Conservation Agriculture

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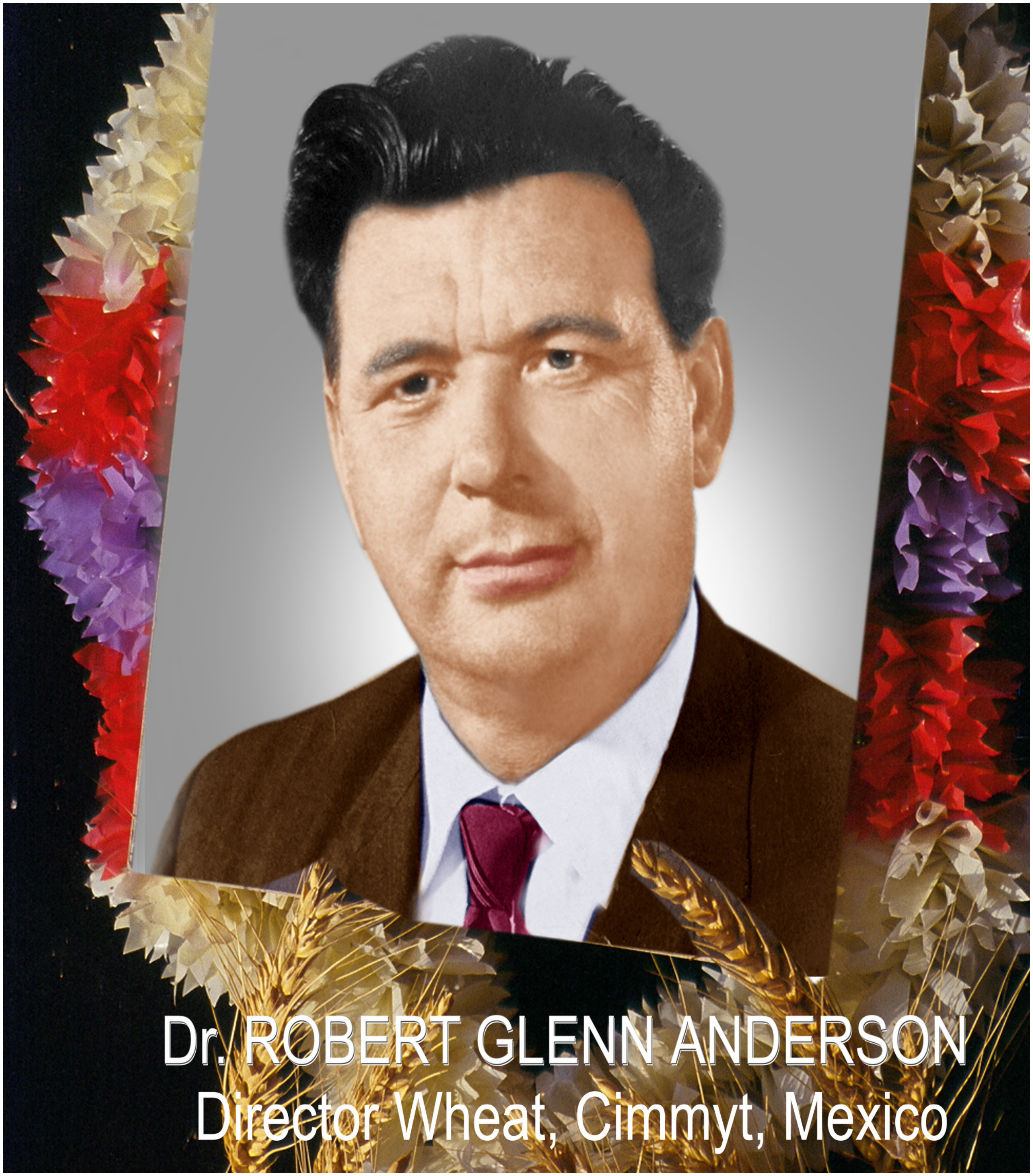

