

Adoption of Unapproved Varieties of Bt Cotton in Pakistan: Impact on Production and Trade

By

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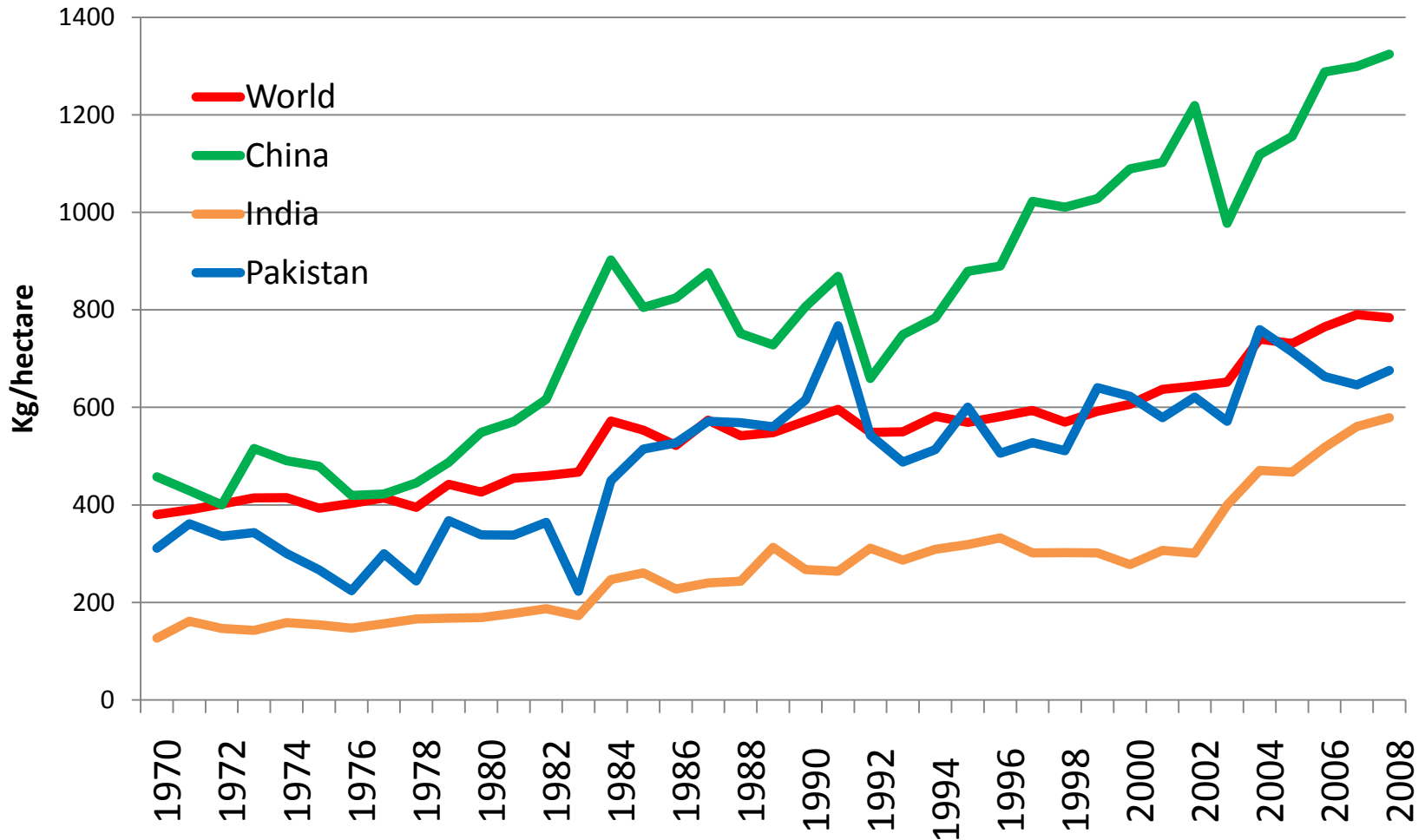
Plan of Presentation

- Background
- Why unapproved Bt cotton in Pakistan
- Bt cotton survey 2009
- Conclusions and direction for future research

Importance of Cotton for Pakistan

- 4th largest producer
- 3rd largest consumer
- Cotton and textiles contribute
 - 10% to GDP
 - 21% to employment
 - 60% to export earnings (yarn and finished textile products)
- Cotton farmers' problem
 - high fluctuations in yield (pest infestation)
 - high cost of production (38% on plant protection)

Yield per hectare in Selected Countries



GM cotton is considered a solution to farmer's problem

- GM cotton is obtained by inserting the gene of soil born bacterium *Bacillus thuringiensis* (Bt) into cotton seed. This gene produces Cry protein that is harmful to the larvae of moths and butterflies, beetles, and flies
- Cost advantages
 - Reduces the number of sprays => Reduces pesticide expenditure
 - Labor saving
- Yield advantages
- Higher profitability than conventional varieties
 - Despite higher price of seed
- Health and environmental advantages
 - Lower exposure to hazardous pesticides

Comparison of cost and yield between Bt and non-Bt varieties in China and India

	Diff in number of pesticide sprays	Percentage difference in Bt and non-Bt varieties				Gross margin (rev-cost) (US\$/ha)	
		Pesticide cost	Seed cost	Total cost	Yield	Bt	Non Bt
China (2001)	--	-58.1	333.3	-27.5	10.9	277	-225
India (2006)							
Gujrat	--	--	136.8	13.7	35.4	713	405
Maharashtra	-1.9	-21.3	192.4	36.5	46.3	503	318
Andhra Pradesh	-3.8	-25.8	173.1	5.6	44.6	418	121
Tamil Nadu	-2.0	-54.5	237.0	13.7	28.5	339	128

Bt Cotton in Pakistan

- Cotton is grown in two provinces: Punjab (80%), Sindh (20%)
- Private breeders developed Bt type varieties by using Monsanto's transforming event MON531 (Bollgard)
- PARC conducted a detailed scientific survey in 2008
 - 50% of the cotton growing area in Punjab and 80% in Sindh was under these **unapproved** Bt type varieties
 - 39 **unapproved** varieties of Bt cotton were under cultivation.
 - 10% of the sample in Punjab and 19% in Sindh were **not positive** for the Cry protein
 - **Variation** in intensity of protein expression from high concentration to low
 - **Non-uniform** plant population
- ⇒ variable and unknown quality of seed – seed mixing – spurious seed

Why Unapproved Bt Cotton?

- Slow progress in agricultural biotech research (initiated in 1981)
 - Mainly 2 public institutions and many private breeders are involved
 - Weak research infrastructure
 - Weak institutional support
 - Lack of coordination
- Lack of political will to adopt biotechnology (slow progress in the legislation process)
 - Convention on Biodiversity (CBD) was signed in 1992
 - Cartagena Protocol on Biosafety was signed in 2001 but not ratified until 2009
 - Biosafety guidelines and the rules approved in April 2005
 - An independent body, the Intellectual Property Organization - Pakistan (IPOP) has been formed in 2005
 - Amendments in the Plant Breeders' Right Act and Seed Act are still awaiting approval from the parliament

Current Situation

- For the approval of a GM variety, a three tier system is introduced
 - Institutional biosafety committee (IBC), Technical advisory committee (TAC), National biosafety committee (NBC)
 - Variety → IBC → TAC → NBC → IPOP → NBC → field trials
- No variety was submitted to NBC for approval until 2008
 - Fear of infringement of Monsanto's patent rights
 - Fear of law suit and trade sanctions if infringement is found
- The GoP recently approved the field trials for six Bt cotton varieties and allowed the import of hybrid seed from India and China for field trials
- The commercial Bt seed is expected to be available for the 2010-11 planting season

