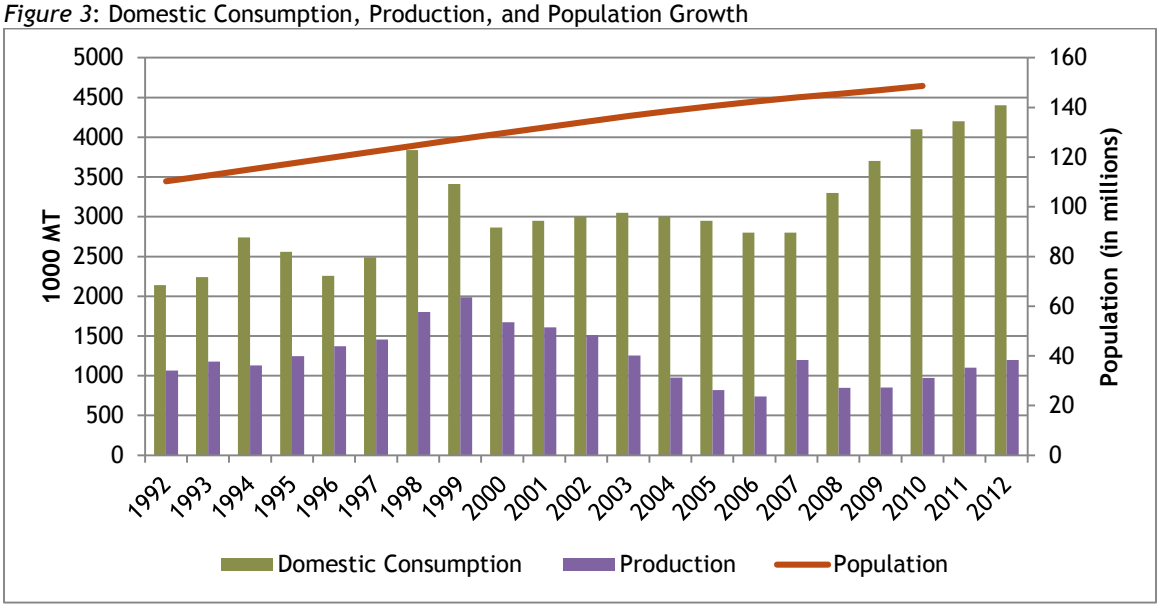


Source: USDA FAS, FAOStat, Bangladesh Ministry of Agriculture (MOA)
Note: Ministry of Agriculture data is presented in agriculture years (eg. 1990/1991). To present this comparison, data was assigned to the end date (eg. 1990/1991 is presented here as 1991).

Consumption Reached an All-time High in 2012

As seen in *Figure 3*, consumption of wheat has generally increased over the last 20 years. The period from 2007 to 2012 shows the greatest increase in wheat consumption; rising to an all-time high of 4,400,000 MT in 2012. According to USDA FAS, all wheat consumption in Bangladesh falls into the category of food, seed, and industrial consumption; no wheat is devoted to feed and residual consumption.

Figure 3: Domestic Consumption, Production, and Population Growth

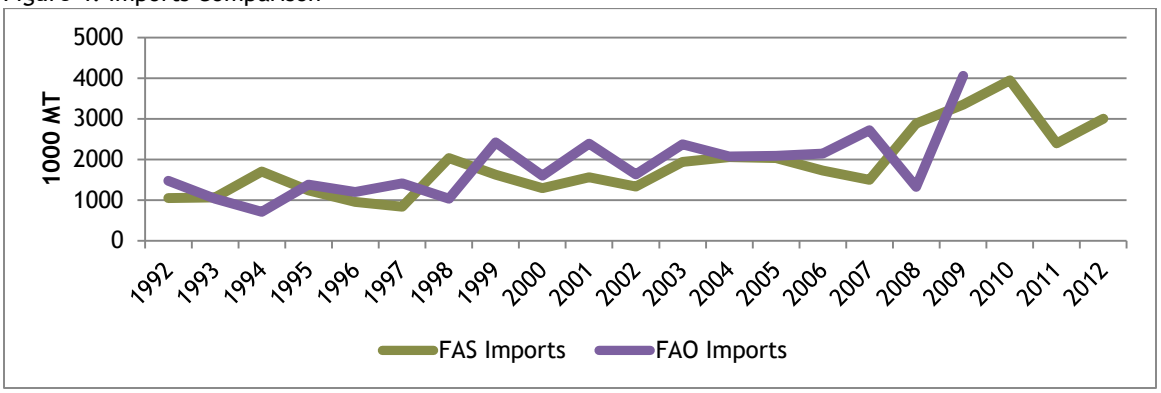


Source: USDA FAS; World Bank DataBank

Wheat Imports Have Increased 150% Since 2000 and are Concentrated in the Private Sector

Bangladesh is a net importer of wheat and does not produce any wheat for export. In 2011 imports comprised 69% of the total available wheat. A comparison of USDA FAS and FAO import data shows notable variations across estimates (see *Figure 4*). For example, USDA FAS reported imports of 2,882,000 MT in 2008, while FAO reported 1,331,000 MT. Still, both sources show an approximate 150% increase in imports from 2000 to 2009. Imports are most likely in the form of unprocessed wheat grain, but no definitive information could be found in the literature.

