COUNTRY PAPER

ON

Conservation Agriculture: A Climate-Smart Agricultural Technology for Sustainable Crop Production in Bangladesh

23-25 November 2016, Hanoi, Vietnam

Presentation by

DR. SULTAN AHMMED

Member Director (NRM)

Bangladesh Agricultural Research Council, Dhaka, BANGLADESH

UNITED NATIONS ESCAP Economic and Social Commission for Asia and the Pacific CSAM VIAEP

Conservation agriculture (CA)

Conservation agriculture (CA) aims to conserve, improve and

- make more efficient use of natural resources through
- integrated management of available soil, water and biological resources combined with external inputs.

- It contributes to environmental conservation as well as to enhanced and sustained agricultural production.

- (i) less soil disturbance, (ii) allow crop residue management and (iii) keep beneficial crop rotation.

Climate Change Impact

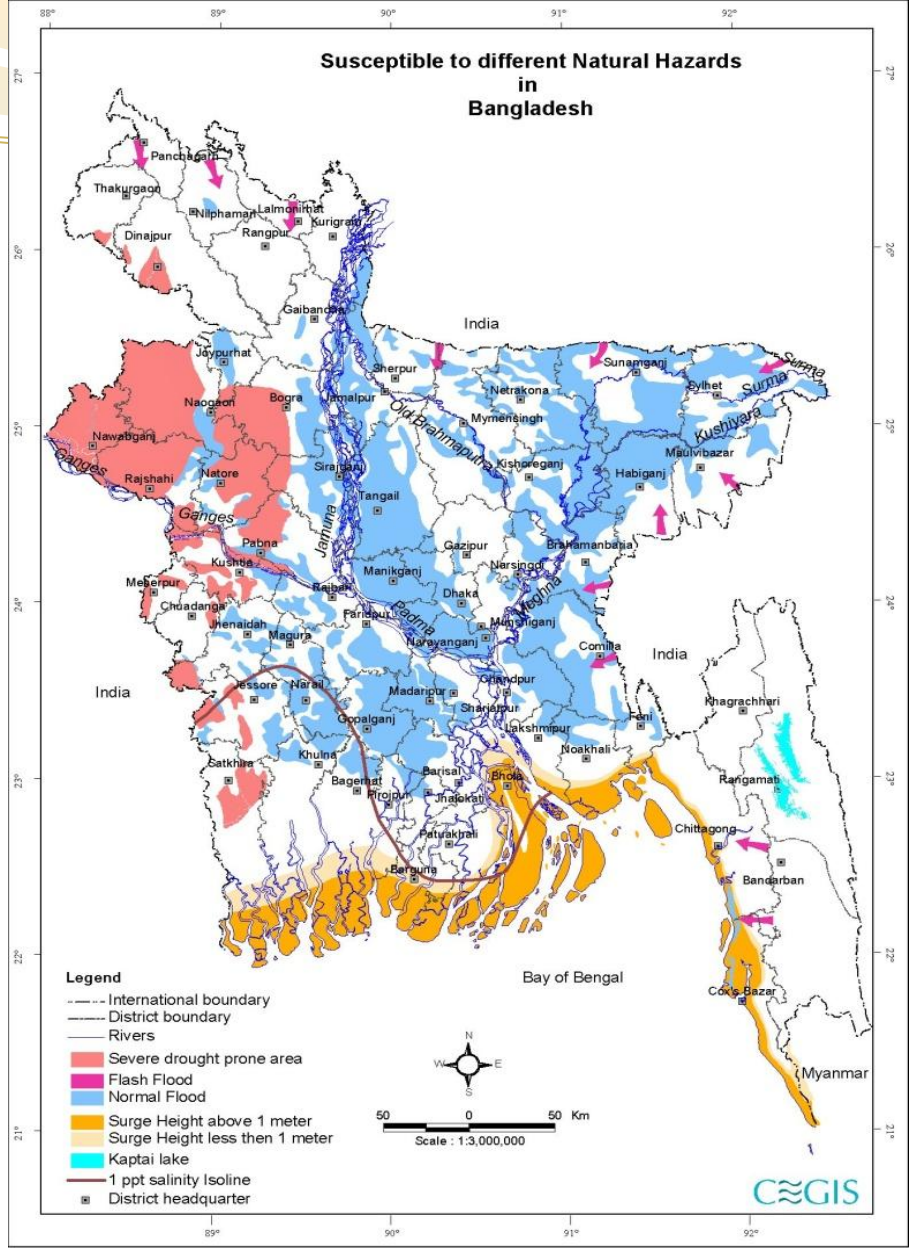
- Summer are becoming hotter (High temperature)
- Monsoon irregular with untimely rainfall
- Increased river flow and inundation during monsoon
- Heavy rainfall over short period causing water logging
- Increased frequency, intensity and recurrence of flood

