Conservation Agriculture Policy – Perspective & Scope

By

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Introduction

- Mid sixties – high yielding varieties – Green Revolution
- Production 50 mt (1950-51) to 203 m.t. (1998-99)
- Required
  - higher doses of fertilizer
  - more irrigation water
  - increase use of plant protection chemicals
  - increase use of diesel and electricity
- Resulted in widespread problems of resource degradation and environmental problems & GHGs

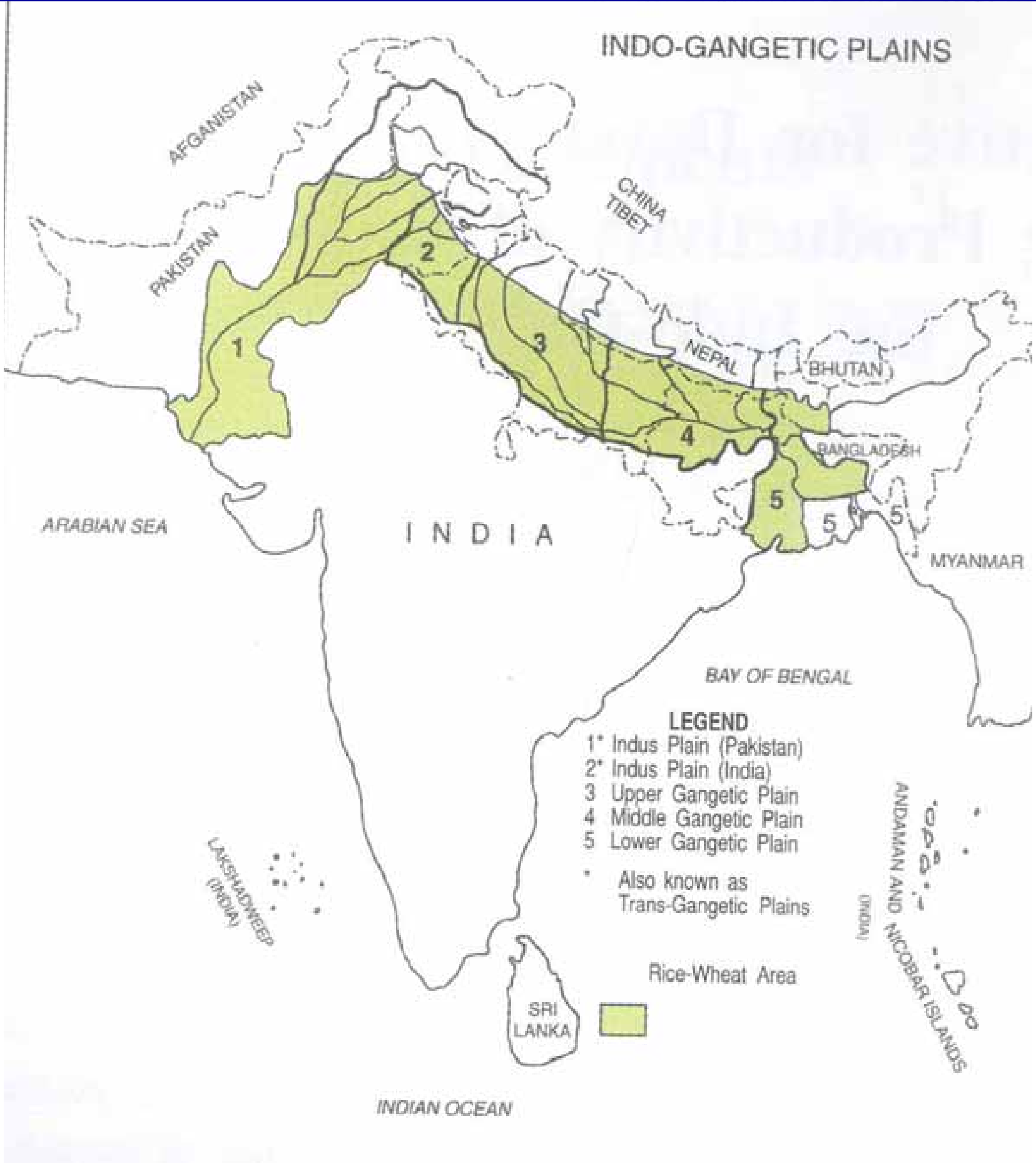
Introduction

- **Fuel crisis in 1970 and uncertainty in**
  - **supply of hydrocarbons**
  - **growing concern of environmental pollution**
  - **by Inefficient use of energy led to emphasis on**
  - **energy efficiency**
  - **energy conservation**
- **Increase demand on energy from Agricultural Sources**
  - **large scale deforestation**
  - **soil erosion**
  - **loss of fertility**
  - **manifold increase in commercial energy**