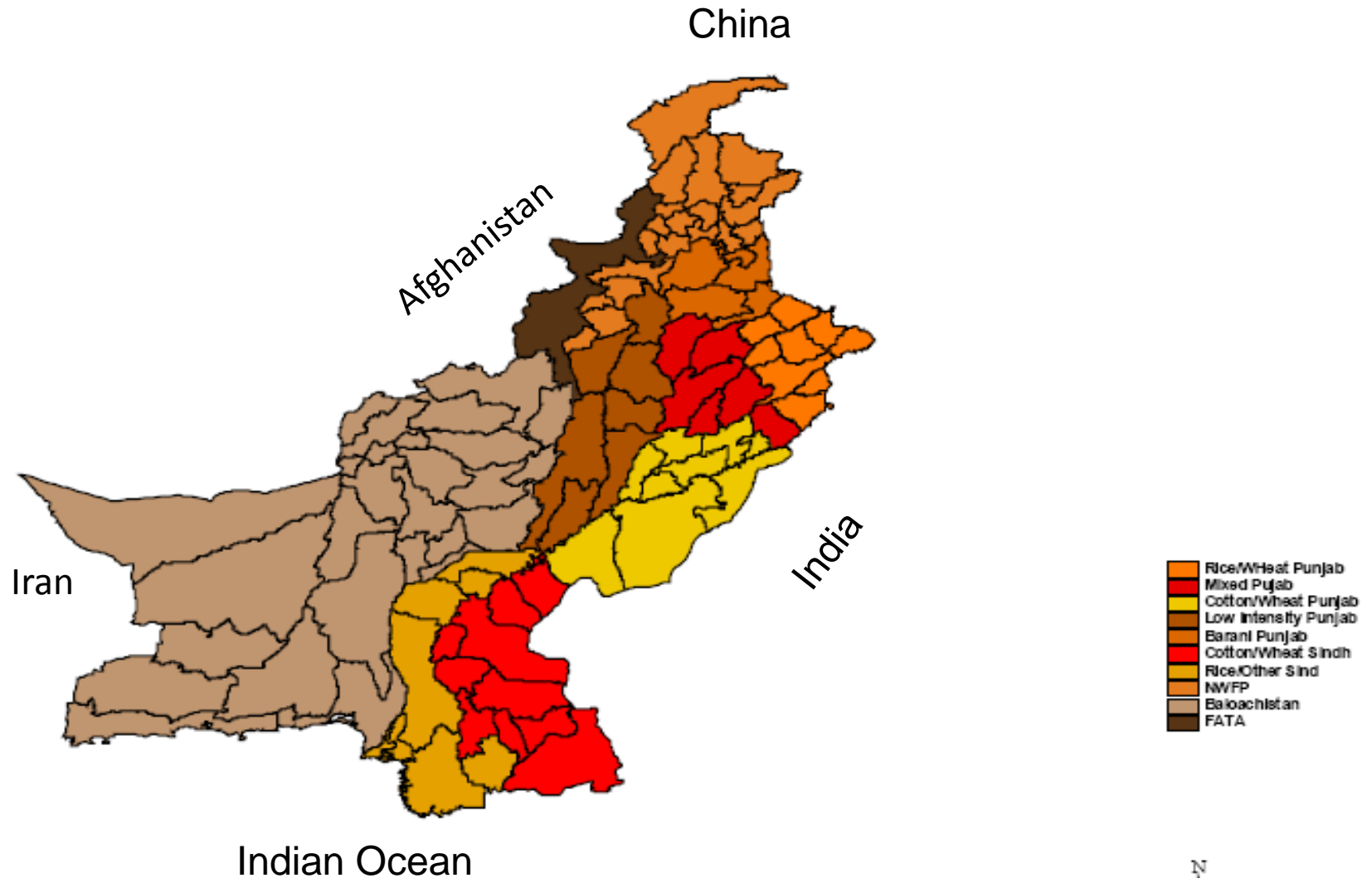
Issues Raised in Public Debate

- IPR
- Technical issues
 - Bt varieties are ineffective for sucking pests (CLCV)
 - Lack of awareness about the use of biotechnology
- Market issues
 - Uncertain seed quality
 - Inefficient seed pricing
 - Confidence of farmers on approved varieties
 - Impact on textile sector (quality of fiber)
- Social issues
 - Uneven distribution of benefits (raised by NGOs)
 - Issue of food security (long duration)

Bt Cotton Survey 2009

- PARC (2008) survey examined the presence/absence of Cry protein in the existing Bt varieties
- PARC survey did not collect information on the economic performance of these varieties in Pakistan
- Bt Cotton Survey 2009 aims to examine the economic impact of the unapproved Bt varieties on cost of production, yield and gross margin in Pakistan

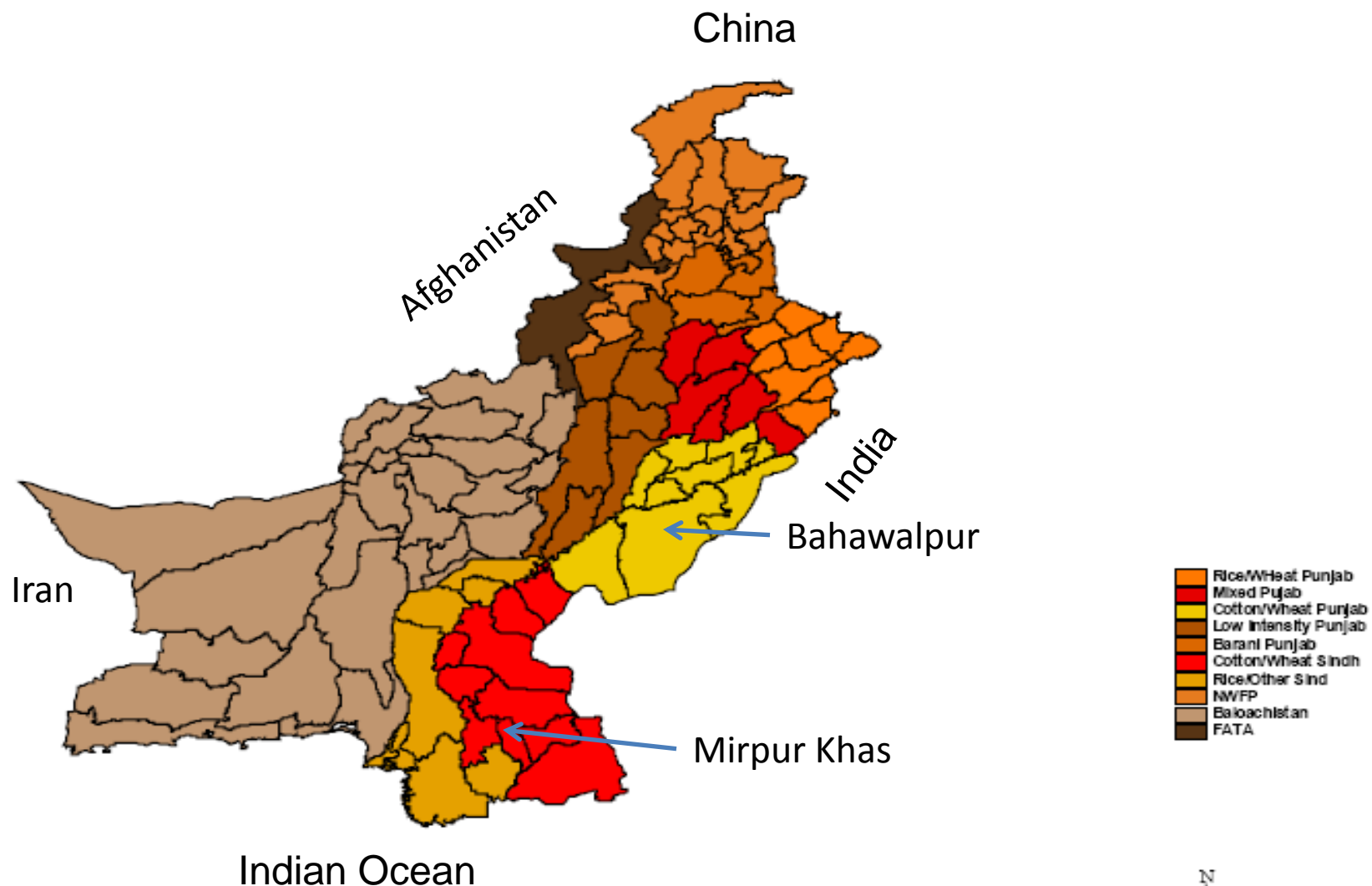
Agro-climatic Zones of Pakistan



Sample Selection Methodology

- The selected sample is drawn from the existing sampling frame of the Pakistan Rural Household Survey (PRHS) (2 rounds)
 - 4 cotton growing districts in 2 provinces
- One district selected from each province based on the share of cotton production in the province (Bahawalpur in Punjab and Mirpur Khas in Sindh)
 - 16 villages, 208 cotton farmers
- Survey conducted during February-March 2009 (difficult security situation)
- How representative are these districts of cotton growing areas