Dr. ROBERT GLENN ANDERSON
Director Wheat, Cimmyt, Mexico

'DYNAMICS' OF RICE IN THE TRADITIONAL STATES OF WHEAT ZONE

	Punjab		Haryana		Rajasthan		Delhi		Utter Pradesh	
	71-72	84-85	71-72	84-85	71-72	84-85	71-72	84-85	71-72	84-85
AREA X1000 HACT.	450.0	1645.0 [3.6]	291.0	557.0 [2]	133.4	169.9 [1.3]	2.6	3.4 [1.3]	4722.2	5535.5 [//]
PRODUCTION X1000 TONNES	920.0	5057.0 [5.5]	536.0	1363.0 [2.5]	159.4	212.8 [1.3]	2.4	6.2 [2.5]	3776.5	7178.5 [2]
YIELD KG/HA.	2044	3074 [1.5]	1842	2447 [1.6]	1195	1253 [//]	923	1824 [2]	800	1297 [1.5]

SOURCE : AREA AND PRODUCTION PRINCIPAL CROP IN INDIA, DIRECTORATE OF ECO. AND STAT. OF AGRIC. AND COOPERATION, MINISTRY OF AGRICULTURE, GOVERNMENT OF INDIA.

'DYNAMICS' OF WHEAT IN NON-TRADITIONAL AREAS (RICE GROWING STATES) IN INDIA

	West Bengal		Assam		Orissa	
	64-65	78-79	71-72	84-85	71-72	84-85
AREA X 1000 HECT.	40.8	521.0 13	40.0	99.2 2.5	20.9	77.0 3.8
PRODUCTION X 1000 TONNES	27.8	998.0 35	48.0	127.9 2.6	38.7	150.0 3.7
YIELD KG/HA.	681	1094 1.5	1200	1290 //	1852	1950 //

SOURCE: AREA AND PRODUCTION OF PRINCIPAL CROPS IN INDIA, DIRECTORATE OF ECO. AND STAT. DEPTT. OF AGRIC AND COOPERATION, MINISTRY OF AGRICULTURE, GOVERNMENT OF INDIA.