Introduction

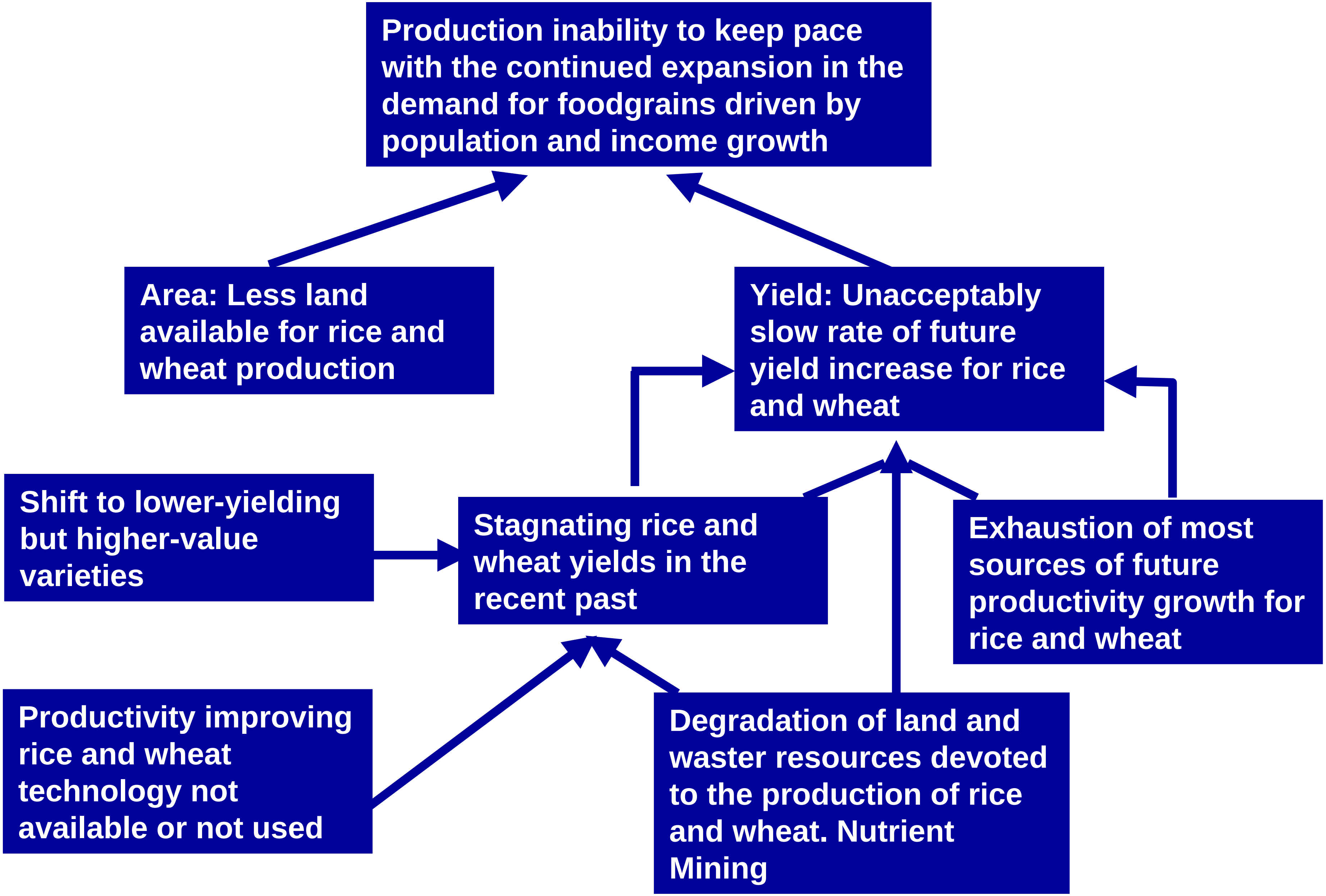
- High mechanized system of USA uses 16.5% of total national energy (80% of which is provided by petroleum products)
- Rice-wheat system (R-W) – main cropping system of IGP.
- 30% of rice and 42% of wheat grown in IGP
- IGP – R-W – 13.5 m.ha.
  - India – 10.5 m.ha.
  - Pakistan 1.6 m.ha.
  - Bangladesh – 0.8 m.ha.
  - Nepal – 0.6 m.ha.
  - China – 10 m.ha.
- Rice-wheat in India – contributes 52% of India's total food production (220 m.t.)

Introduction



The rice-wheat areas of the Indo-Gangetic Plains and the five agro-ecological transects

Interactive threats to productivity and sustainability in rice-wheat cropping systems the Indo-Gangetic Plains



Interrelated Sustainability concerns in rice-wheat cropping systems of the Indo-Gangetic Plains

- Late onset of monsoon
- Available groundwater not used in eastern IGP
- Labor shortage, seasonality
- Excessive tillage and puddling
- Lack of water for break of GM crops in Summers
- Pre-germinated weeds force tillage
- Late seedling in nursery
- Efficient nutrient, water management practices

Delayed rice transplanting

Late planting of winter crops

- Short turn-around time
- Excessive preparatory tillage
- Long duration rice varieties
- Fields don’t come to condition eastern GP
- Ruts of combines spoils field leveling
- Pre-germinated weeds
- Efficient nutrient, water management practices
- Intercrops- agronomic and crop management practices
- Climate change

- Yield stagnation
- Yields below potential
- Declining factor productivity
- Receding water table
- Nutrient mining & K deficiency
- Low input use efficiency
- Decline in SOM, Biodiversity/ diversification
- Surface cover/burning
- Competition for residues
- Environmental pollution
- Rice fallows
- Salinity buildup and
- Ground water quality

Interrelated Sustainability concerns in rice-wheat cropping systems of the Indo-Gangetic Plains

- **Rice-Wheat system**
  - **fatigued – natural resources and declining factor productivity**
  - **reduced organic matter levels**
  - **pesticide – health hazard**
  - **sodicity and salinity problems**
  - **depletion of ground water levels**
  - **lowering of water quality and groundwater pollution**
  - **tillage costs and overall cost rising**
  - **increase emission of GHGs due to burning of paddy straw**

Interrelated Sustainability concerns in rice-wheat cropping systems of the Indo-Gangetic Plains

- Sustainability of the system is in question
- Consortium of South Asian NARS to address R-W system
- (R-W Consortium)
  - Bangladesh, India, Nepal, Pakistan
  - International Centres (CIMMYT, CIP,ICRISAT,IRRI & IWMI)
  - ARIs
  - NGOs
  - Private entrepreneurs and farmers
  - IGP
  - Bangladesh, India, Nepal and Pakistan – most productive agriculture region
  - 24 m.ha.
  - 30% rice and 42% wheat

Interrelated Sustainability concerns in rice-wheat cropping systems of the Indo-Gangetic Plains

- Tillage – Intensive farm operations – maximum energy
- Fuel crises 70's – forced scientists to reduce energy requirement
- Reduced tillage – minimum tillage
- Conservation Tillage (CT)
  - development of zero-till drills
  - rota till drills
  - one pass equipment
- Zero-till drills resulted in saving in
  - fuel
  - time
  - labour
  - cost of operation
  - reduced energy requirement

Interrelated Sustainability concerns in rice-wheat cropping systems of the Indo-Gangetic Plains

- CT – Conservation Agriculture (CA)
  - reduce input use – seed, chemicals, fertilizer, water and excessive tillage
- CA - refers to a system of raising crops without tilling the soil while retaining the crop residues
- Aim – Conserve, improve and make efficient use of natural resources
  - Soil
  - Water
  - fossil fuels through integrated management
- Good number of equipment and technology developed to address to
- CA and these will be discussed.

Conservation Agriculture

- Over exploitation of natural resources
  - water table gone down
  - in some places water logging - leaching of salts
  - excessive use of chemicals – polluted ground water
  - burning of crop residues – GHGs
- C.A. – many definitions
- C.A. refers to the system of raising crops without tilling the soil while retaining the crop residues on the soil surface.
- CA aims to achieve sustainable and profitable agriculture and subsequently aims to improve livelihoods of farmers through the three CA principles
  - minimal soil disturbance
  - permanent soil cover
  - crop rotation

Conservation Agriculture

- CA aims to conserve, improve and make more efficient use of natural resources through integrated management of available water and biological resources through integrated management of available soil, water and biological resources combined with external inputs – referred as resource efficient/ resource effective agriculture.
- CA – range of soil management practices that minimize affects on composition structure and natural biodiversity and reduce erosion and degradation.

