Managing Crop Residual Burning Using Advanced Harvest Machinery - *Evidence from a Cluster Randomized Control Trial in Punjab, Pakistan*

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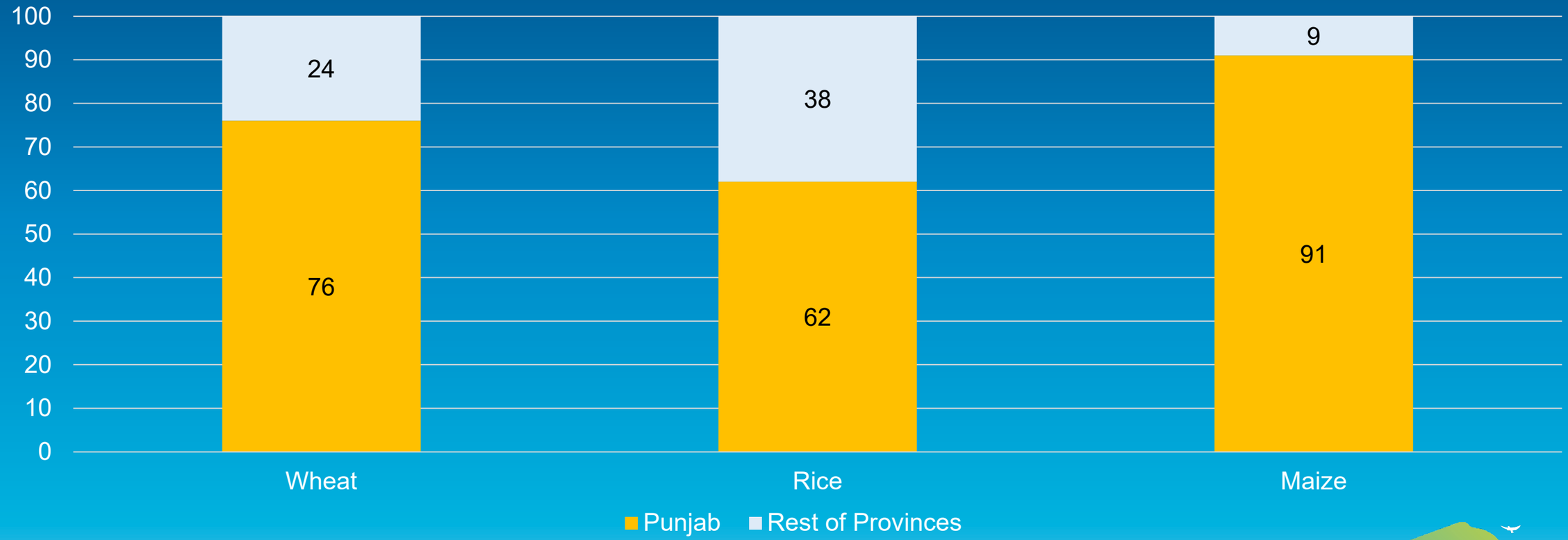
Wheat-Rice cropping system is the dominant cropping system in Pakistan

- Punjab province is the largest contributor in country's production of wheat, rice and Maize.



ADB

ADB TA-9838 PAK
Enhancing Technology Based Agriculture and Marketing in Rural Punjab
Field demonstration data

- Aimed at improving farmers profitability through reduced harvest losses and improved quality of produce
- 60 technology demonstrations in 32 villages in 4 districts in Punjab
- 2 wheat, 3 rice and 5 maize seasons (During 2020-2023)
- Around 16000 farmers participated

Technologies Introduced for Paddy Harvesting

New Holland (8070) Full Feed
(Conventionally used for Wheat/Rice Crop)

Kubota (ER-112) Half Feed
(For Standing Rice Crop)

Thinker (XG750S) Full Feed
(For Lodged and Semi-Lodged Rice Crop)

Machine Performance, Grain Losses and Impurities

Parameter (measured at demo sites sites)	New Holland (8070) Full Feed	Kubota (ER-112) Half Feed	Thinker (XG750S) Full Feed
Field Losses (%)	3.61	1.94	1.79
Impurities (%)	3.99	0.77	1.95
Broken Grain (%)	1.70	0.49	0.75
Stubble Height (inches)	13-15	5.65	5-10

Findings of FAO Report (2019) Report - Punjab, Pakistan

- In the past farmers used to harvest and thresh rice crop manually and use residues as fodder for their animals.
- In past two decade or so there has been an increase in the use of **wheat combined harvesters** for paddy harvesting. Since then rice crop residue burning is a common practice in the month of November.
- The main reasons are to get rid of trash/residue, desire to save labor cost, to eradicate weeds and pests and to facilitate cultivation and timely sowing of the next crop.