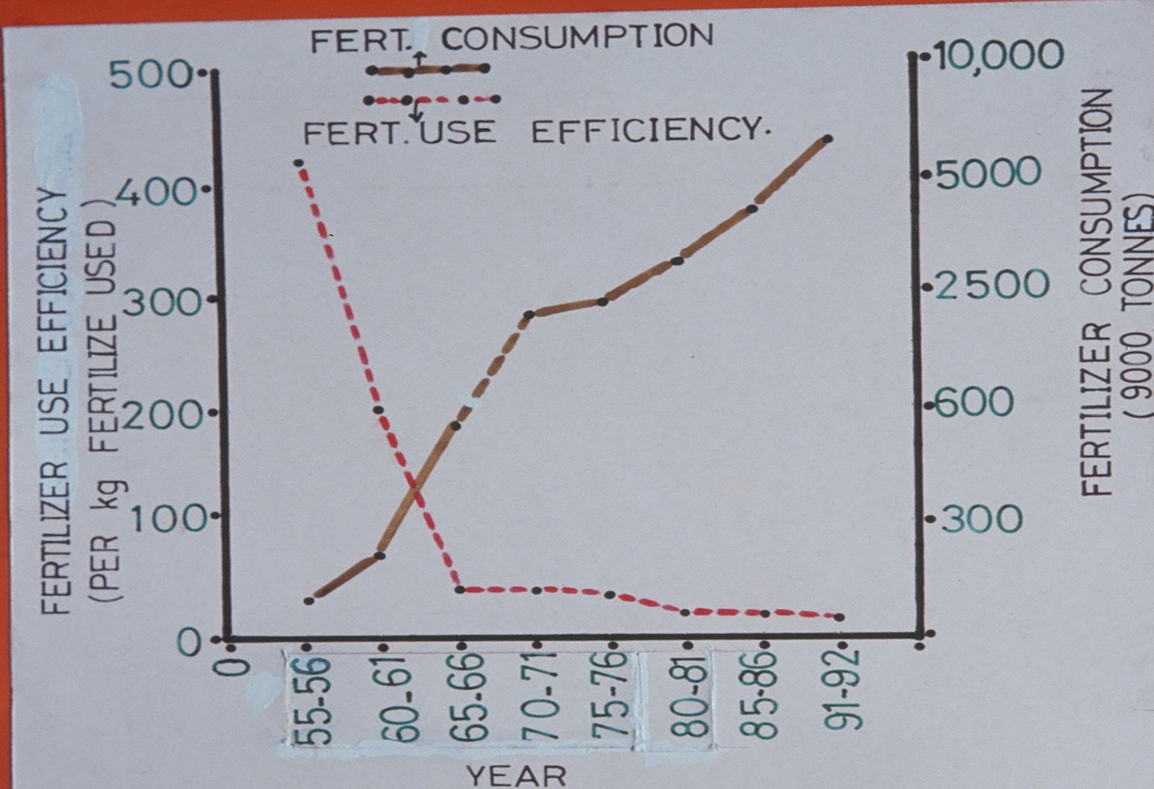


FIG: SHOWING FERTILIZER CONSUMPTION EFFICIENCY

SOURCE : FERT. STATS. 1991 92 FAI NEW DELHI

Table 2 – An Illustrative Nutrient Balance Sheet of Indian Agriculture

Nutrient	Gross Balance Sheet (000 t)			Net Balance Sheet (000t)		
	Addition	Removal	Balance	Addition	Removal	Balance
N	10, 923	9, 613	1, 310	5, 461	7, 690*	- 2, 229
P2 O5	4, 188	3, 705	486	1, 466	2, 961	- 1, 493
K2 O	1, 454	11, 657	- 10, 202	1, 018	6, 994*	- 5, 976
Total	16, 565	24, 971	- 8, 406	7, 945	17, 645*	- 9, 701*

Source 69. Tandon, H. L. S. FADCO, New Delhi. 240 (2004)

Table 3 – Nutrient uptake in important cropping system

Cropping system	Applied (kg ha-1)			Total yield	Total uptake		
	N	P	K	(t ha -1)	N	P	K
Rice wheat green gram	260	70	50	11. 5	328	30	305
Maize-Wheat	250	54	75	7. 60	247	37	243
Rice-Wheat	250	44	84	8. 80	235	40	280
Pigeon pea –Wheat	144	52	100	4. 82	219	31	168
P. Milet-Wheat-Coepea (Fodder)	245	66	66	9. 22	500	59	483
Soyabean –Wheat	145	61	0	7. 74	260	37	170

Yadav, R.L, Kamta Prasrd and Gangwar, K. S. in: long term fertility management through integrated plant nutrient supply (1998).

Table 4 - Nutrient removal (kg/ha) in fruit harvest				
Fruit crop	Fruit yield (t/ha)	N	P2 O5	K2 O
Mango	15. 0	100	25	110
Banana	57. 5	322	73	1180
Pineapple	84. 0	150	45	530
Papaya	80. 0	225	60	180
IPNI Research data (2007)				

Table – 5 Nutrient removal (kg/ha) by some vegetables						
Crop	yield (t/ha)	N	P2 O5	K2 O	MgO	S
Potato	40	175	80	310	40	20
Cabbage	70	370	85	480	60	80
Cauliflower	50	250	100	350	30	NA
Brinjal	60	175	40	300	30	10
Tomato	50	140	65	190	25	30

Tandon, H.L.S (2000) Fertiliser development and consultation organization.

Table 7 – Approxmiate addition and uptake plant by crops in different popular cropping system in West Bengal

Crop Sequence	Nutrient added through fertilizers (kg/ha)				Uptake of nutrient by crop (kg/ha)				Balance of NPK (kg/ha)			
	N	P	K	Total	N	P	K	Total	N	P	K	Total
Rice- rice	180	90	90	360	165	41	213	448	-15	49	-123	-88
Rice-wheat	160	80	80	320	189	57	250	515	-29	23	-170	-190
Rice-potato-Sesame	260	180	180	620	316	490	490	999	-56	26	-310	-379
Jute-vegetable	200	85	130	415	260	118	256	673	-60	-33	-216	-258

Department of agriculture, govt. of West Bengal. Soil tested-based fertilizer recommendations for principal crops and cropping sequences in West Bengal (2005).