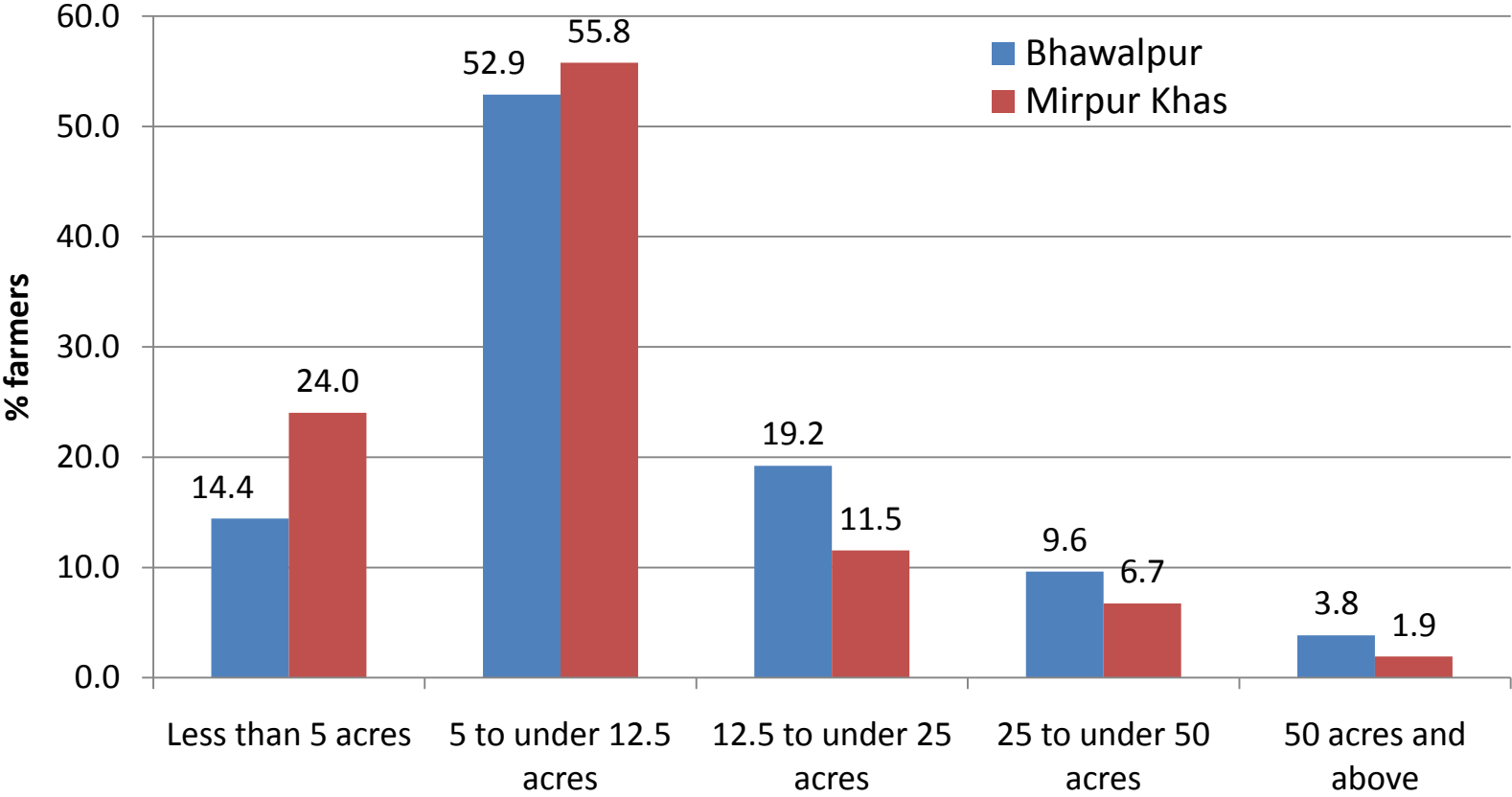
Selected Sample – Bt Cotton Survey 2009



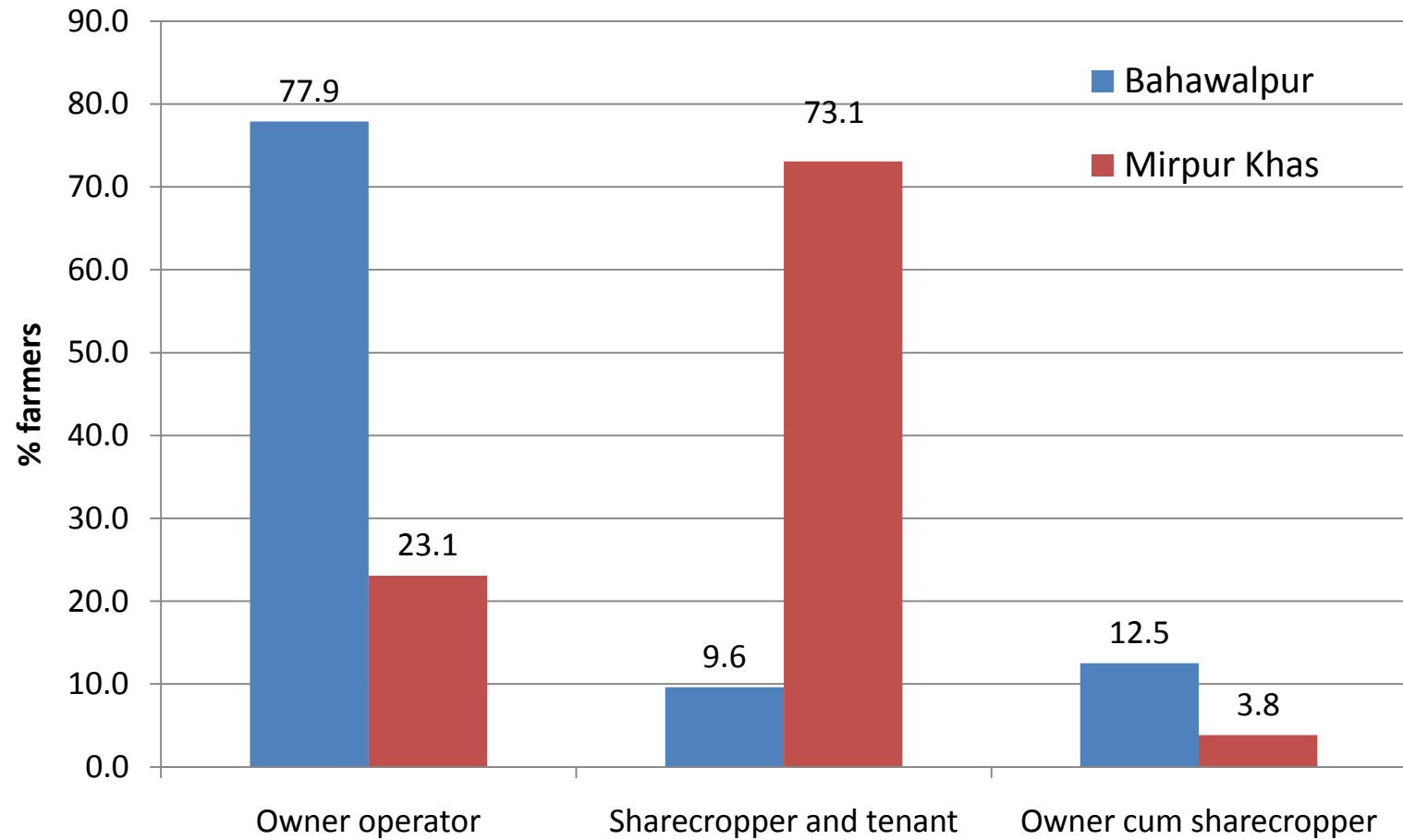
Basic Facts – Selected Sample

	CW-Punjab	CW -Sindh
Incidence of poverty (%)	55.51	56.81
% of rural population	17.47	11.20
% of rural poor	20.13	13.21
	Bahawalpur	Mirpur Khas
Development Rank	64/100	65/100
Weather	Hot and dry	Hot and humid
Soil quality	Sandy	Clay
Average distance (in km) between selected villages and major facilities		
Distance to seed/fertilizer/pesticide shop	15	12
Distance to ZTBL	18	17
Distance to nearest clinic/dispensary	3	5
Distance to secondary girls school	13	11
Distance to secondary boys school	11	9

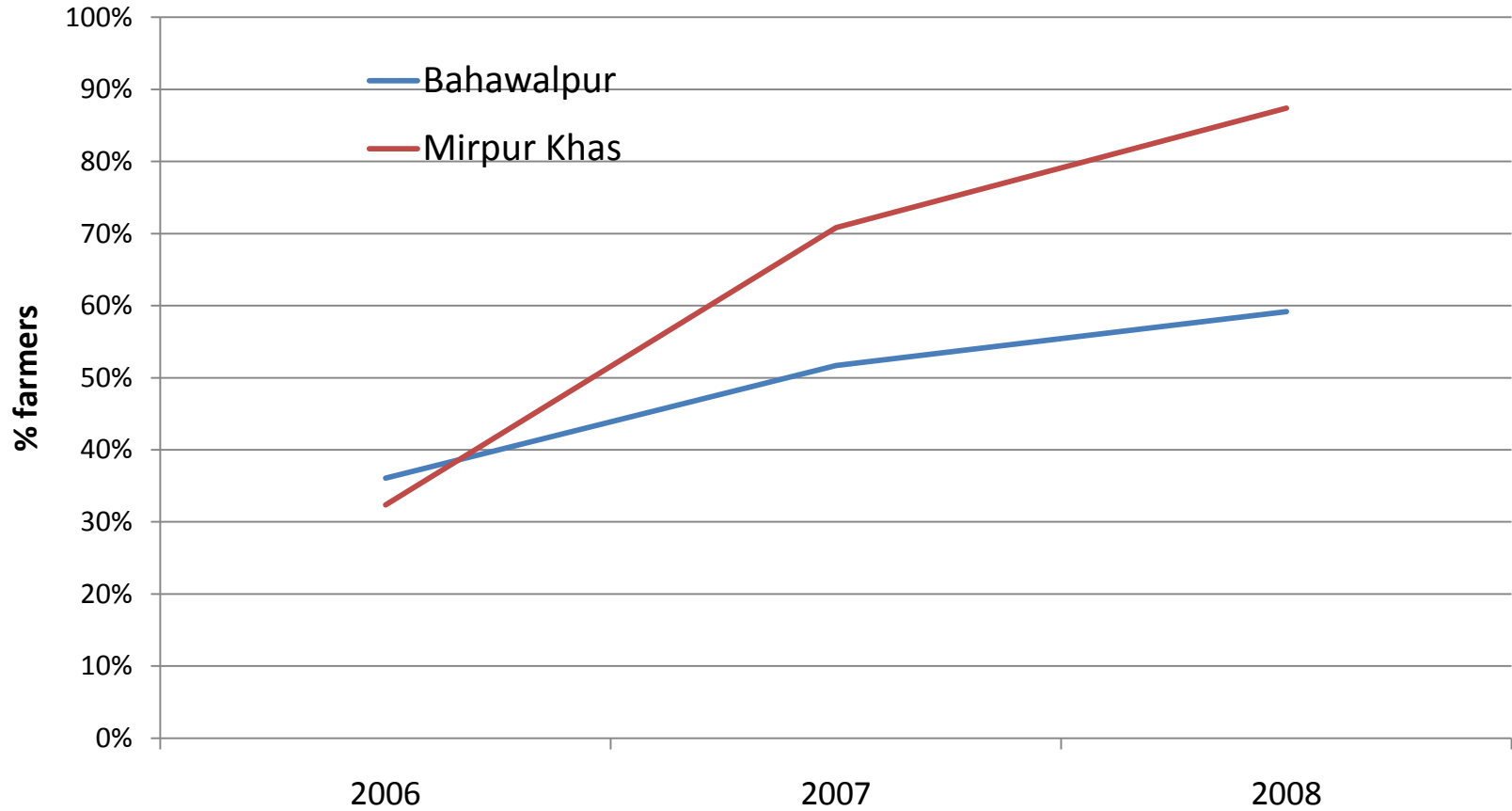
Percentage Distribution of Farmers by Operated Land