Challenge

- Strategies : address twin concerns of
  - maintaining and enhancing the integrity of natural resources
  - improved productivity
- CA – different agro – ecological regions
- CA – 80 m.ha. Globally – US, Brazil, Mexico, Newzeland, Australia, Argentina, Canada, South Asia, China, etc.

Conservation Agriculture

- CA – India – IGP
- Need to evolve a scientifically land use system, a sound CA Policy and mission orient programme.
- CA defer from soil type, rainfall, climate and socio-economic condition.
- Call for developing new strategies and promotion of new technologies to enhance crop production, productivity and formulation of long term perspective.

Advantages and Disadvantages of CA

Advantages	Disadvantages
❖ Reduces labour, time and fuel costs	❖ Formation of hard pan below soil surface due to zero tillage and requires use of sub-soiler to break hard pan after 5-7 years
❖ Reduces overall cost of operation	❖ Need to control weeds by using herbicides thus increasing cost
❖ Reduce use of fossil fuel leads to less environmental pollution	❖ Not suitable to all crop rotations
❖ Reduces soil compaction due to less trafficability	❖ May result in soil borne pests and pathogens in transition stage
❖ More yields in dry years	❖ High cost of machinery such as, laser land leveler, zero-till drill, strip till drill, raised bed planter, straw cutter cum incorporator, straw combine, straw baler, biomass digesters
❖ Saving in water	❖ It may also result in low yields
❖ Less soil erosion less flooding	
❖ Less environmental pollution, Carbon sequestration (green house effect)	
❖ Less leaching of chemicals & solid nutrients into ground water	
❖ Less pollution of water	
❖ Increased crop intensity	
❖ Recharge of aquifers due to better infiltration	

Concern leading to interest in CA

Water regime	Concerns	Possible approaches
High rainfall	❖Rapid erosion and land degradation ❖Nutrient lose	❖ Residue cover ❖ Sensible crop rotations
Low rainfall	❖Late sowing ❖Drought stress ❖Low soil fertility ❖High weeds	❖ Direct drilling ❖ Residue cover ❖ Residue+crop rotation+ mech., chopper+ Pesticides
Dryland	❖Drought stress ❖Soil erosion	❖ Straw cover ❖ Sub-soiling for in-situ moisture conservation
Irrigated	❖Ground water depletion ❖High cost of pumping ❖High cost of production ❖Scarcity of labour ❖Compaction	❖ Water management ❖ Efficient use of input resources ❖ Profitable crop rotations ❖ Controlled traffic cultivation ❖ Permanent bed system

CAM : Requirements

- Alleviate soil compaction
- Soil loosening only in crop rows
- Surface soil loosening with or without straw mulch
- Soil working condition
- Residue cover

Studies on Conventional and Minimum Tillage

Comparison made	No. of Comparisons	Harvest population per acre		Yield, bushel per acre	
		Conventional Tillage	Minimum Tillage	Conventional Tillage	Minimum Tillage
RESEARCH RESULTS ON AGRICULTURAL ENGINEERING FIELD					
Total comparisions	70	14,500	14,000	95	93
Comparisons in which minimum tillage gave higher yields than conventional tillage	12	13,800	14,800	97	110*
Comparisons in which conventional tillage gave higher yields than min^{m} tillage	13	13,900	12,300	90	77*
RESULTS OF DEMONSTRATION FIELDS					
Total comparisons	16	11,800	11,200	100	103

Studies on Conservation Agriculture

Conservation Tillage

- **Tillage – mechanical manipulation of soil to provide conditions favourable for crop growth.**
- **Primary and secondary tillage (m.b. plough, disc plough, rotavator, cultivator, harrow, tractor)**
- **Tillage consumes**
  - **1600 MJ/ ha – wheat**
  - **2200-2600 MJ/ha- rice**
- **Baleman & Bowers (1962) – Illinois – Corn- conventional tillage and minimum tillage**

Comparison of Conventional Tillage, Reduce Tillage & Zero Tillage in wheat in U.K.

Hectares sown in 40 hr week	Treatments	Fuel consumed (litres)	Cost/ha (£/ha)	Man hr requirement per hectare
7.7	Conventional tillage (1 ploughing +3 discking)	6.66	46.50	5.2
10.8	Reduced cultivation (2 chisel plough + 2 disc harrowing)	3.88	37.50	3.7
40.0	Direct drilling (zero tillage + gramaxone)	1.15	25.00	1.0

Conservation Tillage Studies in India

- 1971 – AICRP on ERAS
  - to assess energy use in various farm operations for different production sectors of agriculture.
  - to locate critical components of use and technique to improve
  - system efficiency by reducing wasteful uses
  - make assessment of future energy demand
- results have provided a bench mark of spatial and temporal variations in the energy use pattern in Indian agriculture
- In 1980's – zero tillage concept introduced by ICI to promote "gramaxone"
- Tractor drawn zero-till drill developed in Punjab by Shukla, Tandon & Verma for sowing wheat after paddy without land preparation
  - Reversible shovel
  - Clod formation

Comparative performance of No-Tillage and conventional Tillage Systems for Growing wheat after paddy

Field No.	Plot No.	Treatment	Moisture Content of soil in percentage	Average germination count/m	Wheat Yield (Quintal/ha)
I	1.	No-till	12.00	41.50	31.61
	2	1 discking + 2 cultivator +1 planking	12.50	39.00	30.12
II	3	No-till	14.00	43.10	34.58
	4.	1 discking + 2 cultivator +1 planking	14.00	41.30	34.58

Comparisons of zero tillage and reduced tillage for sowing wheat after paddy and in fallow field

Treatments	Av germination count per meter length/ No. of tillers /plant	Average grain to straw ratio	Yield, q/ha	Type of weeds
1.No tillage (paddy-wheat)	43.00/3.144	1:1.35	34.90	Lamb's quarter/Chenopodium album,Mexican prickly poppy (*Argemone mexicane*)
2.One discking (Paddy-wheat)	57.00/2.34	1:1.95	41.16	Lamb's quarter/Chenopodium album, Cynodondactylon
3.No-tillage (Fallow-wheat)	54.00/2.56	1:0.77	21.32	*Canobis sativa*, Chanopodium album

In 1996 :-

- Pantnagar (GBPUAT) – zero-till drill with “Inverted T-type” furrow openers.
- 100 drills sanctioned under FLD.
- NATP – 30 centres – zero-till drills.
- RWC formed for address problems of R-W growing countries of IGP.
- In India – 3 m.ha. – zero-tillage – Punjab, Haryana, Bihar, U.P.