Sustainability issues in the IGP

- Declining growth in production
- Rising cost of production
- Declining total factor productivity
- Declining and rising water table
- Soil nutrient mining
- Increasing diseases, pests and weeds
- Eroding biodiversity

Present Situation

- Globally food production to be doubled in next three decades.
- Emphasis on live stock needed
- Climate change
- Inputs are costly
- Use of increased fertilizers
- Irrigation water
- High yielding varieties
- Water shortage
- Land decreasing
- High market price.

Not much response

Agriculture sector in India reaching at a crucial point.

- Continue to play vital role in national economy.
- GDP contribution declining over the years.
- Still 65% of our population relay on agricultural sector and not declining.
- On the above trend, many questions being raised.

- How to achieve greatly **accelerated levels of food productivity**, which is stagnating for some time.
- How can such a growth be pursued – does not leave an **impoverished resource base** & can cop-up with **adverse environmental impact**.
- How can **productivity goals** be met with booming population, social equivity and inclusiveness.

We are standing at :

- **Stagnating /declining** productivity of major food**,** crops, pulses, oil seeds etc, in irrigated sector / vast rainfed area.
- Wide spread problems of land degradation,
  - * **declining** soil quality **/fertility**
  - * depleting water **resources**
  - * **diminishing** biodiversity**.**
- **Increasing severity of environmental problems:**
  - * Pollution **of surface and ground water**
  - * Gases **from industries, vehicular etc.**
  - * **Atmospheric loading of** green house pollution**.**
- **Need for adjustments and** adaptations to climate **change.**
- **Spiraling** energy needs**.**

The situation calls for a strategy different from that we have been pursuing thus far. **More radical approach** is needed with the strategy we need now must reconcile our **shorter needs of achieving enhanced productivity** with in the frame work of **long term sustainability**.

Globally ‘Conservation Agriculture” (CA), has emerged as an alternative to conventional agriculture and can be considered a strategic response to the multiple challenges that we face.

Brief History Conservation Agriculture

- Some say it began with Mayans:
  who utilized a stick to plant maize in unprepared soil.
- Others traced its principles as far back as Egyptians.
- Clearly CA in modern sense began in mid 20th century.
- With introduction of :
  - Effective herbicides
  - No till
  - Direct sowing of crops

US in 1950's

CA emerged from events in **Brazil** during **1970' s – 1980's**

Govt. Policy: - **Shift from livestock →crop based** farming on sloping, high rainfall areas of Southern Brazil Farmers started plowing pastures to plant Soybeans (this increased – soil erosion and land degradation)**: reduced productivity.**

Suggestions :- Terracing, Soil cover, avoiding soil disturbance

By the end of 1970's, an efficient no till/CA package developed and began to be adopted by the larger farmers and later, in 1990's by a large number of small farmers

CA reflected in:

- Over coming land degradation.
- By avoiding intensive soil tillage and maintaining **soil cover**

Gains

* improved **soil OM**
* reduced **soil erosion**
* less loss of **nutrients**
* improve **soil structure**
* higher **rain water** productivity
* richer **soil biology**
* **improved crop yields.**

CA in Brazil	**25 mha**
CA in Argentina	**18 mha**
CA in Paraguay	**2 mha**

Recent success wheat zero-tillage after puddle rice, now covering **several million ha in indo-genetic plains.**