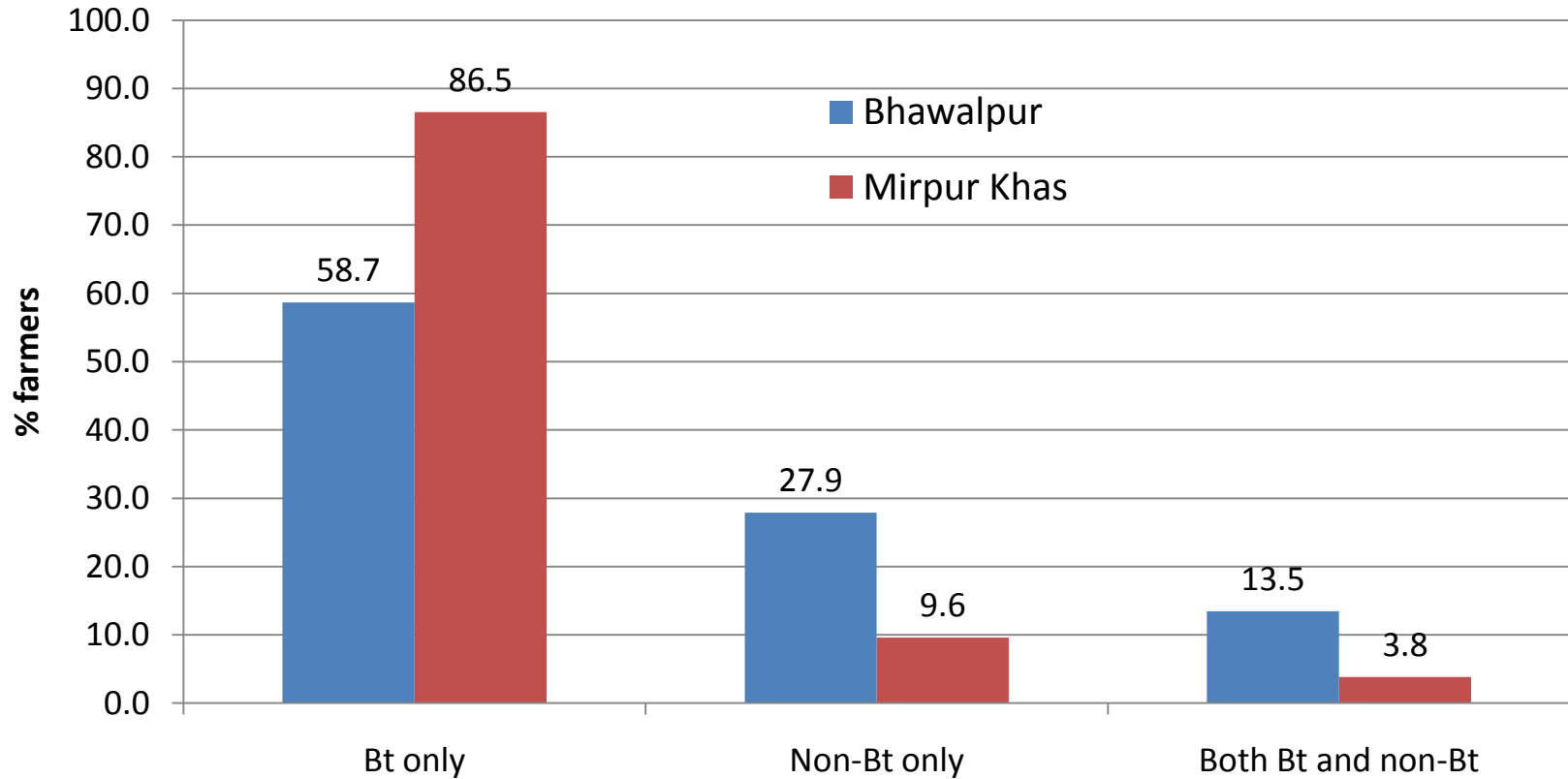
Type of Tenure



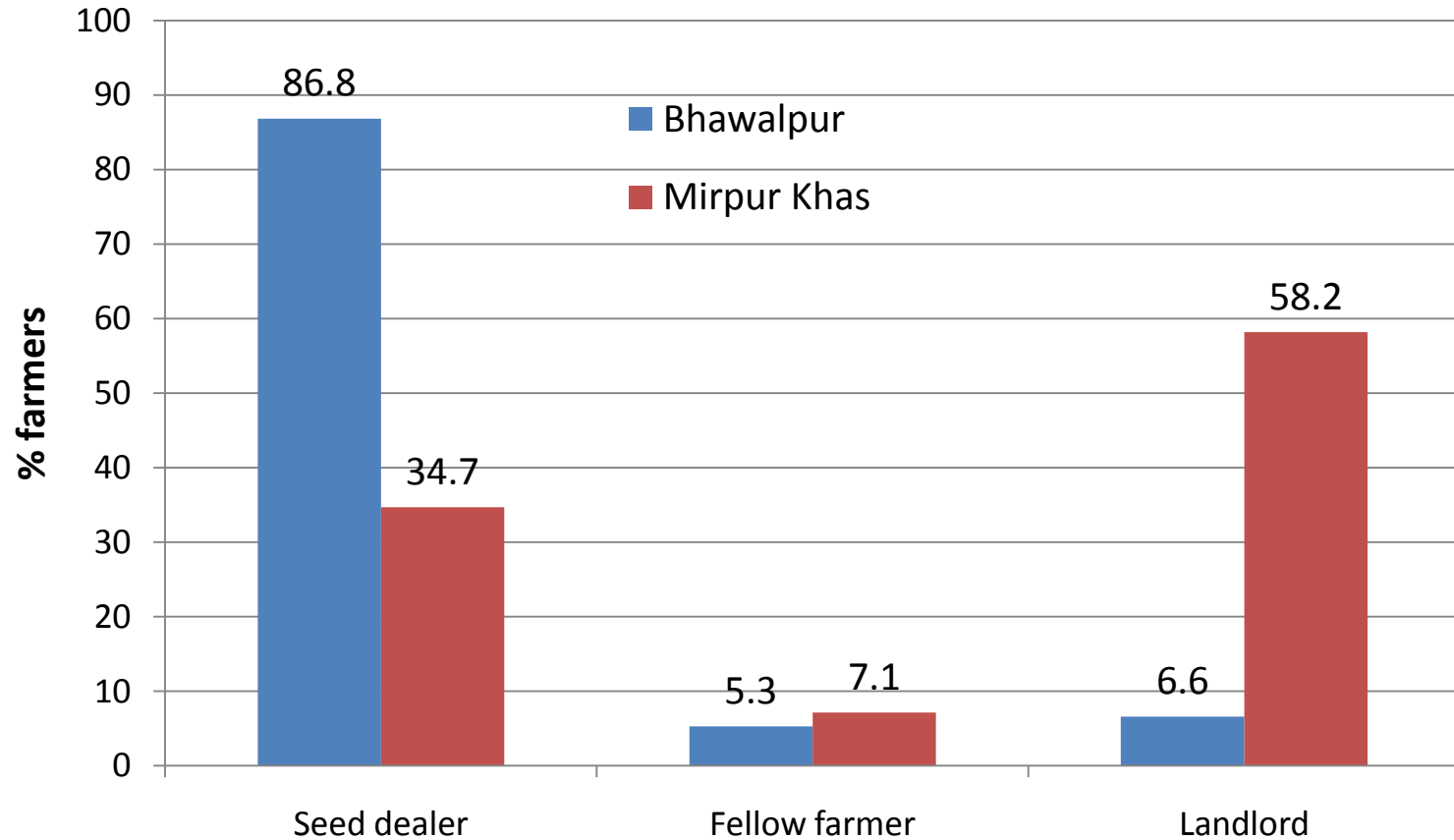
Adoption of Bt Cotton



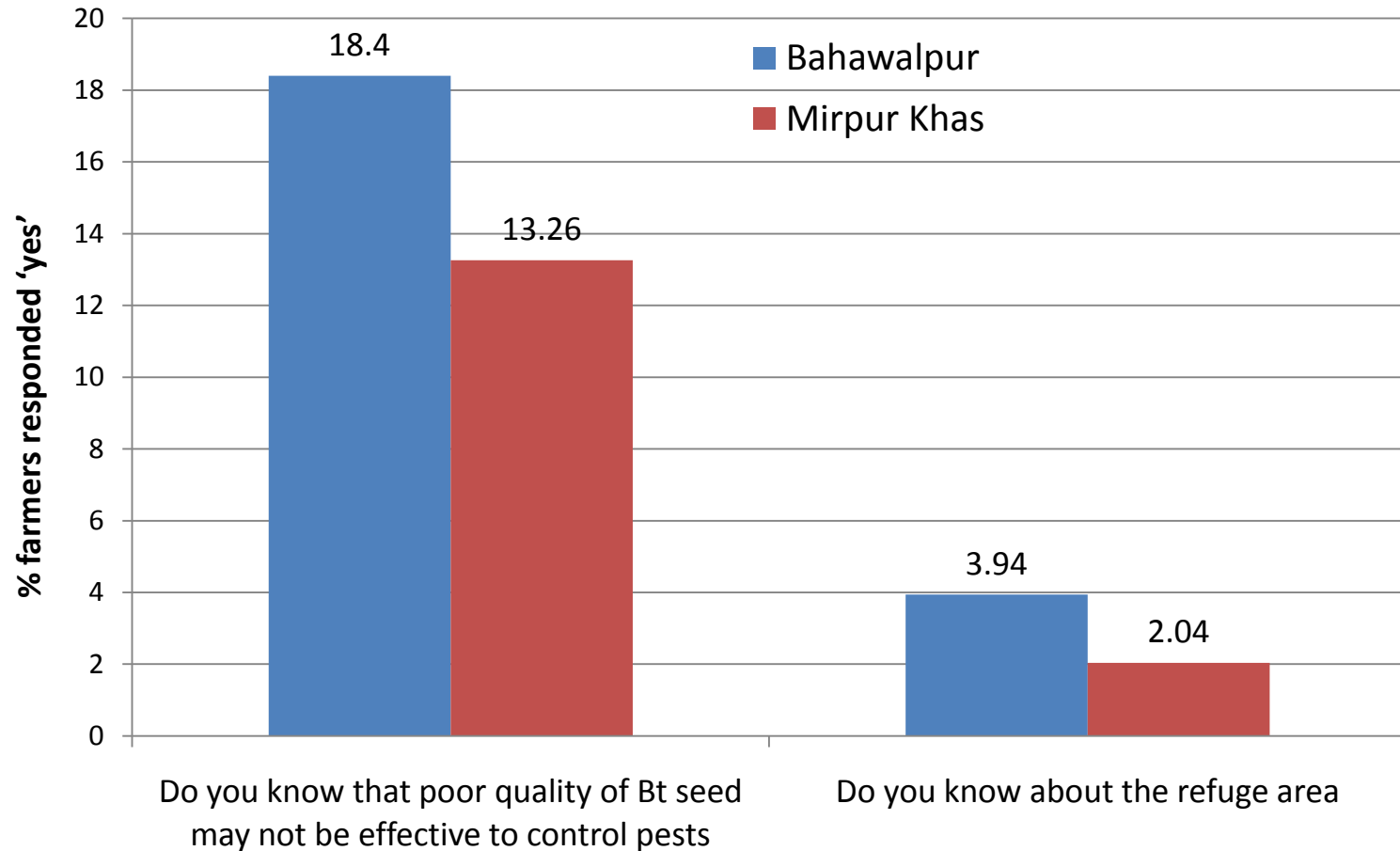