Advantages of use of zero tillage

- Saves INR 2000-3000/ ha
- Higher yields (1-2 q/ ha)
- Less lodging
- No crop yellowing after first irrigation
- Controls *Phalaris minor* (30-50%) - weed
- Less tractor use/ wear of parts
- Better germination in salt affected area
- Less need of herbicide
- Improved residue management
- Saving in time (30-40%)
- Saving in labour and fuel (60 lt/ ha)
- Less incidence of stem borer

Reasons for adoption of zero-tillage for wheat by the farmers

Adopters

All categories of farmers

_______ for Adoption

- **Reduction in cost of cultivation**
- **Reduction in fuel consumption**
- **Timely sowing of wheat**
- **Reduction in philaris minor population**

Other direct benefits

- High crop yield
- Soil fertility increases due to residue management
- Irrigation water - saves 1st
- irrigation – quicker spread of water, reduces pumping time

Major adoption facility factors

- Refinement of no-till drill
- Promotion of manufacturers - by private manufacturers
- Steady government support and subsidies
- Integration of research efforts and large scale demonstration at farmers fields

Conservation drills

Particulars	Zero till drill	Strip till drill	Roto dill drill
Source of power	45 hp tractor	45 hp tractor	45 hp tractor
Type/no. of furrow openers	Inverted 'T' type/ 09-11	Shoe type/09	Shoe type/11
Row spacings, mm	180 (Adjustable)	200 (Fixed)	160 (Adjustable)
Working width, mm	1600-2000	1800	1750
Drive wheel	Angle lug – front mounted	Angle lug – side mounted	Star lug – rear hinged
Weight, kg	210	250	280
Unit price, Rs	15000	45000	60000

Field Performance

Particular(s)	Zero tillage seeding	Strip tillage seeding	Roto tillage seeding	Conv. tillage (3 passes) – sowing
Time, h/ha	3.23 (70.15)	4.17 (61.46)	3.45 (68.11)	10.82
Fuel used, l/ha	11.30 (67.36)	17.50 (49.45)	13.80 (60.14)	34.62
Operational energy, MJ/ha	648.96 (67.16)	1001.76 (49.31)	783.60 (60.35)	1976.11
Cost of operation, Rs/ha	639.54 (66.39	979.95 (48.51)	807.30 (57.58)	1903.04

Production–economics : Conservation drilling

Particulars	Zero till drilled	Strip till drilled	Roto till drilled	Conventionally sown
Grain yield, t/ha	4.84	4.62	4.78	4.60
Cost of production, Rs/ha	8635	9114	9315	10710
Benefit-cost ratio	3.64	3.29	3.34	2.79
Operational energy, MJ/ha	8114	8712	8444	9516

Area under Zero Tillage in different Countries

Sl. No.	Name of the country	Area under Zero tillage
1	USA	19,347,000
2	Brazil	11,200,000
3	Argentina	7,270,000
4	Canada	4,080,000
5	Australia	1,000,000
6	Paraguay	790,000
7	India	3,000,000
8	Mexico	500,000
9	Bolina	200,000
10	Chile	96,000
11	Uruguay	50,000
12.	Others	1,000,000
	Total	46,533,000

Conservation Practices in Paddy

- Paddy raised in nursery
- Transplanted
  - Laborious
  - drudgerous operation
  - requires frequent irrigation
  - 2000-3000 lit of water-1 kg of rice
- Pre-germinated paddy seeder
- Mat type transplanter
- Direct drilling on raised bed
  - Sesbania sisbon (brown manuring)

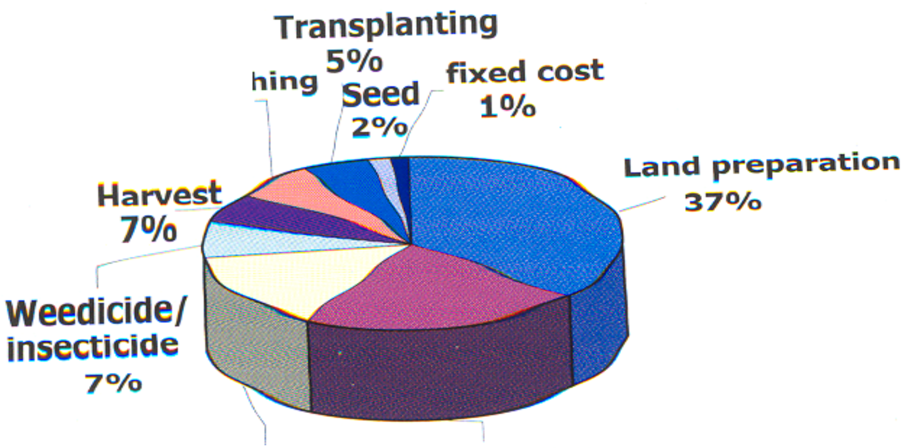
Experience of Bangladesh & Nepal

Participants discussing effect of single transplants, date of transplanting and suitability of rice cultivars (sudha and Parbhat) in cropping system perspective

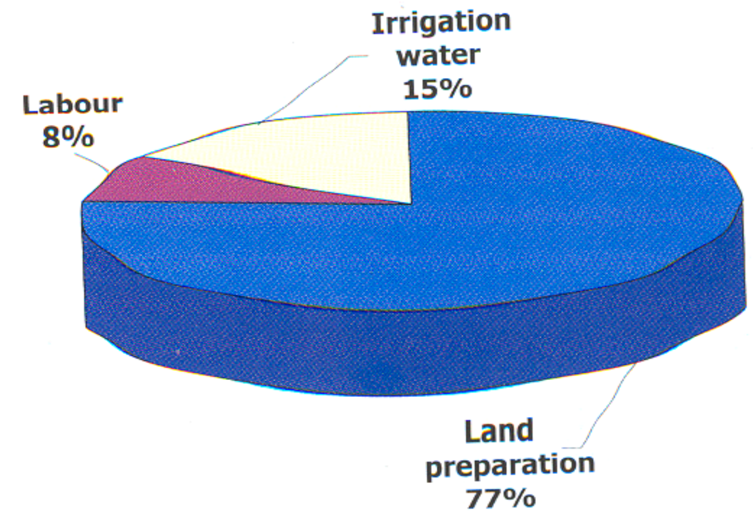
Direct Seeded Rice – A promising Resource Conserving Technology (RCT)

Traveling seminar participants visit a DSR field

Comparative input cost in puddled transplanted rice and saving in DSR



Input cost in Puddled transplanting



Saving in DSR

Input cost in Puddled Transplanting

Saving in DSR

	Puddled Transplanted	DSR	Δ Value
Total Cost US$	518±48	275±47	73
Net IncomeUS$	445±63	354±48	79