Climate Change Impact (Cont.)

- Crop damage due to flash flood
- Very little rainfall in dry period
- Crop failure due to drought
- River bank erosion
- Prolonged cold spell
- Salinity intrusion along the coast region

DROUGHT

- North-western and northern regions of Bangladesh
- Area of 5.46 million Hectare.
- North-western Barind tract -drought prone.



Drought-prone area in Bangladesh

Climate vulnerable Areas in Bangladesh (60%)

Saline area 1.06 mha

Drought prone 3.5 mha

Waterlogged 2.6 mha

Charland 0.83 mha

Haor 0.25 mha

Different tillage techniques

1. Minimum tillage by power tiller operated seeder

- **Working as shallow tilling, fertilizing , seeding in line, seed covering at a time**
- **Residual soil moisture using for seeding**
- **Uniform depth of seeding**
- **Easy planting**
- **Seed saving 20%, cost saving 67%**
- **Wheat, maize, pulses, jute, rice, oilseeds can be sown successfully**

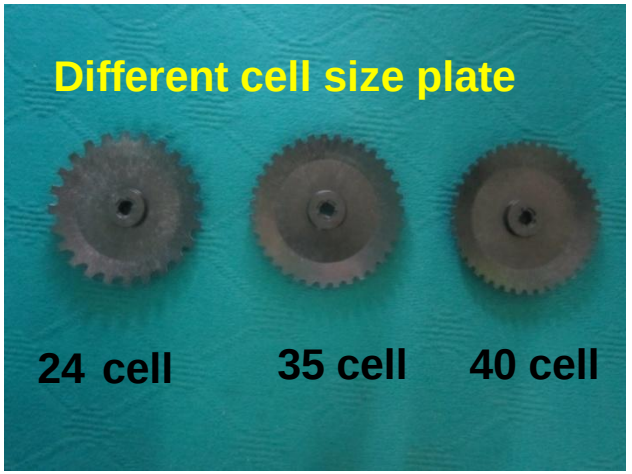
Wheat seeding in farmers Field

- Better seed-soil contact
- Number of tiller more & optimum plant population
- Crop yield 10-15 % more than con.
- Working capacity: 0.13 ha/h
- Local manufacturer can fabricate

Mungbean after wheat harvest

- **Mungbean planting rice-wheat cropping system**
- **Farmers can harvest it as bonus crop as crop duration minimum**

Different seed sowing by the same seeder



- **Plate need to change as per seed size**

Rice direct seeding by seeder


Unpuddled rice


Maturity comes early

- Dry direct seeding (DSR)
- Seed rate: 25 kg/ha
- 9-11 days early maturity
- Water saving avoiding puddling operation

- Roundup herbicide used before 3 days of seeding
- Herbicide sprayed after seeding at moist condition (after 6-24 hrs)
- One hand weeding after 35 days

DSR field Darompur, Rajshahi

Cost of rice production under different tillage at Rajshahi

Nodes	Treat.	Production cost (Taka ha^{-1})	Grosss return (Taka ha^{-1})	Net profit (Taka ha^{-1})	Labour use (nos.)	% Labour saving over PTPR	Growth duration (days)
Dharampur	DSR	37161	86360	49200	53	46	108
	UTPR	45624	102442	56818	82	17	123
	PTPR	46620	100765	54146	99	-	123
Baduria	DSR	36652	97943	61290	52	51	113
	UTPR	46005	104289	58285	86	20	118
	PTPR	48590	103863	55274	107	-	118