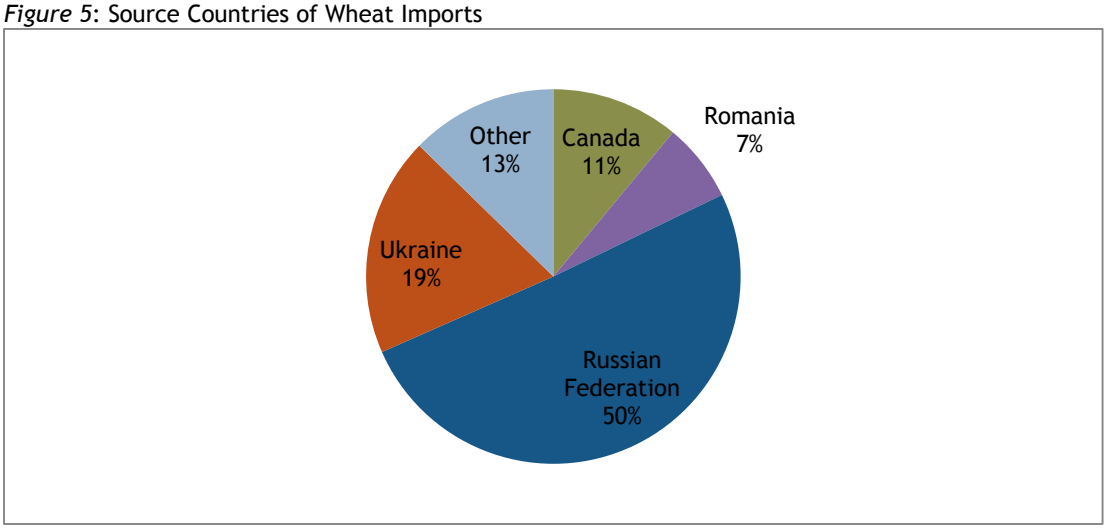
Figure 4: Imports Comparison



Source: USDA FAS, FAOStat

Figure 5 shows the breakdown of wheat imports by country of origin in 2007, the most recent data available from FAO. Lower quality wheat is imported from India, Russia and Ukraine, whereas higher quality wheat is supplied by Canada, Australia, and the United States.[5] Wheat imports are concentrated in the private sector, especially for higher quality wheat. Demand for higher quality wheat is increasing, making this a lucrative sector for private traders. Private traders import higher quality wheat to satisfy the increased demand from millers, bakers, and sweets manufacturers.[4] The government imports most low quality wheat, primarily for use in public food safety net programs.[5]

Figure 5: Source Countries of Wheat Imports



Source: FAOStat, 2007
Note: Other includes Australia, Bulgaria, China, Kazakhstan, Pakistan, Republic of Moldova, Turkey, and the United States.

Although wheat is imported duty free and under no quantitative restrictions, the wheat tendering process discourages widespread participation.[6] The Government of Bangladesh has recently begun implementing reforms to bring the tendering process more in line with international standards. These reforms include reducing the performance guarantee from 10 to 5 percent, increasing the maximum shipment period from 30 to 60 days, and increasing the minimum amount offered from 25,000 to 30,000 tons.[7]

Closer Examination of the Wheat Value Chain in Bangladesh

This section reviews the current literature about the following aspects of the wheat value chain: seed selection, credit, production, transportation and storage, milling, and sales.

Seed Selection

The National Agricultural Research System (NARS) is headed by the Bangladesh Agricultural Research Council (BARC) and is comprised of ten constituent units.[8] The Bangladesh Agricultural Research Institute (BARI) is the largest of these sub-units and carries out research on a number of crops, including wheat. BARI undertakes research to develop high yield variety wheat seeds, improved land use practices and extension services, and more widespread irrigation and input usage.[9]

The government distributes seed and other inputs through the Bangladesh Agricultural Development Corporation (BADC). Farmers obtain 15-20% of their wheat seed from the BADC; the remaining 80-85% is obtained via farmer exchange and seed preservation. Seed storage is a critical issue because a large percent of wheat seeds are obtained through informal channels. Depending on the method of storage, wheat seeds can be exposed to bacterial and fungal growths, which result in crop disease.[10] Biotic stresses that may affect wheat seed health in Bangladesh include Bipolaris Leaf Blight, leaf rust, black point, and head blight. The BARC lists the development of high yielding disease resistant varieties and early maturing and heat tolerant varieties as high research priorities for wheat.[11]

Baksh et al (2003) conducted a Participatory Rural Appraisal in Dinajpur in 2003 to investigate the wheat seed qualities desired for a participatory seed selection process.[12] Farmers prioritized high yields and easy threshability above input efficiency, large spike, bold grain, and white grain properties. Labor shortages and pre-monsoon rains during the wheat harvesting period influenced the importance of easy threshing.[13]

Although new high yield varieties (HYV) of wheat are being developed through BARI, the time it takes for these new varieties to move through the channels and reach the farmer is approximately five years.[14] Some research suggests that the adoption of HYV wheat is low; farmers lack sufficient knowledge about new varieties and current selection methods result in seed selection that is not sufficiently adapted to specific regional conditions.[15]

To reduce the timeline of seed development and to improve the selection process for HYV seeds, the Wheat Research Center at BARI began Participatory Varietal Selection (PVS) trials in 2002. The area under Kanchan (old variety) wheat cultivation in the trial region decreased from 100% in 2002 to 24% in 2005-2006, after the introduction of HYV varieties.[16] In these PVS trials the popularity of HYV seeds were so high that seed preservation rates increased substantially, resulting in increased availability of HYV seeds. The PVS trial distributed HYV seeds to only 20 farmers in 2002, but through the informal seed exchange channels 138 farmers were using HYVs by 2004. The trials also included seed production and preservation training for farmers. BARI continues to conduct PVS trials, as noted in their 2011-2012 research agenda.