Type of Cotton Grown



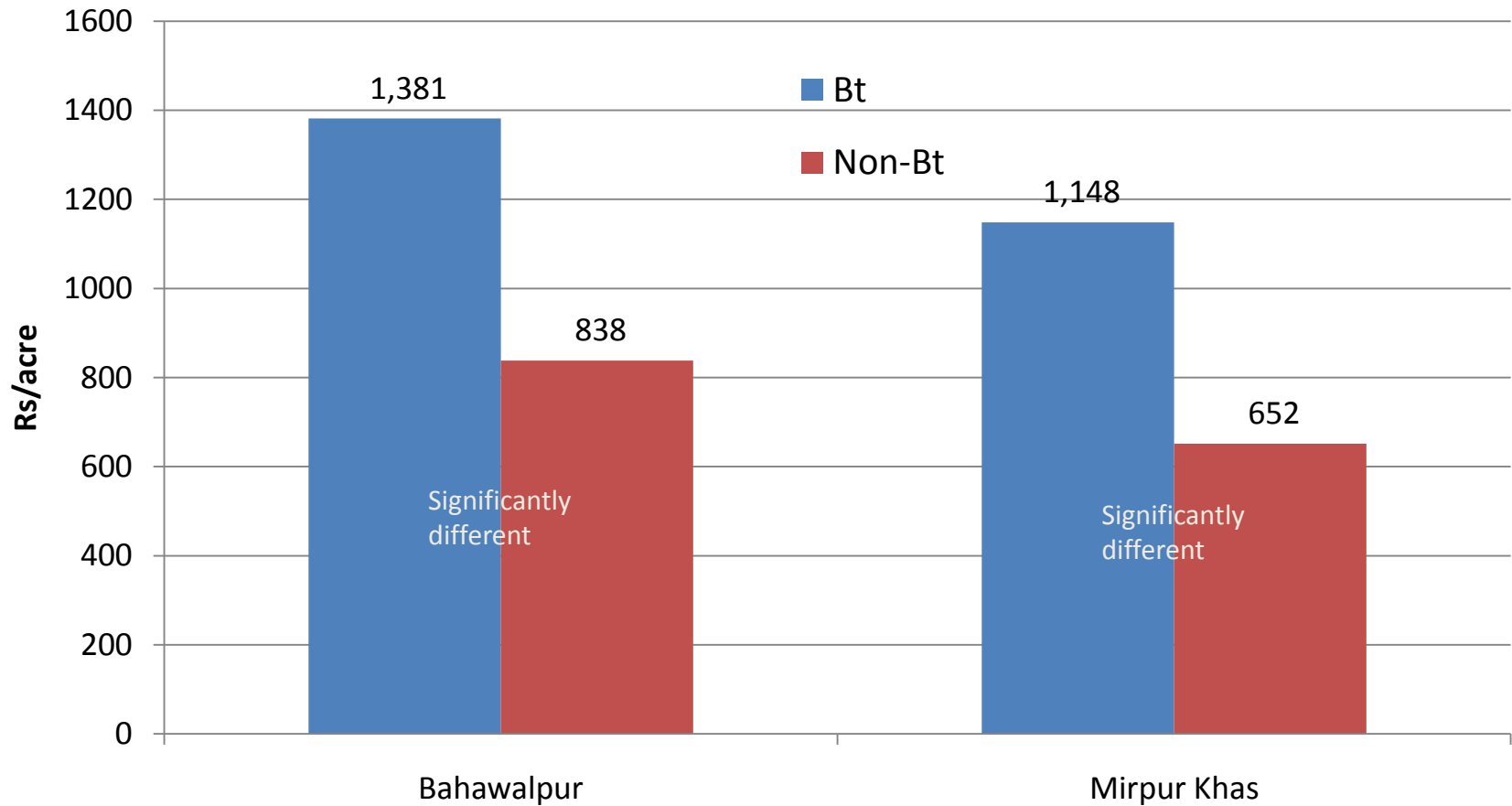
Sources of Bt Cotton Seed



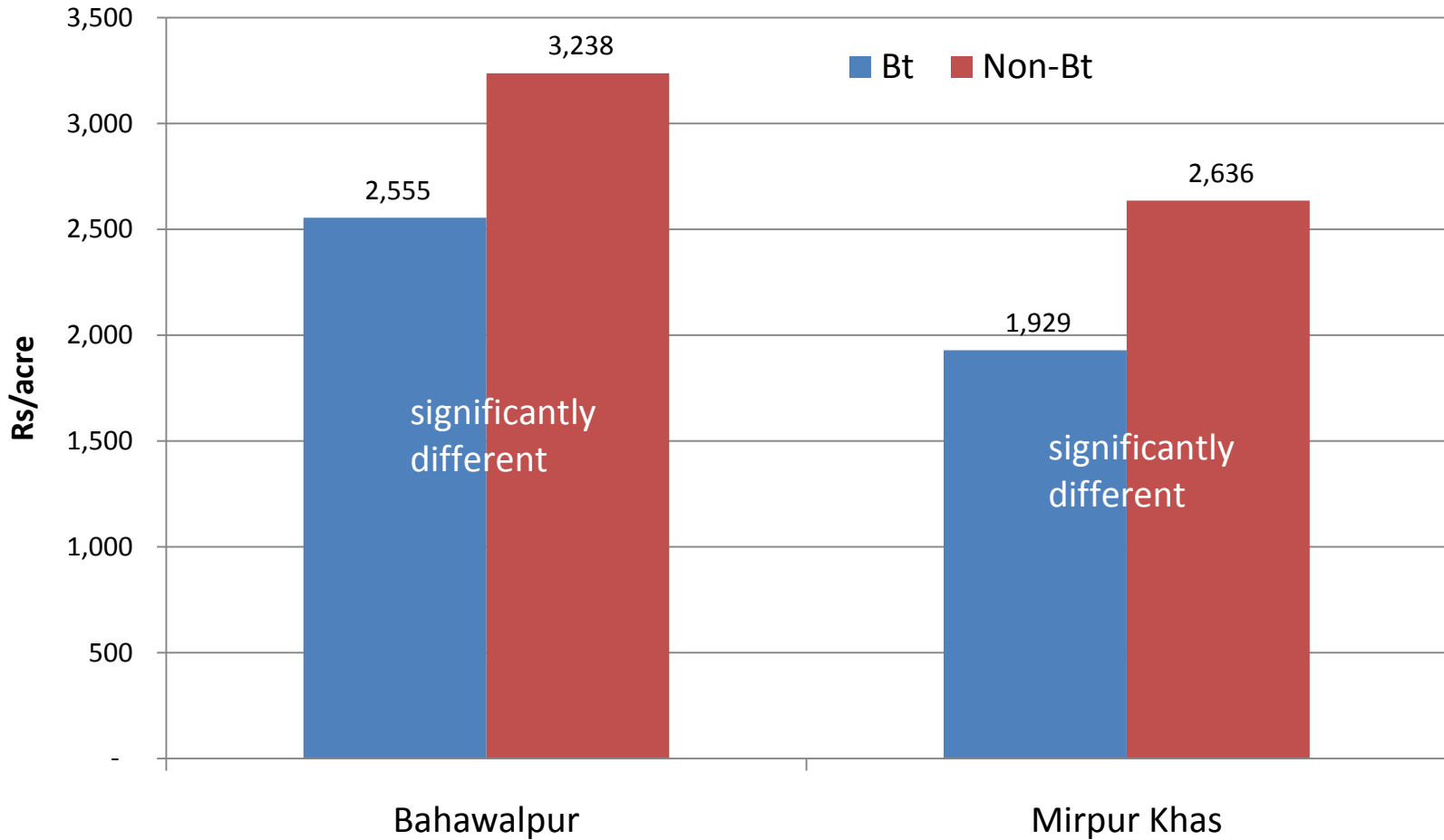
Awareness about Bt Technology among Farmers