ACIAR team


DSR Plot

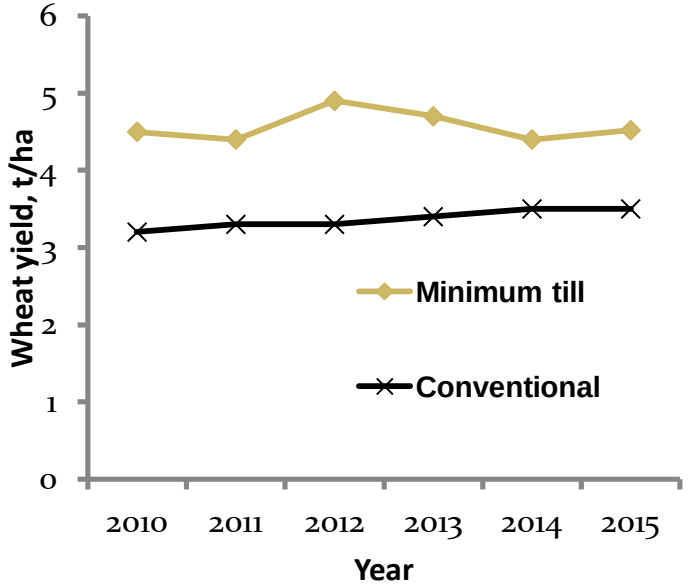
Field day with local farmer

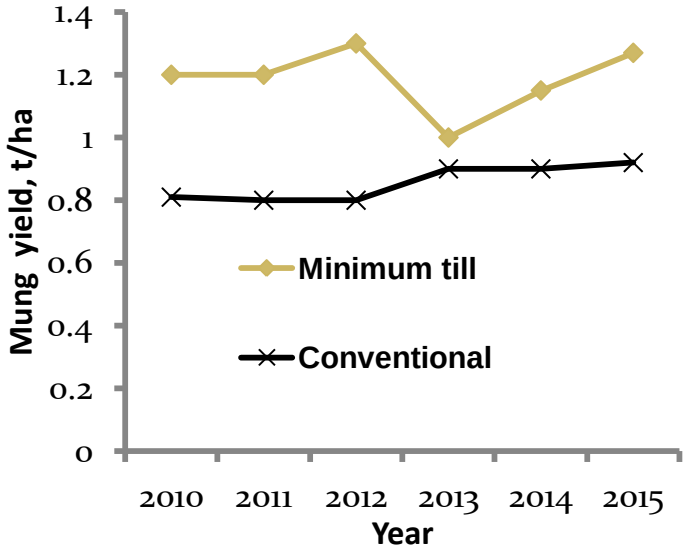
- DSR-Labour saving: 50%, Cost saving: 20-25%

Average crop yield 2015-16

Planting methods	Average yield, t/ha					
	Wheat	Mung	Lentil	Sesame	Maize	Rice
Minimum tillage by the seeder	3.9	0.9	1.4	1.5	10.3	4.0
Farmer's practice	2.9	0.60	0.9	0.90	7.5	4.3

Long term yield trend under minimum till





- **Crop rotation: Wheat- Mungbean-Rice**
- **Last 6 years, wheat , mung yield shows always higher than conventional**

2. Strip till

Seeding, fertilizing and seed covering simultaneously-one operation

- Making a narrow strip and work through moderate level residue, 4-6 cm
- Fine till the strip
- Uniform depth of seed placement, 5-7 cm
- Un-till between the seeding line

- Seed & fertilizer unit separate
- Use as both strip till and minimum till
- Can handle maize and other small seeds efficiently

- Seed & fertilizer unit separate

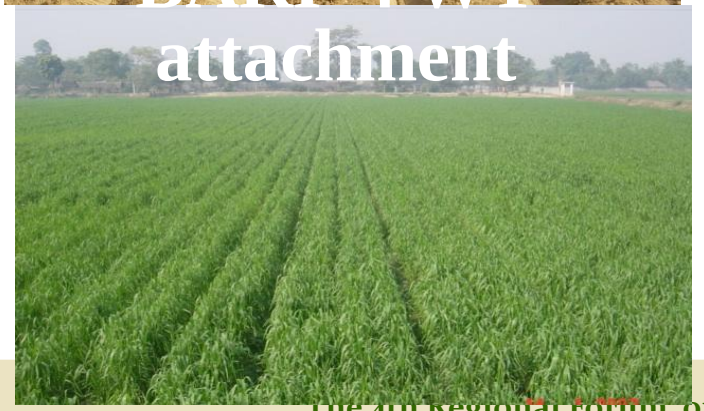
Crop establishment by strip tillage

- Tilling, seeding in line, fertilizing and seed covering at a time
- Utilize residual soil moisture
- Reduce turn around time (7-9 days)
- Multicrops seeding (wheat, maize,rice, pulses, jute, sesame, onion etc)
- Save seed :29%
- Save planting cost :62%