Credit

Access to agricultural credit is managed through the government's Agricultural/Rural Credit Policy. This policy extends to all scheduled banks in the country, and includes NGO-Microfinance Institutions.[17] The estimated amount of credit available for wheat production for 2005/06 totaled 10,100 Tk (Bangladeshi taka) per acre of irrigated wheat and 8,550 Tk per acre for non-irrigated wheat.[18] In addition to accessing credit for irrigation, producers of irrigated wheat received more credit for labor than producers of non-irrigated wheat (2875 Tk/acre compared to 2275 Tk/acre), but less credit for land rental (1300 Tk/acre compared to 2025 Tk/acre). Access to credit was comparable across irrigated and non-irrigated wheat producers for other inputs. [b]

Based upon estimates of total production costs from a 2008/09 survey, this credit represents approximately 93% of the costs for irrigated wheat and 79% of the costs for non-irrigated wheat production, on average.[19] The disbursement of credit through this program was found to be significantly correlated with production levels of foodgrains.[20,c]

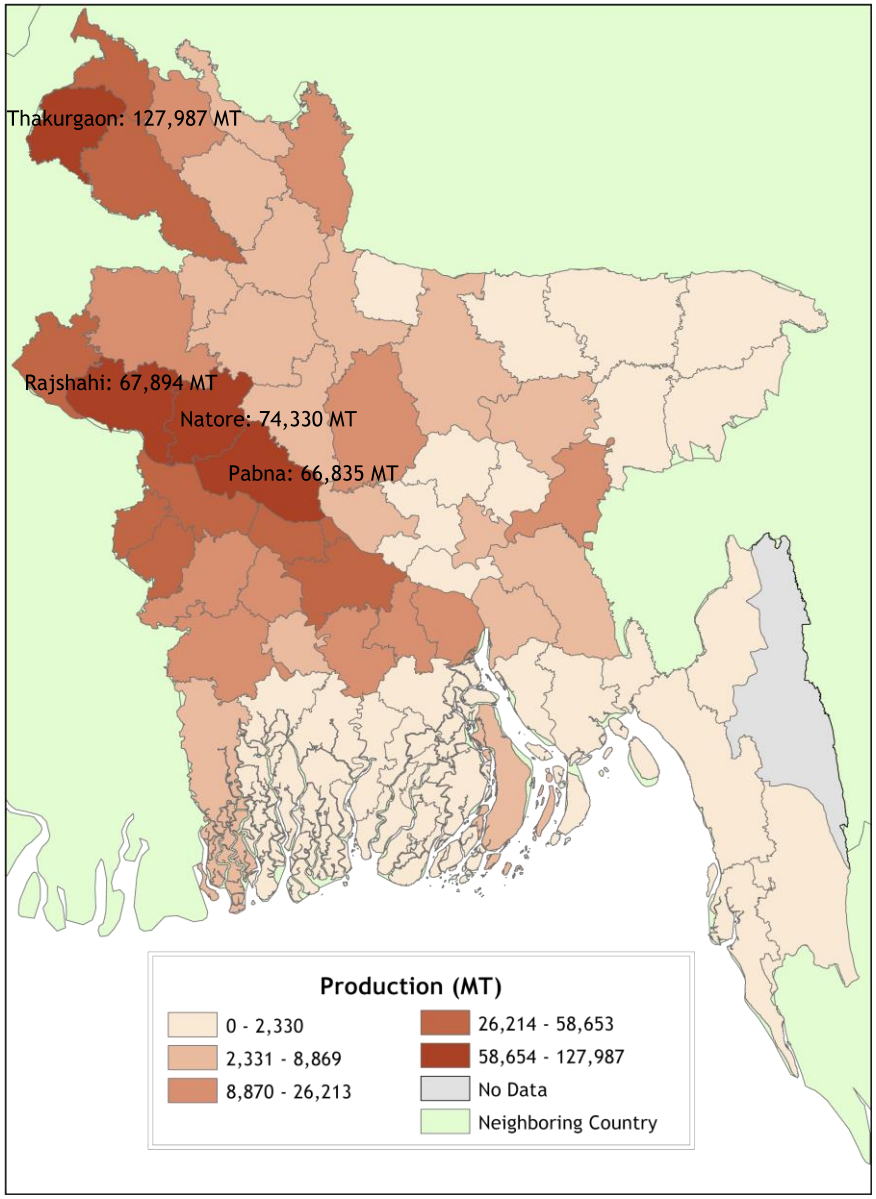
[b] On average, wheat farmers received 2250 Tk/acre for fertilizer, 625 Tk/acre for seed, 175 Tk/acre for pesticides, and 1350 Tk/acre for land preparation.