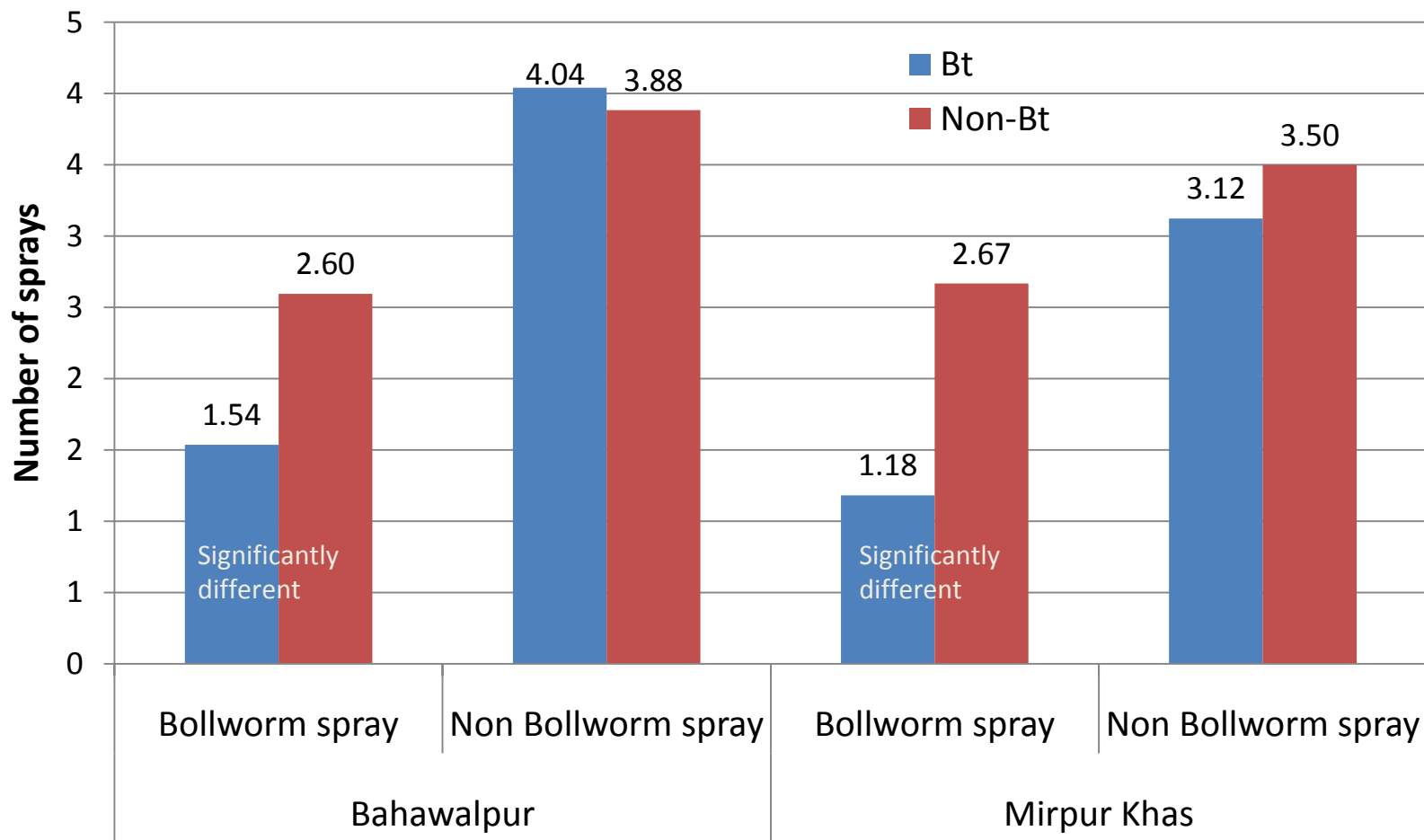
Seed Expenditure (Rs/acre)



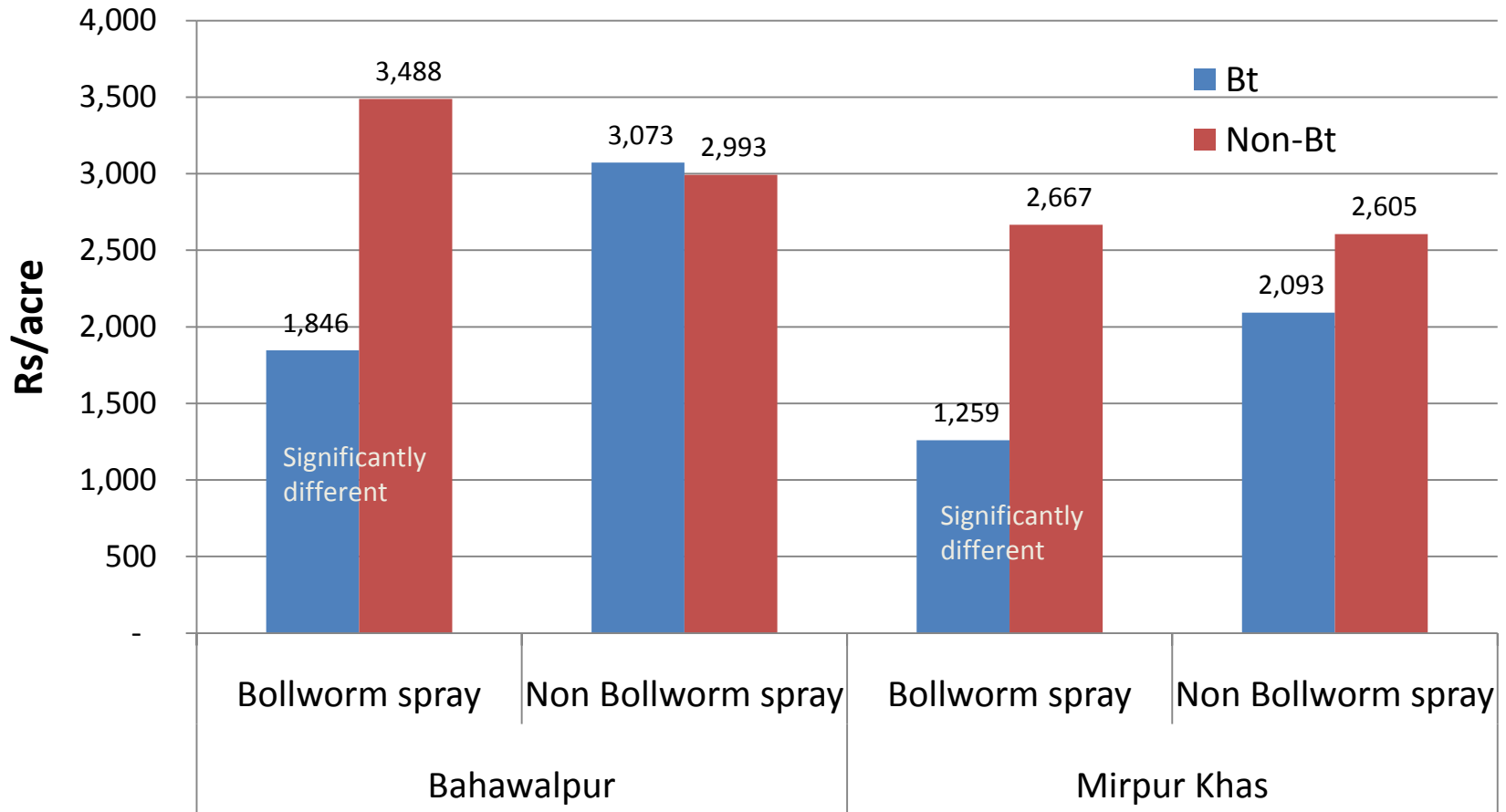
Total Pesticide Expenditure (Rs/acre)