Furrow Irrigated Raised Bed System (FIRBS)

- Wheat raised in small and broad beds
- 50% saving in seed
- 30-40% saving in water
- higher yields
- reduction in drudgery
- facilitates mechanical weeding by tractor
- offers opportunity for last irrigation at grain filling stage
- avoids temporary water logging problems
- allows subsurface basal and top dressing of fertilizer
- reduces N losses & promotes rain-water conservation

Raised bed planter

Paddy sown or raised bed

DSR in flat and Raised Bed in no-till and reduced till land

Sesbania brown manuring

Reducing unproductive evaporation losses of water by

- Residue management
- seedling age at transplanting
- Seeding time
- Cultivar choice
- Laser land leveling

Raised bed planting

Particular	Planting on fresh preparatory tillage	Planting on permanent beds	Flat sowing zero tillage	Conv. Flat sowing
Time required, h/ha	13.04	4.80 (55.6) [63.2]	3.23	10.82
Operational energy, MJ/ha	2605.36	1154.03 (41.6) [55.7]	648.96	1976.11
Cost of operation, Rs/ha	2479.84	1060.80 (44.3) [57.2]	639.54	1903.04

( ) % savings over conventional practice

[ ] %savings over fresh bed planting

Production economics of rice after wheat : straw covered and straw incorporated

Particular	Straw incorpo-rated roto tillage rice	Non-straw roto tillage rice	Straw covered zero tillage rice	Non-straw zero tillage rice	Conv. Tillager ice
Grain yield, t/ha	3.31	3.24	3.36	3.30	2.94
Cost of production, Rs/ha	8801	9740	8640	9115	10610
Benefit cost ratio	1.88	1.66	1.94	1.81	1.39
Operational energy, MJ/ ha	5579	6605	5512	5594	9642
Sp. Cost of production, Rs/kg	2.66	3.00	2.57	2.76	3.61

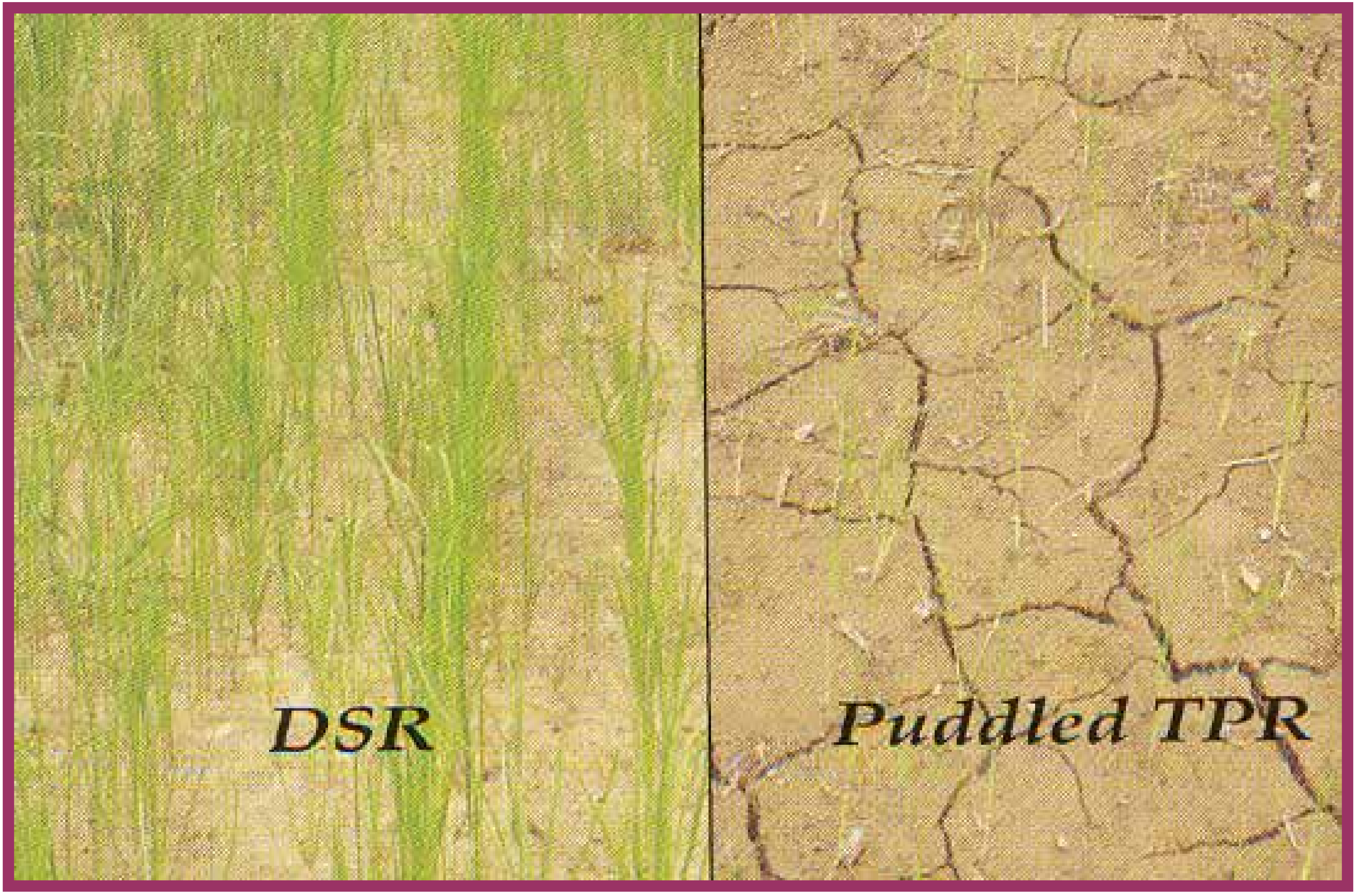
Production economics

Particular	Raised bed wheat		Zero tillage wheat sown	Conventional Flat sown wheat
	Fresh bed	Permanent bed		
Grain yield, t/ha	5.03	5.08	4.84	4.60
Cost of production, Rs/ha	10030	8540	8635	10710
Benefit-cost ratio	3.26	3.87	3.64	2.79
Operational energy, MJ/ha	8750	7684	8444	9516
Special operational energy, MJ/kg	1.74	1.51	1.74	2.07
Special cost of production, Rs/kg	1.99	1.68	1.78	2.33