[c] t-value: 210.98

Production

According to the 2009 Agricultural Census, wheat cultivation is highest in Thakurgaon, Pabna, Natore, and Rajshahi districts. Other authors have identified the major wheat cultivating districts as Dinajpur, Rajshahi, and Jamalpur.[21]

Map 1: Top Wheat Cultivating Districts



Source: Bangladesh Bureau of Statistics

Overall, wheat comprised a relatively small portion of agricultural production in those households growing wheat. The 2009 Agricultural Census found that wheat cultivating households with landholdings between one and five acres devoted 3% of their landholdings to wheat cultivation, a slightly larger amount than those with less than one acre or more than five acres, where the portion of landholdings devoted to wheat averaged between 2 and 2.5%.[22]

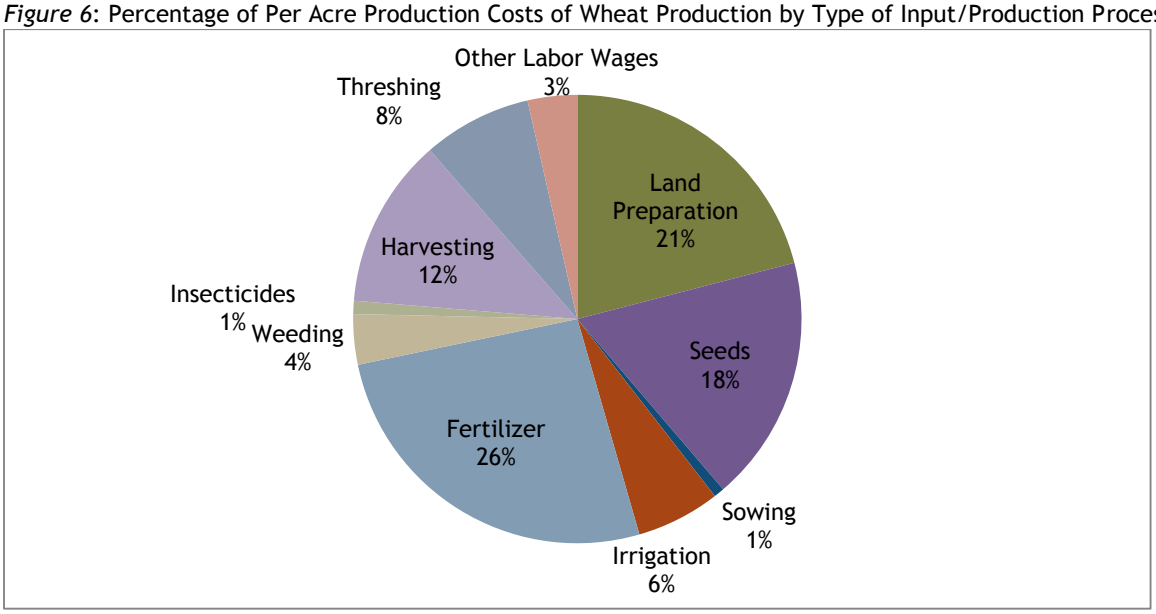
Inputs are Needed to Achieve Higher Yields

The Bangladesh Agricultural Research Council identifies wheat in Bangladesh as a low-input crop, needing very little fertilizer, inputs or irrigation; this is especially noticeable in comparison with rice, which requires significantly greater

levels of inputs and irrigation.[23] Although wheat can be cultivated under these low-input conditions, new seed varieties require an integrated package of inputs to achieve maximum yields. In a survey of 293 wheat-producing households randomly sampled from Dinajpur, Rajshahi, and Jamalpur, Rahman and Hasan (2008) found that 100% of households were using chemical fertilizers for wheat production. The Government of Bangladesh provides farmers with subsidies for fertilizer, irrigation, and other inputs for food crops.[24]

Based on a 2009 survey conducted by the government of Bangladesh of over 1800 farmers, *Figure 6* shows the breakdown of wheat production costs by type of input or production process. Fertilizer (2,836 Tk/acre), land preparation by power tiller (2,270 Tk/acre), and seeds (1,924 Tk/acre) represent the top three costs per acre for wheat production. Total cost per acre is approximately 10,829 Tk.[25,d]

Figure 6: Percentage of Per Acre Production Costs of Wheat Production by Type of Input/Production Process



Source: Bangladesh Bureau of Statistics (2009)

Yield Gaps Persist Despite Increased Adoption of High-Yielding Varieties

Yield gap is defined here as the difference between the potential and actual yields in farmer's environments, given the existing technologies and available inputs. The average yield gap in wheat cultivation estimated for 2006 in Bangladesh was 16%. This is a smaller gap than the earlier 2003-2004 estimate of 27% (2.56 t/ha compared to 1.87 t/ha).[26] Yield gaps for three of the top wheat cultivating districts are displayed in *Table 1*.

Table 1: Yield Gap in Three High Cultivating Districts, 2006

District	Yield Gap, t/ha	Percent
Dinajpur	1.23	17%
Rajshahi	1.22	17%
Jamalpur	0.89	16%

Source: Hasan and Islam (2010)

While overall adoption of HYVs remains low, HYVs are being used more widely and some studies suggest this uptake is contributing to the recent rise in yields and production.[27] Still, most plots are consistently not reaching their potential. Many farmers using HYV implement variations on the recommended packages of inputs and management practices, rather than the entire package.[28]

[d] The average wholesale price of wheat was 15658 Tk/MT in 2009 (exchange rate: 69 Tk/USD).