TA-9940 REG : Mainstreaming Impact Evaluation Methodologies
Impact Evaluation of ADB TA-9838 PAK

- Cluster randomized control trial
- , Farmers Listing (Aug 2020), Baseline (Sep 2020), Midline (Oct-Dec 2021), & Endline (Nov-Dec 2023) surveys
- 1,560 farmers were surveyed of which 1050 were rice growers

Benefits of using Rice Harvester (Half Feeder)

- Precise Harvesting
- Minimal grain losses
- Little impurities
- Negligible grain breakage
- Less stubble height
- No straw burning
- Straw for feeding livestock

ADB

Economic Benefits of using Rice Half feeder Harvester

	Baseline – 2020	Midline – 2021	Endline – 2023
Cost of wheat combine harvester (USD/acre)	16.31	20.29	27.61
Cost of paddy harvester (USD/acre)	35.97	39.36	49.33
Reduction in harvest losses (Kg/Acre)	0.86	0.90	0.86
Additional price of paddy harvested by rice harvester (Rupees/40 Kg)	0.46	0.59	0.48
Price of straw saved by rice harvester (USD/Acre)	32.37	38.66	39.76
Cost saving in land preparation for next sowing (USD/Acre)	13.48	14.91	19.77
Net Benefit/Acre (USD/Acre)	81.00	96.00	104.00

Treatment Effects of Technology Demonstrations

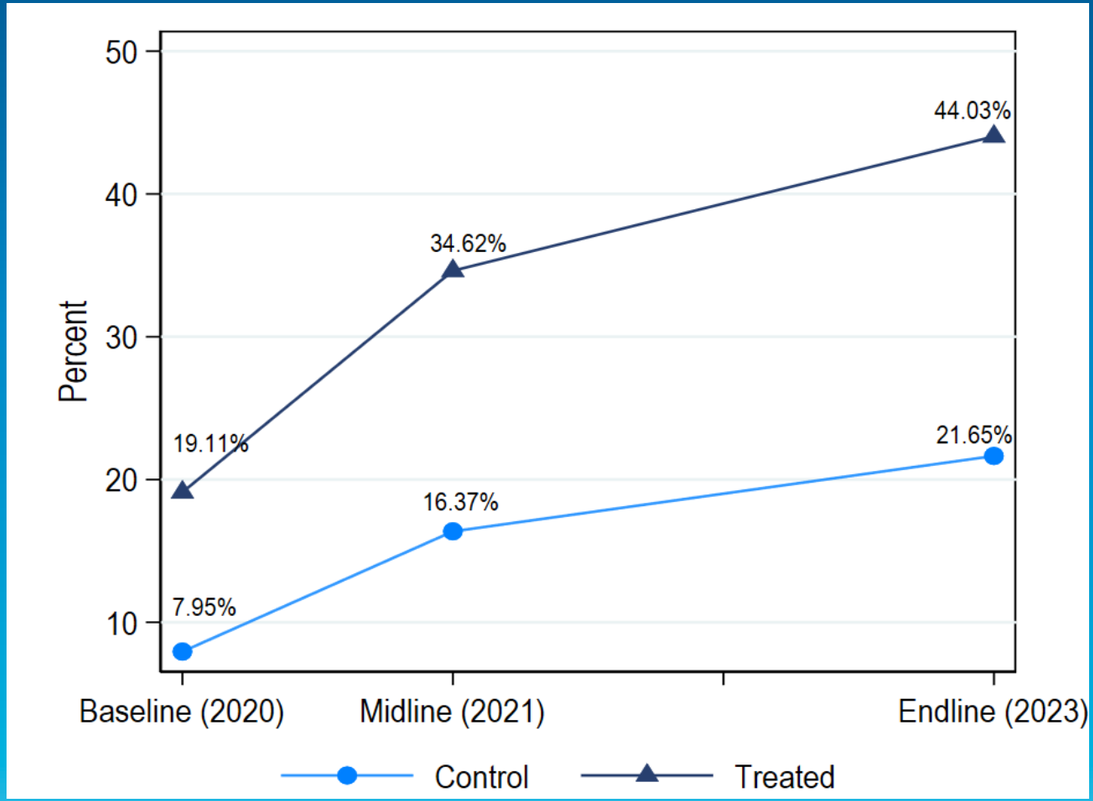
	Rice yields (Kg/acre) [1]	Reduction in harvest losses (Kg/Acre) [2]	Additional price of paddy harvested by rice harvester (USD/40 Kg) [3]	Price of straw saved by rice harvester (USD/acre) [4]	Cost saved in land preparation for next sowing (USD/acre) [5]
ATET	-0.033 (0.034)	0.322*** (0.074)	-0.085 (0.137)	0.231*** (0.066)	-0.057 (0.075)
Household controls	Yes	Yes	Yes	Yes	Yes
Farm level controls	Yes	Yes	Yes	Yes	Yes
Survey FE	Yes	Yes	Yes	Yes	Yes