Saving in water

Fresh bed = 30%

Permanent beds = 40%



Cracking pattern in DSR and puddled rice fields

Leaf color chart

Site specific N Management practices - U.S.G. leaf colour chart

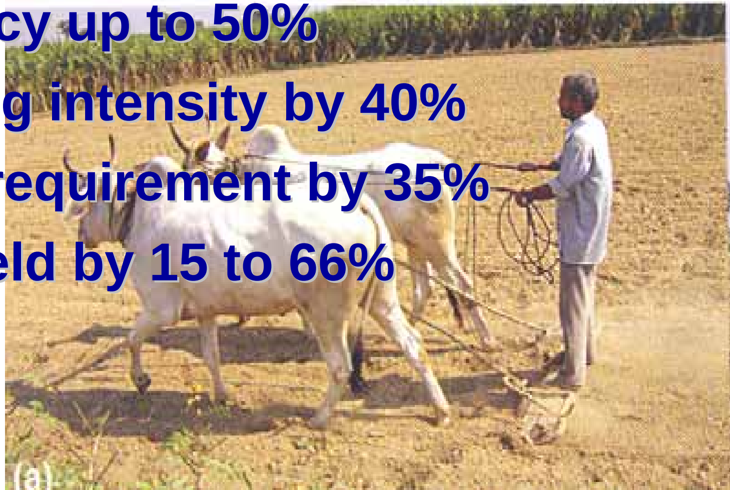
Surface Seeding of Rice in Water Logged Area

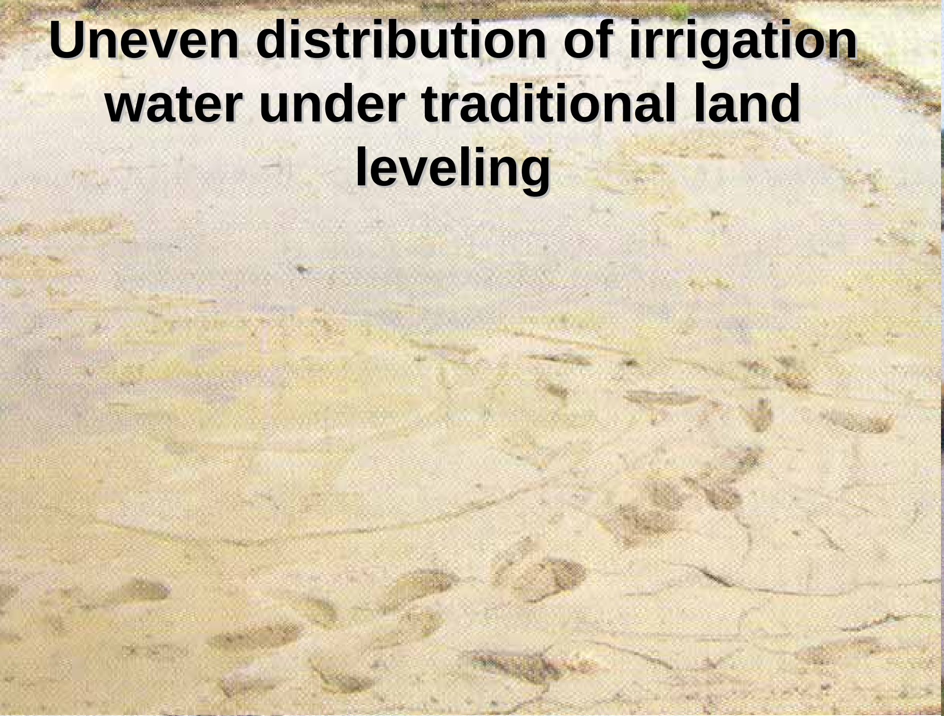
- Wheat seeds broadcasted in standing paddy field or after paddy harvest
- Avoids fallow fields
- Helps in taking one more crop
- Additional yield 3-4 t/ ha
- Low lying areas of IGP of India, Bangladesh and Nepal
- Popular in Yangtze River in China
- Saves labour, fuel and tillage costs

R.C. through use of laser land leveling

- Leveling by
  - animal drawn leveler
  - tractor drawn leveler
  - laser land leveler (both direction)
- Poor crop stand
- Laser land leveler
- Over irrigation and uneven distribution due to unevenness
  - increase water application efficiency up to 50%
  - cropping intensity by 40%
  - labour requirement by 35%
  - crop yield by 15 to 66%