Hasan and Islam (2010) identified socioeconomic factors that had an effect on the yield gap. They found that farmers' education and wheat farming experience both had a significant effect on technical inefficiency.[e] Technical inefficiency decreased as either farmers' education or wheat farming experience increased. The authors concluded that investment in formal education and in wheat technology training will improve wheat yields and efficiency.[29]

Due to increasing competition from HYV rice and other crops, wheat is often cultivated on marginal lands, which feature lower soil quality and inadequate irrigation access.[30] These marginal lands, however, may be better suited for wheat cultivation, rather than crops such as rice that require reliable irrigation.[31] Kamruzzaman and Islam (2008) identified lighter soils in highly elevated areas with poor irrigation access as attractive lands for wheat cultivation.[f] These authors also found that previous wheat farming experience was a significant contributor to production efficiency in some cases.[g] In addition, the authors found that farmers who cultivated wheat in sandy loam soil had greater efficiency, as did farmers with frequent contact with extension workers.[h] Timing of sowing and harvesting were not significantly associated with yield gaps in this model.[i] Rahman and Hasan (2008) also found that technical efficiency increases with farm size.[32]

Environmental Considerations for Wheat Production

Wheat production in Bangladesh[j] has contributed to a number of environmental and natural resource management problems that lower agricultural productivity and threaten long-term regional food security, including physical and chemical deterioration of soil, leaching of agrochemicals into water, overuse of soil and groundwater resources and greenhouse gas emissions.[33,34,35] Zero tillage production systems have been shown to mitigate some of the environmental impact of wheat production in the region and have also been found to increase wheat yields compared to conventional tillage systems in Northeastern India.[36,37]

Climate change will affect global wheat production by changing temperatures and rates of precipitation. Several studies have predicted that South Asia will be one of the areas where agricultural yields will be most adversely affected by global warming.[38,39] A study on wheat production in Northern India and Bangladesh predicted that rising temperatures would reduce the amount of "ideally suited" wheat acreage by 51% in the year 2050.[40,k] A report by the government of Bangladesh predicted that climate change would increase the risk of flooding, tropical cyclones and adversely affect rice and wheat yields.[41]

The upcoming EPAR Brief No. 205 will discuss the environmental implications of wheat production in greater depth.[l]

Transportation and Storage

Because of the large import sector, transportation and storage of wheat is critical to the success of the wheat market in Bangladesh.[42] Transportation systems, however, are generally weak and grain is poorly distributed throughout the country, particularly from surplus areas and import hubs to high-need regions.[43]

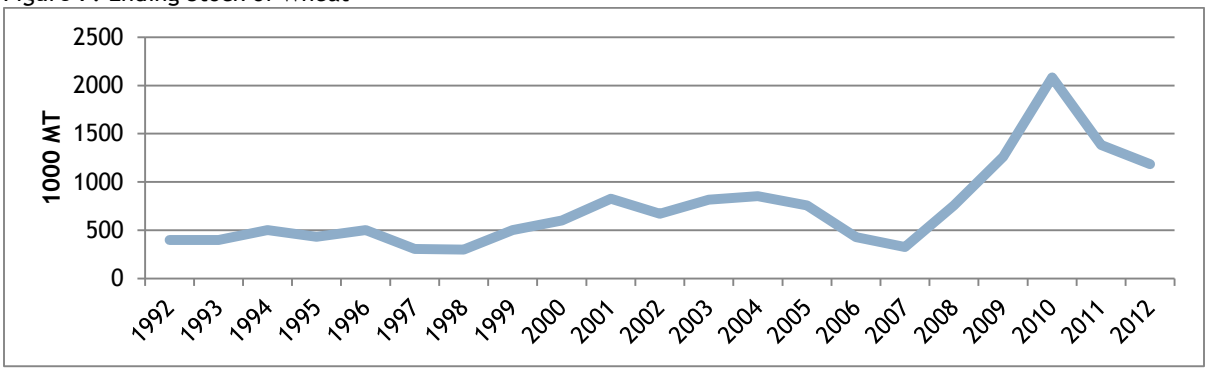
Storage is an integral part of the government's Public Foodgrains Distribution System (PFDS). Imported wheat used in the public distribution network is transported to the main silos, from the silos it is distributed to Central Storage Depots, Local Storage Depots, and Local Supply Depots.[44] Private traders rely on privately owned warehouses for storage. Relatively little is documented about these private systems.[45] Privately owned warehouses are concentrated in Chittagong and Naryanganj.[46]

Ending stocks are defined as the total quantity in all known storage facilities at the end of the 12-month market year. *Figure 7* shows ending stocks for wheat over the last 20 years. The low point in 2006/2007 corresponds with a dip in

[e] Farmers' education: significant at 1% level, t-statistic: -2.81; wheat farming experience: significant at 5% level, t-statistic: -1.98.
[f] Sample size: 60 farms across five villages in Dinajpur district.
[g] Wheat farming experience: significant at 1% level, t-statistic: -6.63
[h] Soil dummy: significant at 1% level, t-statistic: -2.45; frequency of extension contact: significant at 1% level, t-statistic: -2.63.
[i] Sowing: t-statistic: 0.80; harvesting: t-statistic: -0.16
[j] Research is primarily at the level of the Indo-Gangetic Plains, which stretches across Northern India and Bangladesh, bounded by Pakistan Punjab in the west and Bengal and Bangladesh in the east.
[k] The paper defines ideally suited wheat environments to be irrigated, low rainfall, relatively cool environments with high yield potential.
[l] EPAR Brief No. 114 (2010) includes more analysis about the impacts of climate change on wheat production, but is focused on Sub-Saharan Africa.

production and consumption of wheat. This low point corresponds with a global decline in grain stocks. The notable food price inflation seen from 2008-2010, especially in South Asia, is likely a result of this decline.[47]