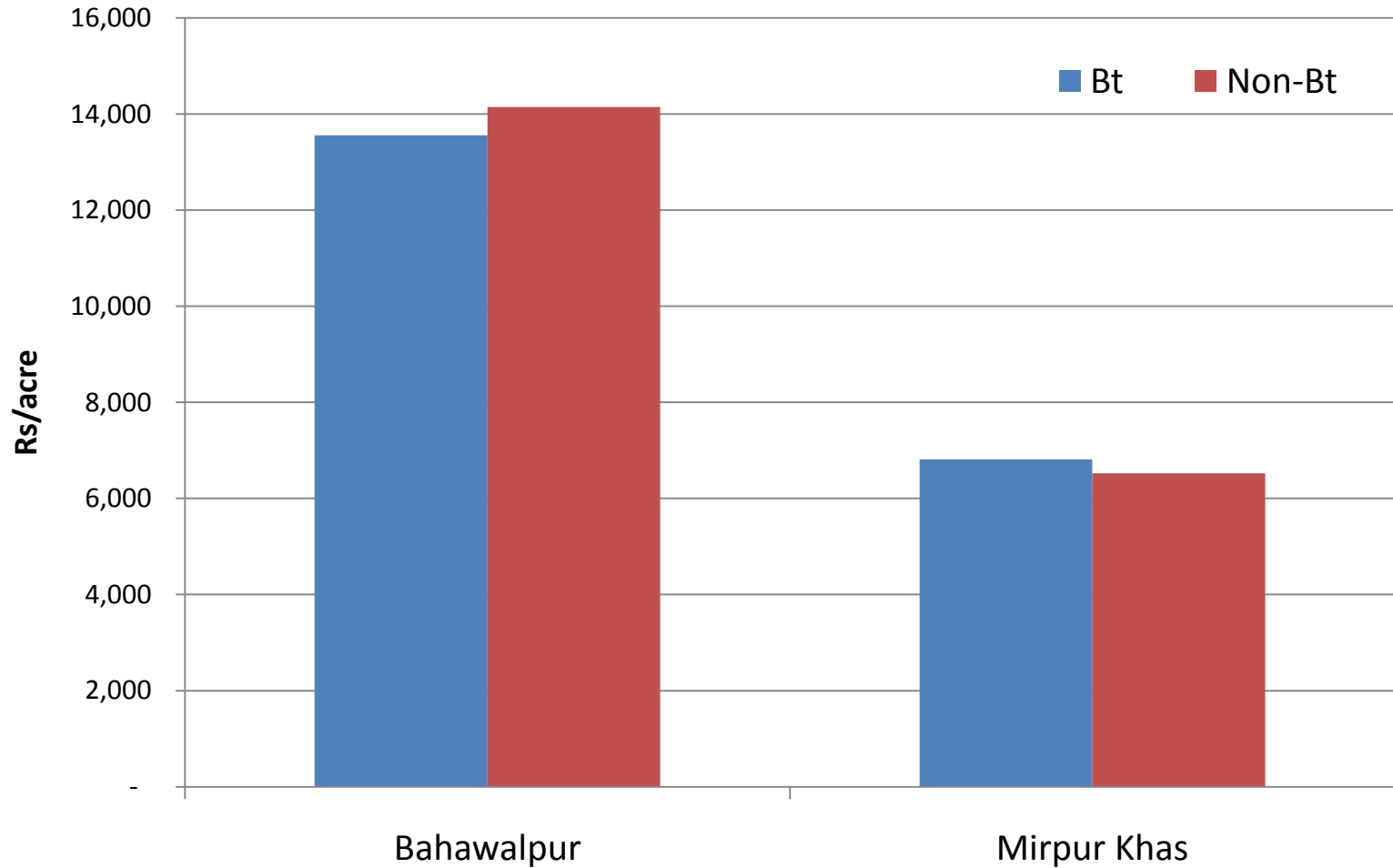
Number of pesticide Sprays



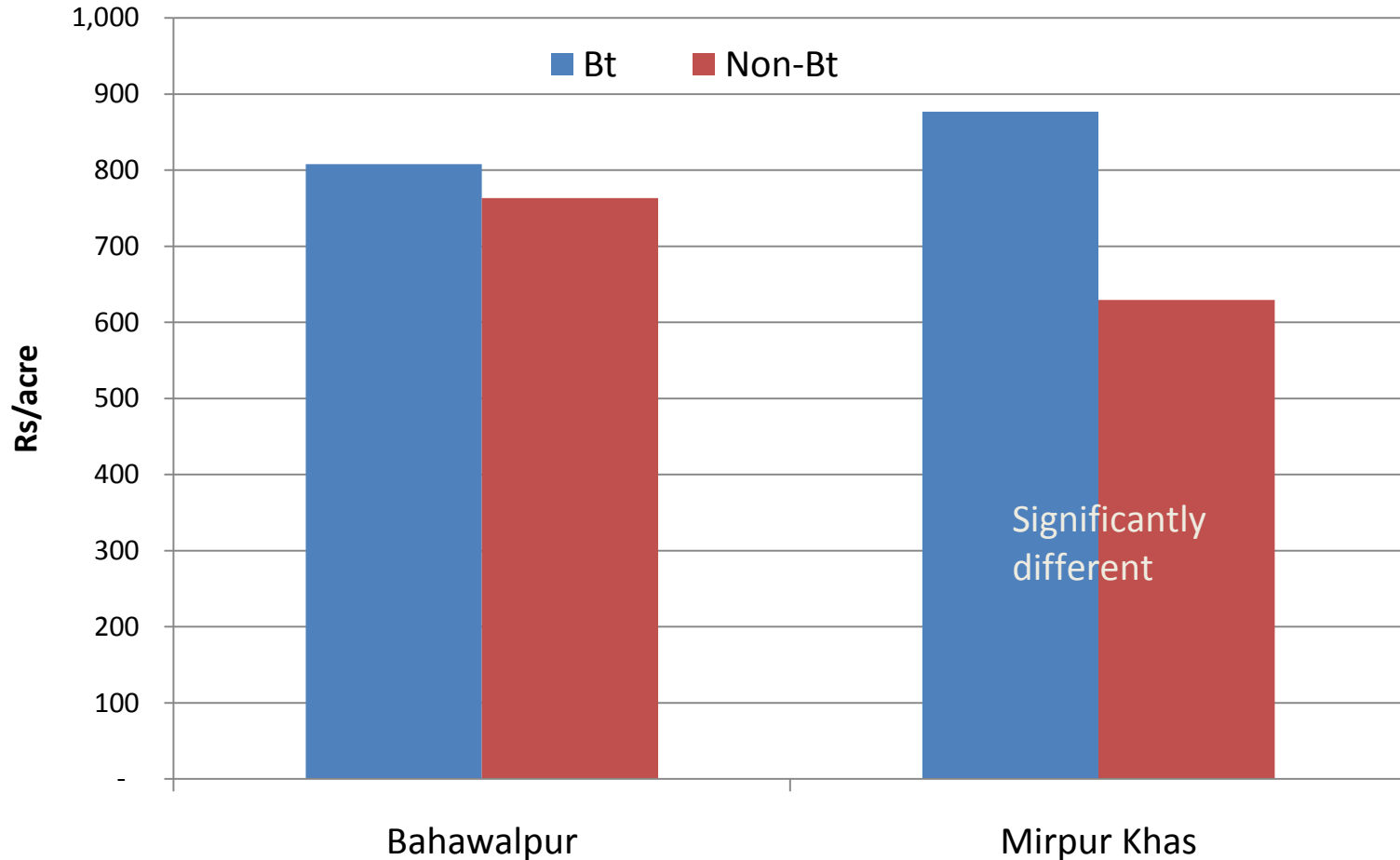
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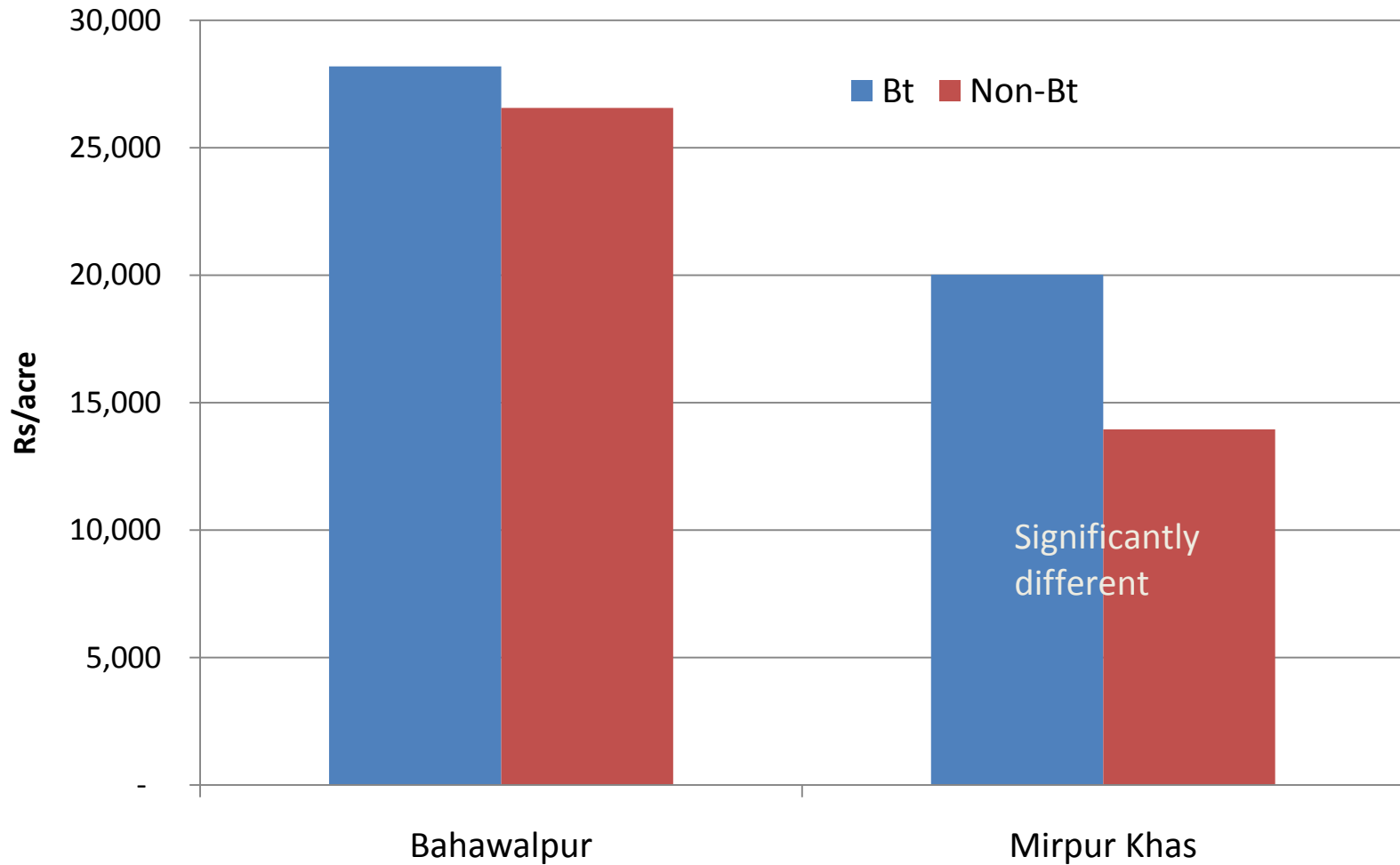
Total expenditure (Rs/acre)