Notes: estimates are based on DID regressions. All regressions include household (size, income, gender and literacy of head, age of head) and plot (irrigation source, soil type) level covariates. Standard errors are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

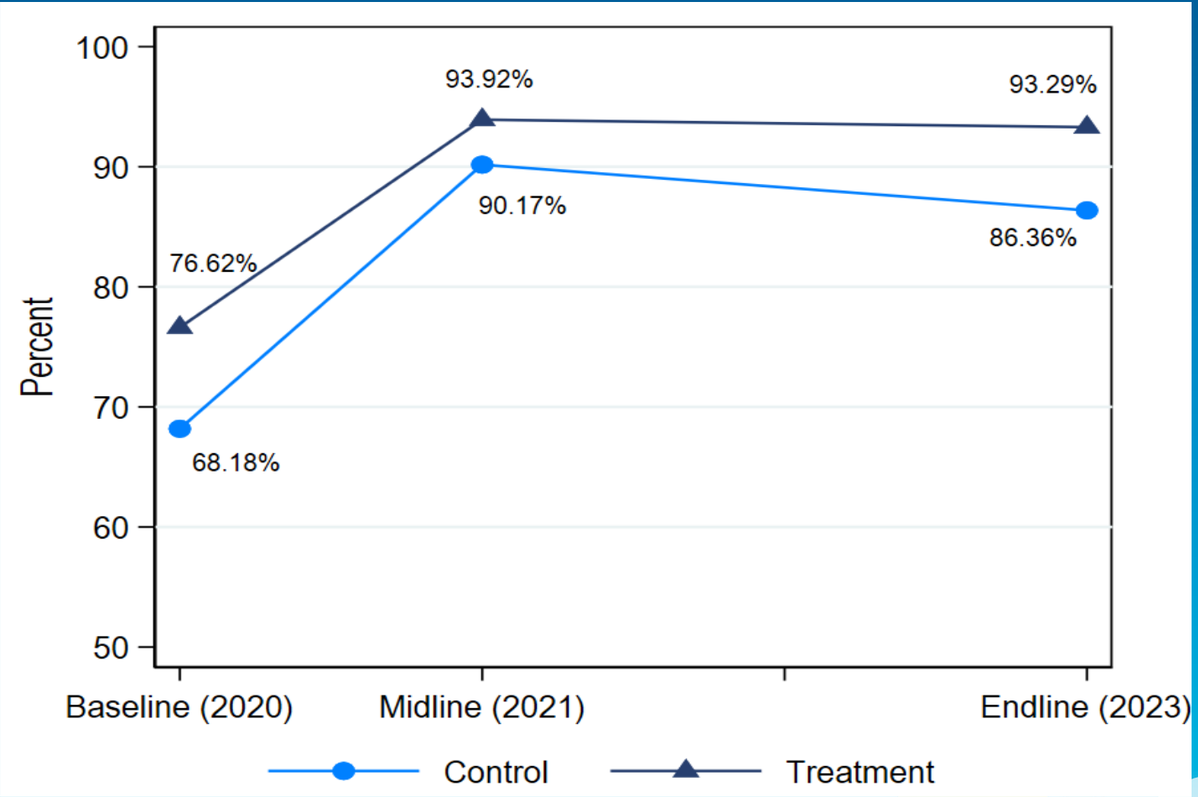
Technology Adoption and Intent for Adoption