Figure 7: Ending Stock of Wheat



Source: USDA FAS

Milling

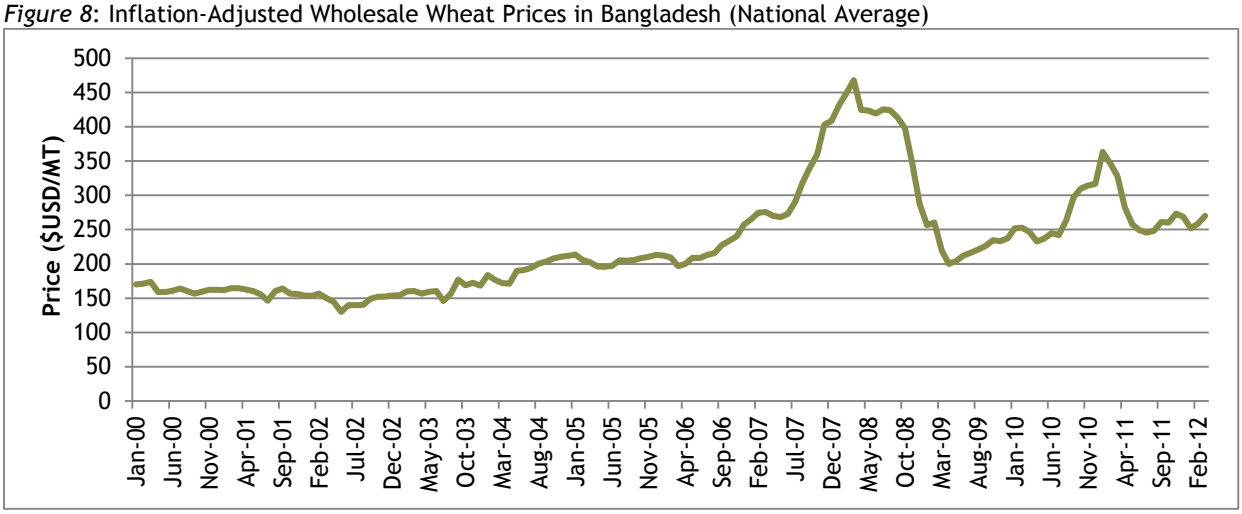
Unlike rice, wheat presents many intermediate processing opportunities to promote value-added and sector employment. The wheat market in Bangladesh has recently transitioned from being dominated by public distribution and simple processing, to featuring an increase in private imports and a multitude of millers and bakers.[48] Furthermore, consumption shifts among the middle to higher income urban population have increased demand for refined packaged flour. Similarly, growth in the bakery and biscuit industries has increased demand for refined flour. Millers are moving into this production market by producing refined flour that they package and market under their brand names.[49]

Wheat processing takes place in three different types of mills: compact mills, roller mills, and Atta Chakkas, or wheat crushers. Roller mills and Atta Chakkas can only produce course atta flour. There are approximately 3,000 roller mills in Bangladesh, and countless Atta Chakkas. Compact mills can produce fine atta, white flour, and by-products such as semolina, vermicelli, and bran. As of 2003, there were approximately 300 compact mills in the country, although this number has likely grown since then due to increasing demand for the end products.[50]

Sales

Current wholesale wheat prices in Bangladesh are US$270.20/MT as of March 2012 (see *Figure 8*). After an increase in late 2010 and early 2011, current prices have remained steady since April 2011. Wheat prices rose approximately 15% during the 2007-2008 food price inflation.[51] However, Bangladesh was the only country in South Asia to feature wheat prices in 2009 that were lower than pre-inflation prices in 2005-2007.[52]

Figure 8: Inflation-Adjusted Wholesale Wheat Prices in Bangladesh (National Average)



Source: FAO GIEWS Price Tool, http://www.fao.org/giews/pricetool/
Note: The base year for the CPIs is 2005.

Wheat prices in Bangladesh have been on average 30% greater than the international price over the past twelve years. During 2008-2009, wheat prices in Bangladesh were 50% higher than the international price. However, the difference between international and domestic prices has been decreasing over the last three years, averaging 7%, and the domestic price fell below the international price during 2011.

Table 2 provides a comparison of farm gate price of wheat with final wholesale and retail prices. Between 2005 and 2011 prices have varied significantly between the farm gate and the final market; some years show an increase in the price from farm to market, while other years show a decrease in price from farm to market. This variation is likely a reflection of fluctuations between urban and rural prices, changes in input prices, and changes in import prices, among other factors.

Table 2: Price Comparison Across the Value Chain

	Farm Gate Price, USD	Wholesale Price, USD	Retail Price, USD	Percent Change, Farm to Retail
FY2005	11.85	12.49	12.65	6.75
FY2006	13.88	13.90	14.37	3.53
FY2007	18.12	17.35	17.50	-3.42
FY2008	28.89	27.03	27.83	-3.67
FY2009	14.49	20.92	22.24	53.49
FY2010	17.27	16.28	16.90	-2.14
FY2011 (December 2010)	20.76	23.65	26.50	27.65

Source: ADB, Food Price Escalation in South Asia- A Serious and Growing Concern

The government of Bangladesh also procures wheat to channel through the Public Foodgrains Distribution System (PFDS). The PFDS includes both monetized and non-monetized channels. The FY2011-2012 budget allocated 332,000 tons of wheat for the monetized channels and 526,000 tons for the non-monetized channels.[53] This allocation follows a continued decrease in government-distributed wheat. These programs influence the consumption patterns of wheat; decreasing PFDS distribution leads to a decrease in wheat consumption among lower income and rural populations. However, wheat consumption among medium to high-income populations is increasing due to shifts in dietary habits and preferences.[54]