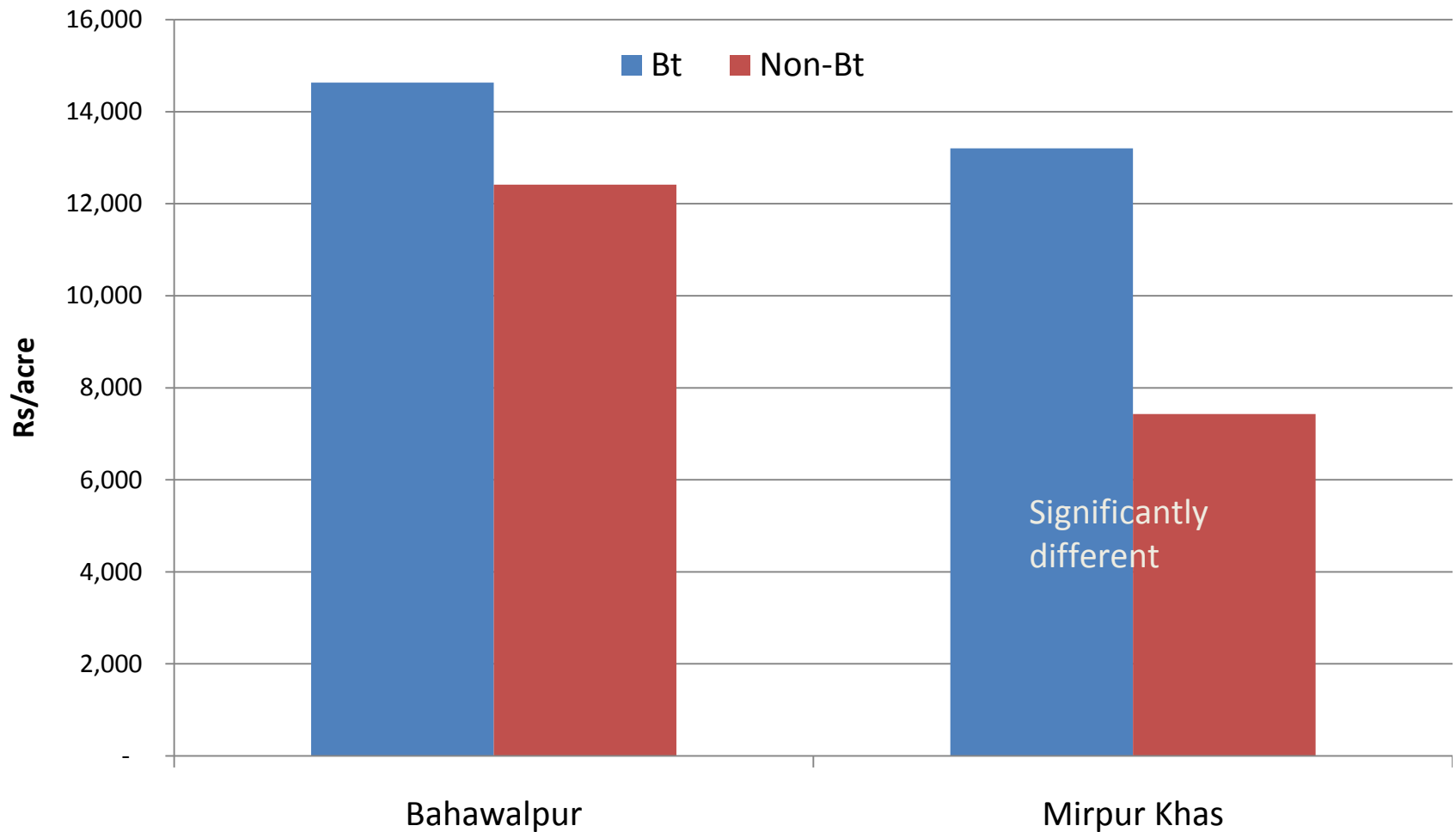
Yield (Kg/acre)



Revenue (Rs/acre)



Gross Margin (Rs/acre)



Characteristics of Adopters and Non-adopters

Individual Characteristics	Household Characteristics	Farm characteristics
Age (years)	Household size	Operated land (acres)
Experience in cotton farming (years) (+*)	Number of dependents	Owned land (acres)
Education (years)	Own motorcycle (yes=1)	Cotton area as % of Kharif area
Degree of risk aversion (-*)	Own TV (yes=1)	
	Value of livestock (Rs/animal) (+*)	
	Have telephone (yes=1)	
	Agricultural credit (yes=1)	
	Crop income (Rs/year)	
	Livestock income (Rs/year)	
	Other income (Rs/year) (-*)	
	Total income (Rs/year)	
	Share of food expenditure (-*)	
	Share of education expenditure (+*)	

Summary of Findings

- Technical issues
 - Low levels of awareness among farmers about Bt technology
 - The impact of Bt varieties differs across two districts
- Market issues
 - Adoption rate is high among both owners and sharecroppers
 - Pesticide expenditure is lower and seed expenditure is higher on Bt varieties
 - Higher revenue
 - Profitable for farmers
- Social issues
 - Both owners and sharecroppers get the benefit

Comparison of Pakistan's Unapproved Bt Varieties with China and India's Approved Bt Varieties

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Pakistan (2009)							
Bahawalpur	-0.90	-21.07	64.9	-4.19	5.86	452	384
Mirpur Khas	-1.86	-26.81	76.3	4.54	39.27	408	230

Future Directions for Research

- Need for a national survey
 - Due to the high diversity of cotton growing areas, more location-specific information and larger sample size is required
- Need for further analysis
 - Can Pakistan come out of unregulated market after the commercialization of Bt cotton?

Thank You