**Combating Air Pollution from Biomass Burning through Mechanization Solutions for Integrated Straw Management** 

## **Mechanization-based Solutions: Perspectives from Nepal**

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	Overview	CSAM
• Agricult	are contributes 15.44 % in Gross Domestic Product (GDP) in 2019-20	
• Out of w	hich Cereal and other crops = $8.49$ %, out of which	
o pa	addy and straw= $15.35\%$	
o m	aize and straw= 8.85%	
o w	heat and straw= $6.34\%$	
Paddy	is the most widely cultivated crop in Nepal, followed by Maize then wh	neat, Production of
grain a	and straw 2019-20 (MOALD, 2020)	
	Table 1. Major crop yield and straw potential	

Crop	Grain Yield million MT	Straw Grain Ratio	Straw Yield million MT
Paddy	5.5	1.1	6.05
Maize	2.8	1.14	3.19
Wheat	2.1	1.09	2.29

• Straw burning has started and expanding after use of combine harvester. Exact data is not available at recent stage.







## Mechanization-based interventions @ESCAPTICSAM

# In-situ mechanization-based interventionsHappy/Super seederMulcher

- Super Seeder one pass sowing solution incorporate paddy straw & stubbles into soil, and simultaneously sow seeds.
- Reduce the time required for soil preparation and help to meet the season.
- Reduce production cost and increases profit.



- Mulcher– Cuts paddy stubbles into small pieces and covers the soil to preserve moisture.
- Incorporation will increases the organic content in the soil.





- Left Side control plot (traditional) & Right side (super seeder)
- Crop statue of 66 days after sowing- 6<sup>th</sup> Feb 2023



# Mechanization-based interventions @ESCAPTICSAM

# In-situ mechanization-based interventions

## Drum Seeder

- Drum seeder Resource conservation technology, which reduces rice plantation time and labours, and also the overall crop harvesting time.
- Save time and money.
- Easy to operate and low cost technology.





## Mechanization-based interventions SESCAPTICSAM

# Ex-situ mechanization-based interventionsDTMR Block making machineStraw Baler

- DTMR Block making machine compress and make straw block with added nutrients.
- Increases the density so reduces the storage space, ease bulk transportation and reduce cost.
- Reduce production cost and increases profit.



- Straw baler compress a cut and raked crop residue into compact bales that are easy to handle, transport, and store.
- Clears the soil and prepares it for the sowing of the next crop, and provides secondary income for the farmer.





## **Results from field trials/test**



**Table 2:** Organic content and net nitrogen content of soil in control & experimental plot at 15 cm fromthe surface in 2 crop cycle

Soil Sampla	Before Wheat Sowing (2021 Dec)		After Harvesting Rice (2022 Nov)		Increased by (%)	
son sample	OM (%)	Net Nitrogen (%)	OM (%)	Net Nitrogen (%)	OM	Net Nitrogen
Control plot	1.43	0.07	4.15	0.195	190	179
<b>Experimental plot</b>	1.48	0.073	3.53	0.169	139	132

*Table 3:* Yield and B/C ratio of wheat and paddy production in control & experimental plot

	Wheat	Paddy		
Plot	Yield (kg/ha)	B/C ratio	Yield (kg/ha)	B/C ratio
Control plot	2,719.00	1.07	5,566.67	1.99
<b>Experimental plot</b>	2,721.50	1.62	5,648.33	2.59



Figure 7: Participants in awareness events *Figure 6: Training participants: local & outstations* 



#### Table 4: Farmers number in 3 awareness events

Sessions	Male	Female	Total
1 <sup>st</sup>	50	12	62
2 <sup>nd</sup>	54	08	62
3rd	37	33	70
Total	141	53	194



## Key achievements/benefits



- Farmers were made aware of straw burning consequences and the economic benefits of valorization.
- Training tractor operators on new in-situ & ex-situ machinery was effective for smooth operation and maintenance but longer training is needed. Represented cooperatives are willing to buy such machine.
- In-situ machineries, Super Seeder and Mulcher, were added in the pilot sites.
- Cost of production by labour saving DTMR block was reduced by adding of auxiliary machines and arranging proper production flow.
- Demonstration of newly purchased super-seeder for in-situ management of straw in wheat cultivation was highly appreciated by farmers, researchers and extension workers.
- Government stakeholders are convinced with Super seeder for in-situ straw management, DOAR, Tarahara is planning to purchase one unit for vigorous trials and demonstration.
- Surrounding farmers of Pilot site will be adopting Super seeder wheat cultivation, but more machines are needed for mass replication.

# Key learnings & recommendations SECAPTICSAM

### **Key recommendations**

- Use of minimum-tillage seeder for wheat cropping is highly recommended for both straw management and economic perspectives.
- Ex-situ management of straw using DTMR block increases the density by compaction and hence lowers the storage and transportation costs.
- Proper government planning & strategies is needed to discourage straw burning and encourage straw based industries.
- Organic content of the Nepalese soils are degrading so proper in-situ residue management is necessary to improve the soil quality and hence the productivity.
- Further replication and expansion of the pilot is needed to draw more conclusions on the improvement of soil condition, and strengthen efforts to convince the farmers to adopt new concept or new technologies.



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