Consumption of Wheat in Bangladesh

Wheat is a Good Source of Protein and Other Nutrients, but Nutritional Content is Highly Variable

There are three major types of wheat: bread, durum, and emmer.[55,56] Bread wheat (*Triticum aestivum*) is commonly used in leavened and unleavened breads, noodles, cookies, and cakes. Durum wheat (*Triticum turgidum durum*) is more common in semolina and pasta. Due to its smaller size and weight, bread wheat can be broken into a finer flour and has a softer

texture, making it popular in agro-industries.[57] Emmer wheat is the wild progenitor of the domesticated durum and bread wheat varieties.[58]

Table 3 shows how the nutritional composition of wheat compares to other cereals. Whole wheat has the highest protein level and contains more iron, riboflavin, and niacin than rice or maize. *Table 3* also demonstrates the negative relationship between nutrient content and the degree of milling, with less processed cereals retaining more nutrients. White wheat flour does not contain most of the germ and outer layers that contain some of the protein and the majority of B vitamins and other nutrients.[59] The degree of wheat processing also has a significantly negative effect on antioxidant content and bioavailability; consumption of whole-grain wheat has been associated with a reduced risk for several chronic diseases due to those antioxidant properties and insoluble fiber content.[60]

Table 3: Nutritional Composition of Wheat Relative to Selected Cereals (per 100 grams)

Food	Energy (kcal)	Protein (g)	Fat (g)	Calcium (mg)	Iron (mg)	Thiamine (mg)	Riboflavin (mg)	Niacin (mg)
Wheat, whole	323	12.6	1.8	36	4.0	0.30	0.07	5.0
Wheat flour, white	341	9.4	1.3	15	1.5	0.10	0.03	0.7
Maize flour, whole	353	9.3	3.8	10	2.5	0.30	0.10	1.8
Maize flour, refined	368	9.4	1.0	3	1.3	0.26	0.08	0.1
Rice, brown	362	7.9	2.7	33	1.8	0.41	0.04	4.3
Sorghum*	337	10.6	3.2	26	4.3	0.36	0.15	3.8
Millet, pearl	363	11.8	4.8	42	11.0	0.38	0.21	2.8

Sources: Latham, 1997; EPAR, 2010; White and Broadley, 2009
*Reported values are the average of estimates from two or more sources.

In addition to the degree of processing, several other factors contribute to the high variability of nutritional content across different types and strains of wheat. Varieties of emmer wheat generally have higher grain mineral concentrations than durum or bread varieties (see *Table 4*).

Table 4: Variability Across Nutritional Composition of Different Types and Varieties of Wheat (per 100 grams)

Type	Number of Varieties Included	Protein (g)	Iron (mg)	Zinc (mg)
Bread	197	n/a	2.4-5.7	1.4-5.3
Durum	2 in both wet and dry conditions (N=4)	14.9-18.4	2.9-4.7	4.9-5.6
Emmer	22 in both wet and dry conditions (N=44)	16.4-38.2	4.8-8.8	6.9-13.9

Sources: White and Broadley, 2009; Peleg et. al, 2008

There is also evidence that the adoption of modern, higher-yielding varieties and/or agronomic practices can reduce the nutritional content of wheat.[61] In both bread and durum wheat varieties, a negative relationship has been observed between nutritional content and grain yields, although the strength of the relationship has depended greatly on environmental factors such as water availability. Nutritional quality is also affected by the micronutrient quality of the soil.[62] Finally, tradeoffs can exist between nutritional content and consumer desirability in the absence of strong nutrition education programs. For example, white wheat flour is often preferred by consumers, but increasing beta-carotene levels will turn white varieties to a yellow-orange color, which may lower uptake of the fortified wheat.[63]

Ongoing research is being conducted to increase the nutritional content of wheat, along with other cereals. CIMMYT (2011) is working to explore and identify new traits of nutritional significance, develop low-cost phenotypic and genetic screening for those traits, breed crops with higher protein and micronutrient quantity and quality, and promote biofortified wheat in India and Pakistan through the HarvestPlus program. The wheat component of the HarvestPlus program is focused on increasing its iron and zinc content, and is targeting areas with high per capita wheat consumption levels.[64] Other nutritional qualities of wheat are also being studied as potential targets, including increased levels of bran, soluble and