Maize


Lentil
26 12 2007

3. Bed planting



Advantages

- Less seed
- Less water
- Less labor
- Less crop damage (rats, pests, diseases)
- Less production cost
- Higher yields
- Higher economic returns
- Facilitate crop diversification
- Increased agricultural sustainability

Bed planting: Water saving technology

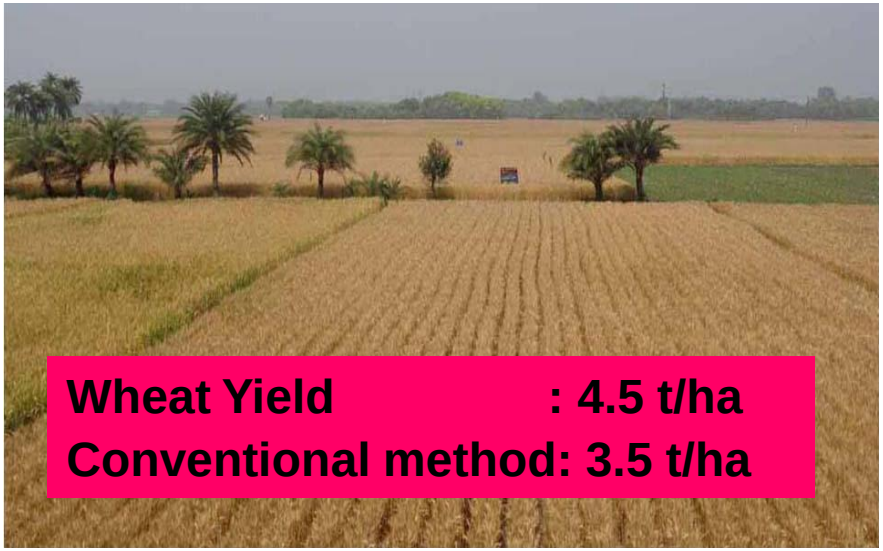
Advantages of bed planting

- Easy irrigation and minimum water loss
- Less amount urea required
- Less lodging tendency of crop
- Easy management and overcome water lodging problem
- Crop survive in medium level salinity

Wheat establishment by bed planter

- Tilling, Bed formation & seeding on bed at a time
- Two lines wheat per bed

- Utilize residual soil moisture for crop establishment
- Minimize turn around time between the two crops



Wheat Yield : 4.5 t/ha
Conventional method: 3.5 t/ha

Mungbean after wheat

- Mungbean seeding on same bed after wheat harvest
- Successive crop grown keeping bed permanent

Mungbean survive on bed in case of water logging condition

Maize planting after potato

- **Land preparation, fertilizing, planting on bed and earthing up at a time.**
- **No need additional earthingup**
- **Single line per bed**
- **Bed formation capacity: 1 bigha/hr (33 Decimal per hr) (0.12 ha per hr)**

Cost and labour saving: 60%

Lentil on bed system

- **Bed formation & seeding at a time**
- **Two lines per bed**
- **Seed rate: 25 kg/ha**
- **Planting :20-28 Nov 2015**

Lentil Yield : 1.2 t/ha

Conventional method: 0.8 t/ha

Vegetables on Beds System

- Crops survive water log condition
- More yield compare to flat planting

Efficient irrigation water application

Method of planting	Wheat cultivation			Maize cultivation		
	Irrig. Time/irri (hrs)/ha	No. irrigation	Total Irrigation time (hr)/ha	Irrig. Time/irri (hrs)/ha	No. of irriga.	Total Irrigation time (hrs)/ha
Bed planting new bed method	6.6	3	19.8	6.4	3	19.2
Permanent bed	5.4	3	16.2	5.5	3	16.5
Conv. method	8.25	3	24.75	6.4	3	19.2