Laser land leveler




Uneven distribution of irrigation water under traditional land leveling

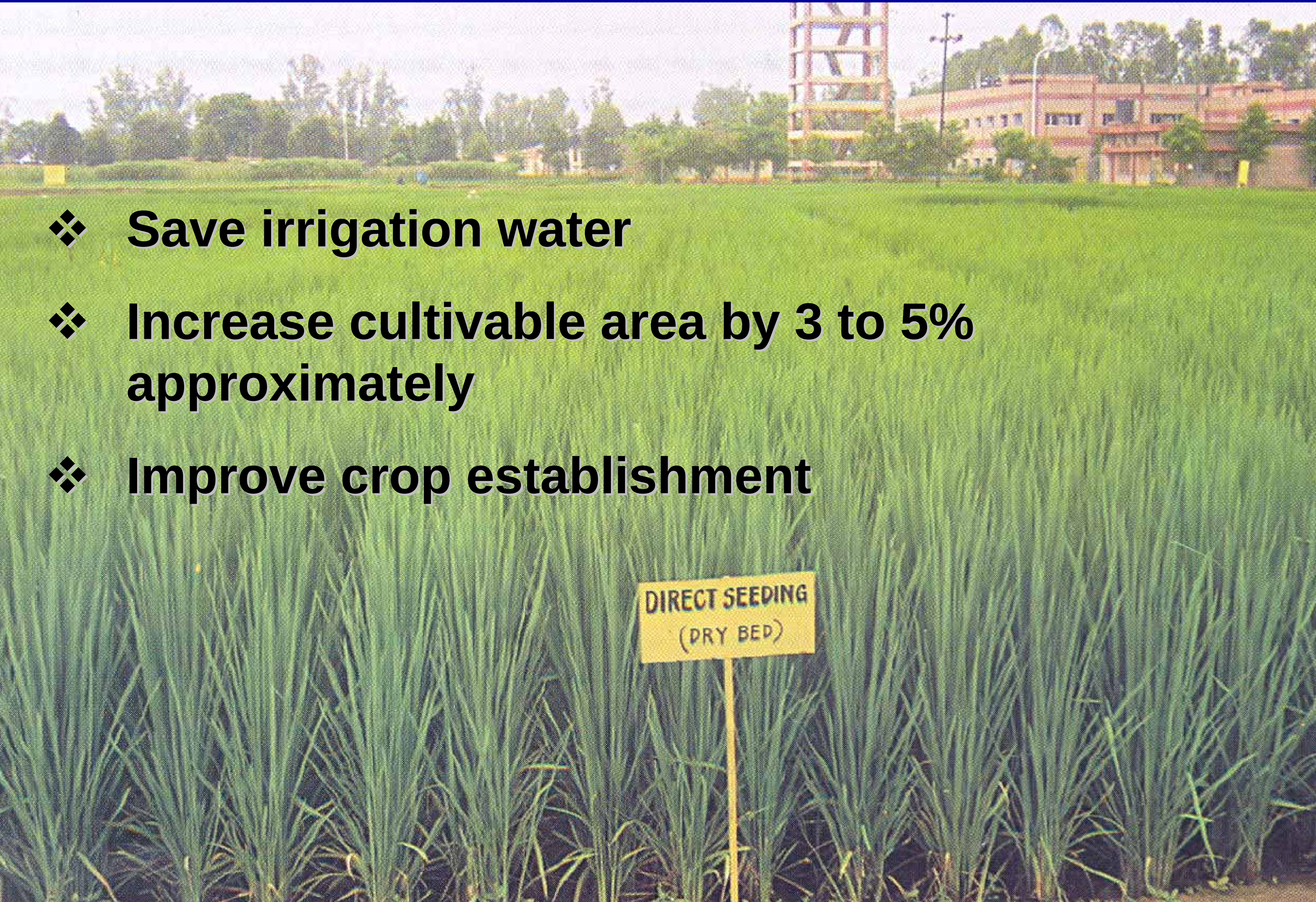

Laser leveled field prepared for rice transplanting


Waterlogging in a wheat field

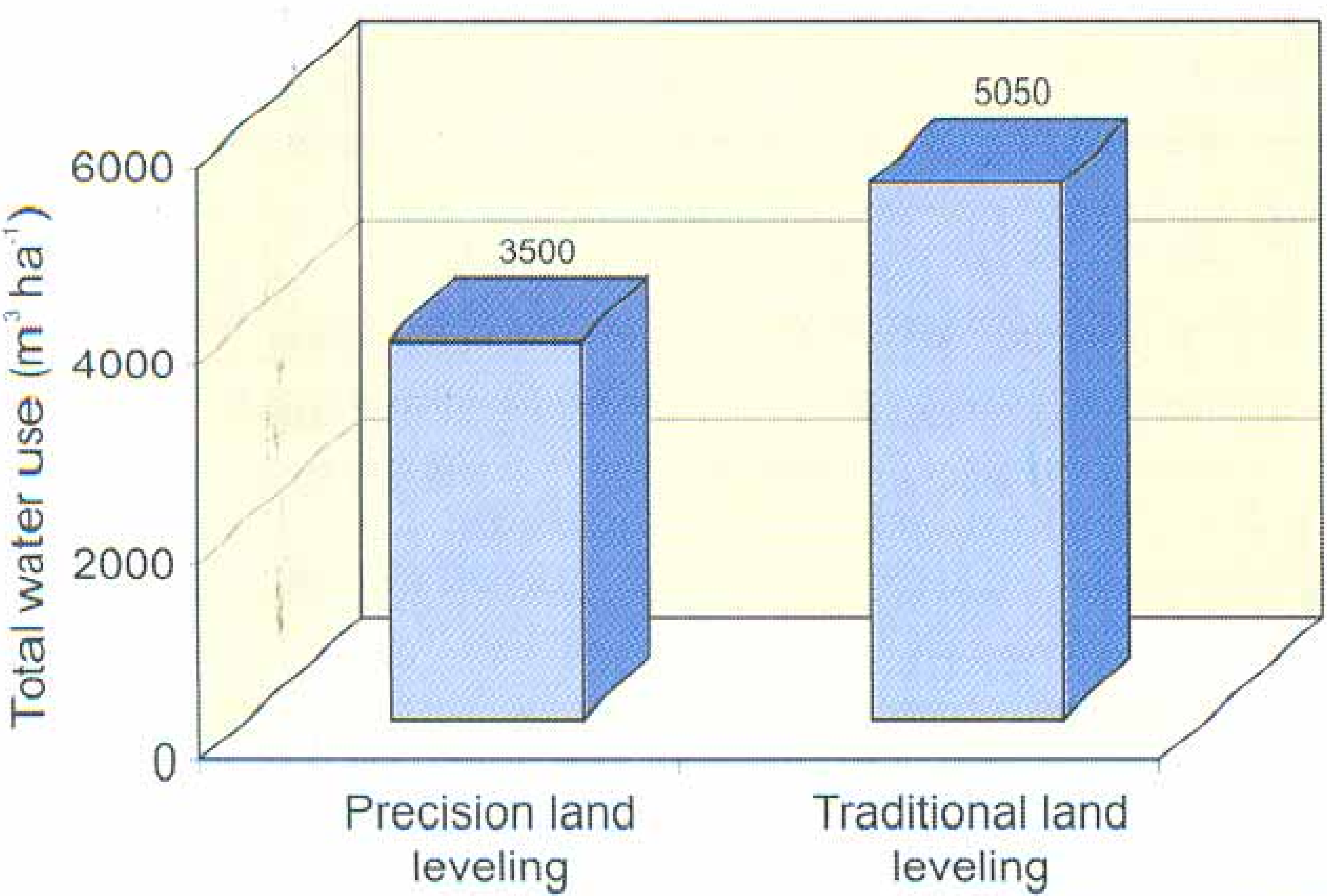

Non-uniform crop stand in an undulated field

Direct seeded rice in a laser-leveled field

- Save irrigation water
- Increase cultivable area by 3 to 5% approximately
- Improve crop establishment



Total water use (m^3 ha^{-1}) in wheat under precision and traditional land leveling



Residue Management and Reduction in Environmental Pollution

- Paddy straw burnt
  - Pollution
  - GHGs
  - soil degradation (loss of organic matter)
- mulch and promote ground water recharge
- reduces soil erosion
- solve liming problem in acidic soils
- About 1000 kg of of biomass can give 10 litres of ethanol

Roto till drill

RDD seeding in full residue

Turbo seeder seeding in full residue

Happy combo seeder

Straw incorporated tillage seeding

Rotavator (in-chopped straw) shallow working-higher work rate than MB plough based cultivation system