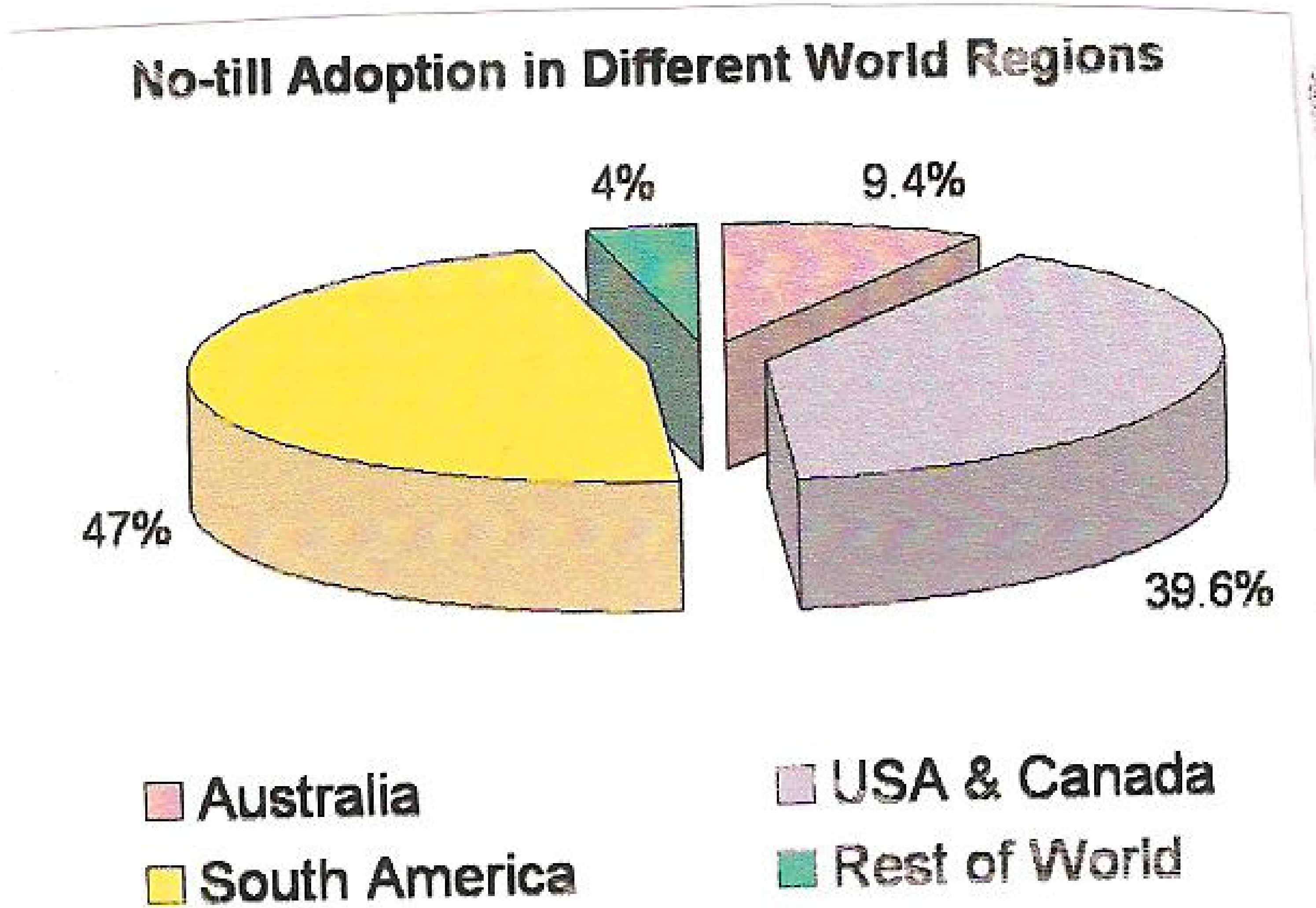
- Initial work zero-till began in south Asia: began in PAU as early in 1970 .
- On farm zero-till began in the early **1980's** in Pakistan when CIMMYT imported **Aitcheson zero till drill** from **New Zealand** for testing on farmers fields for wheat sowing **: dates advancement**.
- **Imported drills-** expensive, few in no., heavy not suited to use by farmers, broke too easily with loose straw, further progress stalled-stubble retentision-rice stem borers.

- In 1988 attention shifted to India – 4 Aitcheson drills from New Zealand to India. Ist to Pantnagar – on farm testing in 1990-91 season-slow pace "inverted T" from Aitcheson – in local drill made original Pantnagar drill. (dealer ship near Pantnagar).
- In 1992 company fitted inverted -'T' openers in conventional - till drill.
- By 1994 it was ready for large scale testing.
- In 1994-96 adoption of this implement was accelerated due to herbicide – tolerant Phalanve minor.
- By 1995-96 – save on tillage and lesser weed in zero till fields.
- In 1999- 02 zero –till wheat exceeded 10,000 ha .
- By 2006- 07 – zero till wheat was around 3 mha.