- **Minimize water loss**
- **Less labour involvement for irrigation**
- **Faster irrigation**
- **Water saving: 31%**

Yield advantages of bed planting

Season	Crop	No. of Trials	Yield Increase with Beds %
Rabi	Wheat	497	13-18
Kharif-1	Mungbean	121	25-30
	Lentil	64	21-42
	Jute	33	13-22
	Maize	30	10
	Sesame	19	16-37
	Groundnut	3	97
	Potato	19	8-33
Kharif-2	Rice	208	5-19

Wheat yield and cost of seeding

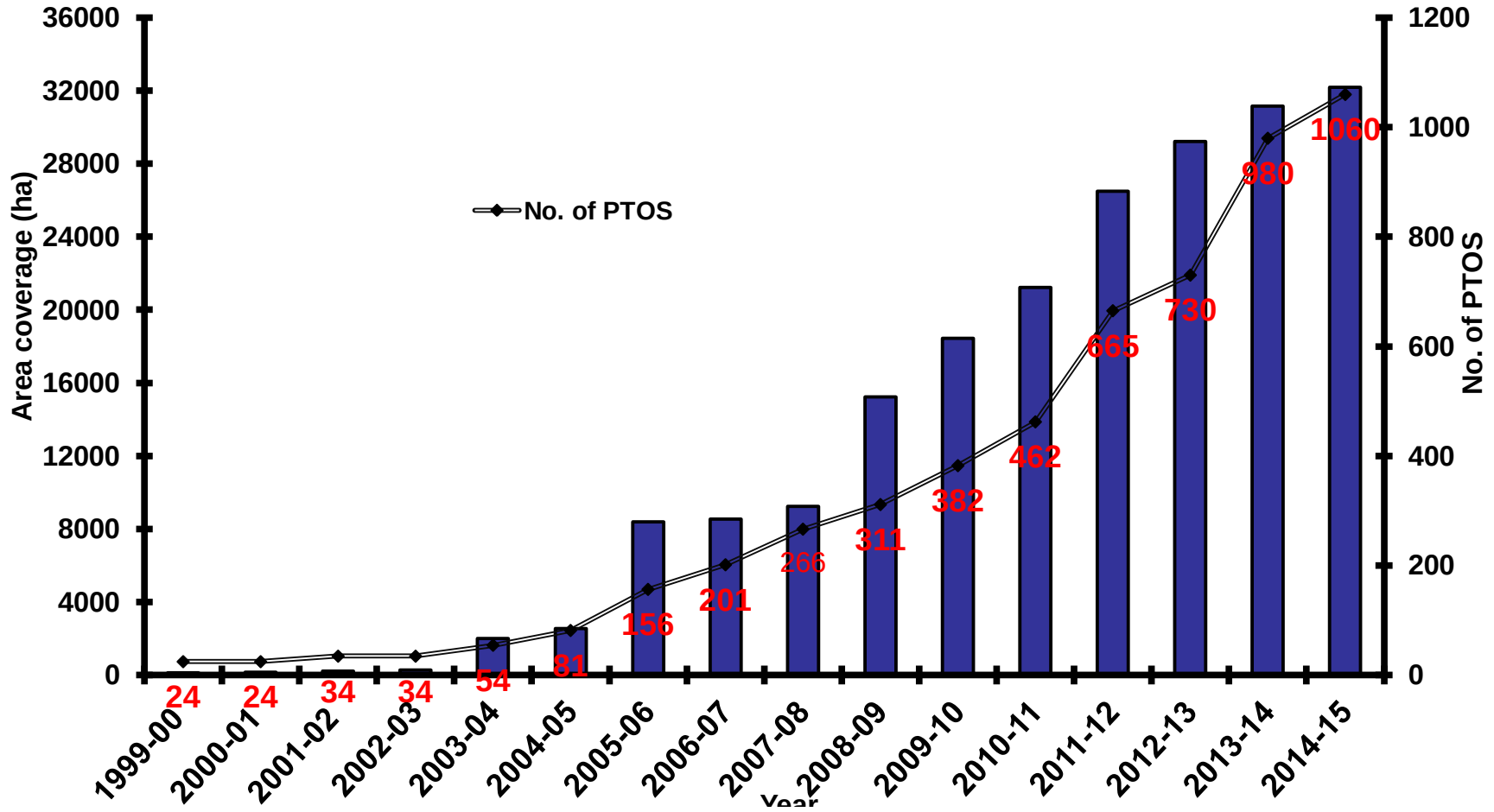
Planting methods	Average yield, t/ha		Cost of planting (Tk./ha)
	Wheat	Mungbean	
PTOS/minimum till	4.8	1.2	1873.0
Strip till	4.9	1.0	1850.0
Farmer's practice	3.5	0.75	4900.0