Type of straw field	Implement used	Time required, h/ha	Direct energy used, MJ/ha	Cost of operation, Rs/ha	Amount of straw incorp-orated, %
Combine harvested rice and wheat straw field (T1)	Stubble shaver (1)	2.75	508.06	511.99	-
	MB plough (1)	5.13	1151.46	1041.84	76.70
	Rotavator(1)	3.00	644.58	617.84	13.00
	Seed-Fertilizer drill(1)	3.71	696.63	678.93	-
Combine harvested rice and wheat (T2)	Stubbler shaver(1)	2.75	508.06	511.99	-
	Rotavator(1)	3.58	721.30	768.71	60.43
Straw fields	Seed fertilizer drill(1)	4.88	916.39	893.04	-
Non-straw rice and wheat fields (T3)	Duck foot sweeps(3)	7.71	1446.87	1386.90	-
	Seed fertilizer drill(1)	2.99	560.53	546.26	-

Production economics : straw fields

Particular(s)	Wheat straw/non straw (control) -rice sown			Rice straw/non straw (control)-wheat sown			Rice-wheat straw/non straw (control)-field		
	T1	T2	T3	T1	T2	T3	T1	T2	T3
Grain yield, t/ha	3.54	3.18	2.94	4.68	4.64	4.60	8.22	7.82	7.51
Cost of production, Rs/ha	10569	9805	10610	12020	10128	10710	22589	19933	21320
Benefit cost ratio	1.67	1.62	1.39	2.53	2.98	2.79	2.10	2.30	2.09

Straw mulch minimum tillage rice-wheat

Treat-ment	Equipment used	Time requ-ired, h/ha	Operat-ional energyMJ/ha	Cost of operation, Rs/ha	Total time requi-red, h/ha	Total opera-tional energy, MJ/ha	Total cost of opera- tion, Rs/ha	Amount of straw incorpora-tion, %
T_1	Stubble shaver drill	3.45	653.68	648.60	8.71	1859.06	1979.44	54.4
	Roto till drill	5.26	1205.38	1230.84				
T_2	Stubbleshaver	3.45	653.68	648.60	8.21	1610.46	1591.08	-
	Zero till drill	4.76	956.78	942.48				
T_3	Stubbleshaver	3.45	653.68	648.60	11.57	2201.98	2277.08	62.1
	Rotavator	3.57	710.59	763.98				
	Seed cum fertilizer drill	4.55	837.71	864.50				

Production economics of wheat after rice : straw covered and straw incorporated

Parameter(s)	Rice straw condition			Non-straw conv. practice			Non-straw conv. Prac-tice
	Roto till drilled wheat	Zero till drilled wheat	Rotavator+ drill combination wheat	Roto till drilled wheat	Zero till drilled wheat	Rotavator+ drill combination wheat	
Grain yield, t/ha	4.92	5.10	4.80	4.78	4.84	4.64	4.60
Cost of production, Rs/ha	9728	8885	10503	9315	8635	10128	10710
Benefit cost ratio	3.29	3.73	2.97	3.34	3.64	2.98	2.79
Operational energy, MJ/ ha	8746	8345	8946	8444	8114	9116	9516

Straw Combine

Straw Baler

Conservation Development situations in the World and Member Countries and Policy Implication of C.A.

- CA adopted in America, Australia, U.K., Brazil, Canada
- Latin America and South Asian countries
- CA promoted
  - easy credit
  - extension programmes
  - pasture conversion by providing free seedlings
  - enforced land retirement due to excessive soil erosion and taxes due to soil erosion
- In France, Europe, Spain – CA – 1 m.ha.
- European Agriculture Federation (EAFs)
- United National Associations in France, Germany, UK, Spain, Portugal and Italy founded to promote CA.

- **CA has been adopted in Japan, Malaysia, Indonesia, Nepal and Bangladesh**
- **Community led initiative strongly supported by R&D organizations and farmers and industry participation – widespread adoption.**
- **Targeted Policy Approach and Motivate Farmers**
- **Punjab – Water table going down-grow other crops than rice**
- **Pride and Peer pressure- Canada, Ontario's Environmental Farm**
- **Plan(EFO) Programme- innovative approach to Envirn. Conservation & voluntary participation of farmers to assess the Envir. Risks & riase environmental awareness**
- **Farmers driven process supported by Govt. through funds & technical advise.**
- **Appropriate Incentives- short & long term impact, diversification & Infrastructure**

Conservation Policies & Programmes

CA Programmes/Studies launched

- African Conservation Tillage network(ACT)
- French Agriculture research Centre for
- International development(CIRAD), swedish
- SIDA funded Regional land Mgt. Unit
- FAO

Study throws light on

- Challenges farmers face in keeping soil covered
- gaining access to adequate equipment
- Controlling weeds
- Challenges faced ti implement true PA

Farm Conservation Bill of US

Lays emphasis on- Cons. of resources, clean water, improvement in Grassland habitat & biofuel

- CSP- maintain & enhance quality of water, air, soil & habitat-$ 45,000/year
- CRP-reduce soil erosion-plant grasses-rental payments & 50 % cost sharing
- WRP-restore & protect wetlands- 100 % funding
- GRP- help to protect & restore grasslands, pasture , range and other lands(90 % restoration cost funded)
- FRPP – protect Ag. land from urban sprawl & other development- one time payment
- EQUIP- to reduce air and pollution use, energy use and wildlife impacts(70% cost sharing)
- CWLCP- ensure no ovarall net loss & achieve net gain in performance of wet land acreage

Conservation Policy in India

- No Policy as such
- Govt- Watershed Development Programme- to conserve water & reduce soil erosion
- Promotion of RCT-zero-till drill, laser land leveling, straw baler, straw combine etc.
- R-W Consortium- ICAR- CIMMYT
- Alternate crops –Diversification

Following recommended

- Minimum support price, subsidy, Institutional financing, no free electricity, PPP, Land consolidation, Encourage Cooperatives, voluntary participation of farmers, NGOs, etc.

Conservation Ag. Strategies in India

Conservation of water through

- paddy sown in unpuddled soils
- paddy sown on ridges
- Less frequency of irrigation
- laser land leveling- 25 % saving in water

Conservation Tillage Studies

- Development & demonstyration of zero-till drill, strip till drill, roto-till drill, till planting, raised bed planter etc.

Conservation Ag. Strategies in India

Farm Residue Management through

- stubble shaver,
- straw chopper cum incorporator
- straw combine
- straw baler

Environmental Pollution

- Exhaust gas emission norms for tractors/engines
- Fuel standards
- CNG
- Biofuel Mission

Conclusions

Benefits accrued of CAT

- Reduction in cultivation cost (1500-2000 Rs/ha)
- Savings in water and nutrients (25-30%)
- Reduced occurrence of weeds and savings in pesticides (20-25%)
- Increased yield (05%)
- Protection of environment by elimination of burning of straw (Cattle feed)
- Facilitating recycling of residue and plant nutrients (Back to soil)
- Opportunities for sensible/profitable crop rotations.

WE to Conserve for US

THANK YOU