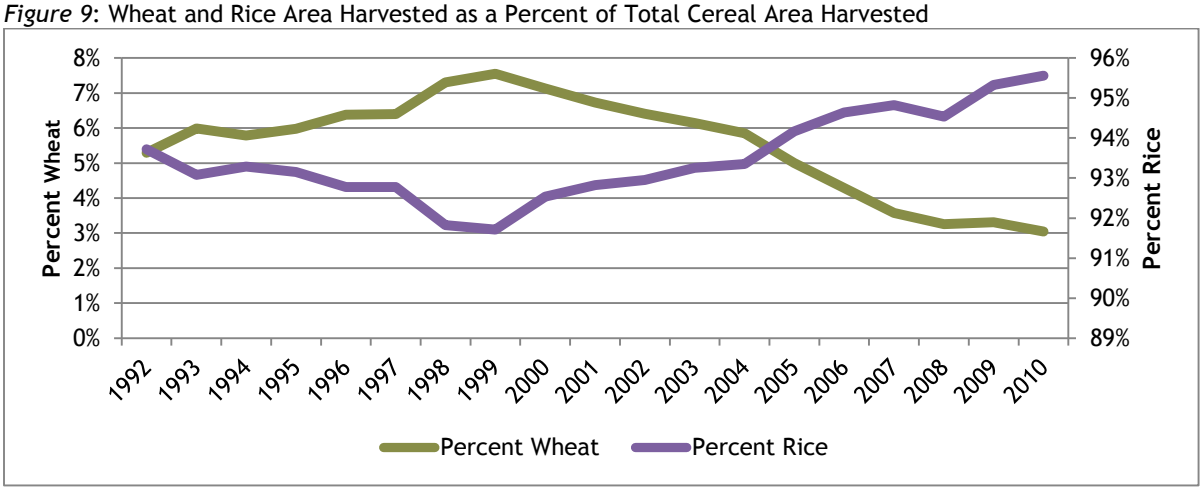
insoluble fiber, and high-amylose starch. In addition to biofortification efforts, the bioavailability of iron from wheat can be improved through the adoption of processing techniques such as removal of the phytate-rich hull or by combining wheat with foods containing ascorbic acid.[65]

Rice is the Most Important Substitute Grain in Production

The most important substitute crops for wheat farmers include rice, corn, potatoes, and winter vegetables.[66] As high yielding varieties of these crops become increasingly available, their competition for productive land with wheat increases; this is especially true if high yielding varieties of wheat are not available or suitable in a particular area. Furthermore, because of the high demand from the feed industry, farmers are substituting corn for their wheat crops. Wheat imports also are a major competitor limiting domestic wheat production.[67] Similarly, as more farmers choose to cultivate substitute crops, the increasing demand for wheat will produce an even greater reliance on imports. As a result of all these factors, farmers are increasingly choosing to plant substitute crops rather than cultivating wheat.

Rice is the most important crop and food grain in the country; the highest quality land is devoted to rice cultivation because rice is more sensitive to the growing conditions than wheat. In comparison to rice, wheat is cultivated on a very small percentage of land; over the past 20 years, rice has been cultivated on an average of 93.5% of the total cereal area harvested, compared to only 5.5% for wheat.[68] *Figure 9* also demonstrates the likely competition wheat faces with rice; as wheat harvested area decreased, rice saw a reciprocal increase.

Figure 9: Wheat and Rice Area Harvested as a Percent of Total Cereal Area Harvested



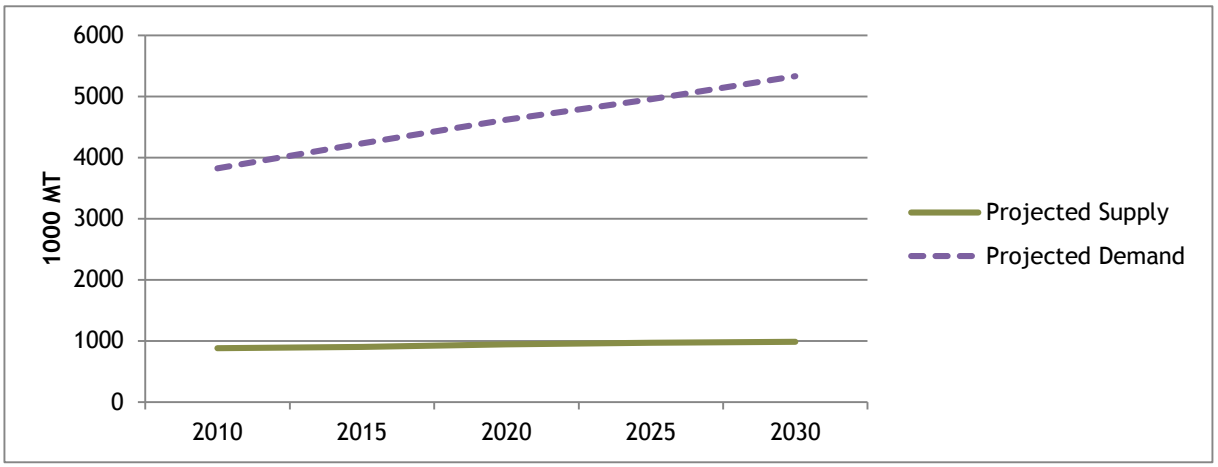
Source: FAOStat

Bangladesh Projects a Wide and Growing Wheat Deficit

Current demand for wheat in Bangladesh far exceeds domestic supply and the gap is expected to become more severe moving toward 2030 (see *Figure 10*).[m] From 2010-2030, wheat demand in Bangladesh is expected to grow by 39%, from 3.8 million tons to 5.3 million tons. Over the same period, wheat supply is expected to grow by only 12%, from roughly 880 thousand tons to 980 thousand tons. In the year 2015, the projected gap between supply and demand is expected to be over 3 million tons. By 2030, the gap is projected to grow to over 4 million tons.

[m] These estimates are based on the IFPRI IMPACT model, which examines future scenarios for global food supply, demand, trade, prices, and food security for 30 commodities. It is specified as a set of 115 country-level supply and demand equations where each country model is linked to the rest of the world through trade. FAO data from the year 2000 is the input data for the projection model. More information on model methodology is available at http://www.ifpri.org/book-751/ourwork/program/impact-model

Figure 10: Projected Supply and Demand in Bangladesh through 2030



Source: IFPRI IMPACT Projections

Please direct comments or questions about this research to Leigh Anderson and Mary Kay Gugerty, at eparx@u.washington.edu.

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