(Results from Three Rounds of Surveys)

Adoption Rate

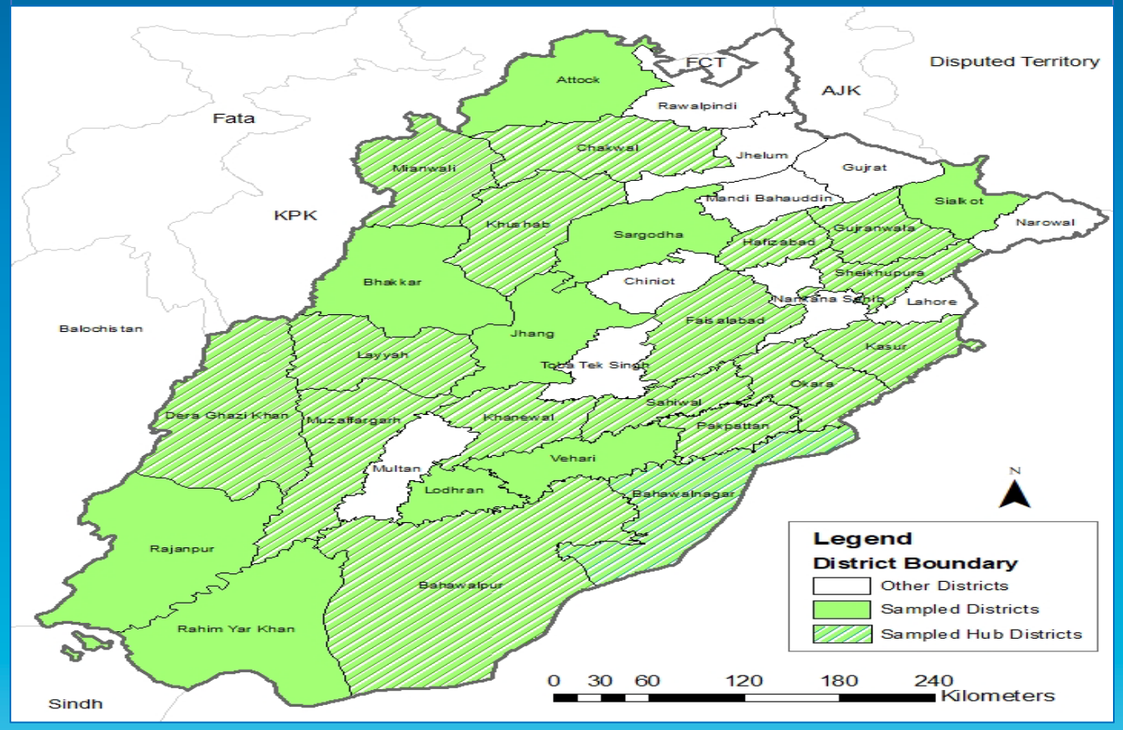


Intent for Adoption



Agriculture Mechanization Study : Farmers and Machine Service Provider Surveys in Punjab, Oct-Nov 2023 under ADB TA-6663 PAK

- **174 clusters from 26** districts from Punjab
- **1,056** farmers and **1,226** service providers



Major Barriers in Adoption of Kubota Rice Harvester

- Non-availability of machine during the peak harvest season
- High rental charges
- High initial investments, and
- Longer recovery period

Conclusion

- Along with identification of right machinery to curb residual burning, supplementary initiatives such as targeted awareness programs and financial incentives for farmers are needed to promote the use of such machinery.
- Considering the high investment costs involved, any proposed model for delivering mechanization should be refined to ensure its feasibility and scalability (e.g. subsidy or subsidized loans etc.)

Thank you!