- PTOS saved :61.7% planting cost

Table 2. Area under conservation agriculture tillage system in Bangladesh

Name of conservation agriculture tillage techniques	2010-11 (ha)	2011-12 (ha)	2012-13 (ha)	2013-14 (ha)	2014-15 (ha)
Minimum tillage	9864	17527	29225	31155	32205
Strip tillage	72	106	108	225	300
Zero tillage	79	59	97	105	110
Bed planting system	4337	4636	5745	5950	6350
Total	14352	22328	35175	37435	38965

Adaption of Minimum tillage Technologies Bangladesh



Number of active PTOS

Table 3. Yield comparison of major crops under CA tillage systems

Conservation agriculture system	2012-13 (t/ha)			2013-14 (t/ha)			2014-15 (t/ha)		
	Wheat	maize	Mung bean	Wheat	maize	Mung bean	Wheat	maize	Mung bean
Minimum tillage	4.7	9.5	1.3	4.5	9.3	1.1	4.2	9.2	1.1
Strip tillage	5.2	9.3	1.2	4.6	8.4	1.2	4.3	9.0	1.1
Zero till	4.4	8.8	1.2	4.1	8.2	1.1	3.9	8.8	1.2
Bed planting	5.2	9.7	1.0	4.8	8.2	1.1	4.5	8.1	1.1
Conventional system	3.5	9.0	0.7	3.6	8.3	0.75	3.5	8.8	0.8

Table 4. Cost of planting in different CA tillage system over conventional methods

Sl. No.	Seeding methods	Cost of seeding (Tk./ha)
1	Minimum tillage	1950.0
2	Strip tillage	1850.0
3	Zero tillage	1740.0
4	Bed planting system	3394.0
5	Conventional method	5695.0

Table 5. Comparative use of diesel fuel on conventional and reduced tillage method

Tillage option	Diesel used (lit./ha/yr)	CO_2 emission (kg/ha/yr)*	Fuel save (lit./ha/yr)
CA system	119	309.4	94
Traditional method	213	553.8	

Hossain et al., 2009; *1 kg diesel produced 2.6 kg CO_2

Problems of CA technology adoption

- Policy planners are not much convince about these technology
- Uncertain machinery demand
- Manufacturing infrastructure and distribution channels of products are little developed
- High price of machinery and low prices of agricultural produce discourage investments.

Problems of CA technology adoption (Cont.)

- Financial organizations are not much friendly to farmers in terms of reducing rate of interest and installments.
- Absentee farmer and small landholder limited access to new technology
- Research–extension-farmers linkage are not well established about these technology transfer
- Limited promotional activity and awareness build up program.

Challenges promotion of CA technology

- Changing mind set up of the users for CA technology
- Motivation private sector investment for scaling up these technology
- How to make available appropriate CA implements and tools at an affordable price to farmers
- Training needed in different level of workers, about the advantages of conservation agriculture
- Policy support is necessary for further acceleration of this technology among the users.

Recommandations

- CO_2 emission is 44% less than conventional tillage system
- Appropriate CA technologies are available, can be used in different farm size and ecosystem
- Several prototypes of power tiller operated implements have been already developed and presently require commercial production.
- Government is friendly to farmers supporting with subsidized rate machinery application in agriculture
- Bed planting systems are more popular in Rajshahi Bangladesh.
- Farmers accept this technology and service providers started commercial business with the CA planters.

Thank You Very Much.....

Name : DR. SULTAN AHMMED

Email Address: s.ahmmed@barc.gov.bd

md-nrm@barc.gov.bd

Website: www.barc.gov.bd

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