In recent decades CA or its elements made progress in

- US
- The southern cone of Latin America
- Australia
- China
- South and central Asia and
- less progress in sub Saharan Africa

100 Million ha



(Source, Derpsch, 2008)

IN SOUTH ASIA

- **The presence of puddled rice in the rotation: permanent residue retention is not feasible.**

- **Until sustainable and highly by productive aerobic rice varieties and management practices become available, the potencial for full CA in South Asia will remain in un fulfilled**

From wheat

- Zero –till to **resource conservation** technology (RCTs)
- including **laser leveling** of fields
- **Surface seeding** of wheat in low-lying, poorly-drained areas.
- **Site specific nutrient** management in rice,
- **Bed planting** fresh or permanent, for rice, wheat and other crops

Components of Conservation Agriculture

- Laser leveling – water sawing
- Zero –till ferti machine – enhance planting date and seeding in untilled soil.
- Residue management after chopping left back on field surface.
- Ridge and furrow system : Maize, wheat, cotton, soybean.
- Permanent bed planting – wheat, cotton sunflower, soybeans.
- Recycling of farm waste, cattle shed, poultry / piggery yard residue and vegetable and fruit mandies wastage, with rural and urban organic residue.

Conservation Agriculture

Getting Agriculture to Work for People and the Environment

Mechanization Needs of Conservation Agriculture

Laser Land Leveler

- Savings in cost of seed bed preparation of approximately by Rs. 2,500 to 3,000 per ha.
- Savings in fuel from 37.3 to 70 litres of diesel/ha. dependent on soil condition
- Saving in time through seed bed preparation and sowing
- Advancement in sowing time over conventional system by 2 weeks depending upon soil conditions
- Saving in water up to about 30%
- Reducing the incidence of weeds (*Phalaris minor*) by about 40-50% in rice-wheat system

Tractor Operated Zero-Till Drill

An indigenously produced "No Till Seed-cum-Fertilizer Drill"

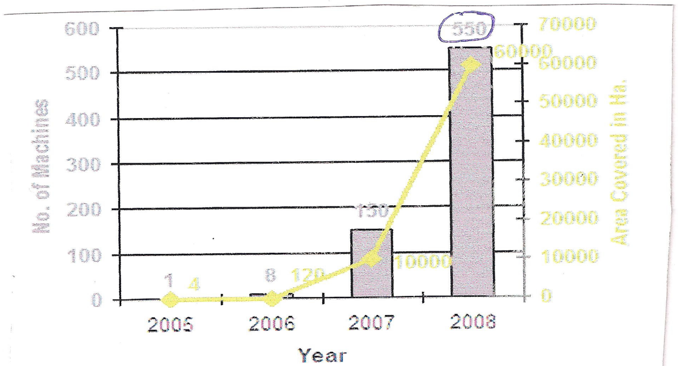
Broad Bed Former
Source: Edwards Farm Machinery Ltd.

Power Tiller Operated Zero-Till Drill

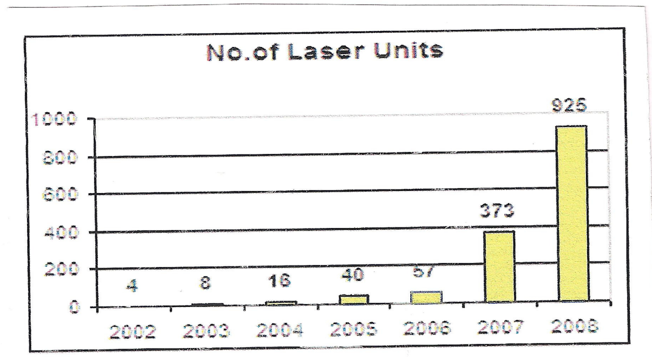
Happy Seeder
Source: National Agro Industries

Animal Drawn Zero-Till Drill

Demonstration of Laser Land Leveler for Farmers in Punjab



Growth in Coverage Area/numbers for Laser Land Levelers in Punjab



Progress of Laser Leveller custom services in Indo-Ganges of India

Contour cultivation as a practice to conserve soil moisture

CA Experiments in Wheat and Maize in Rainfed Region of Mexico

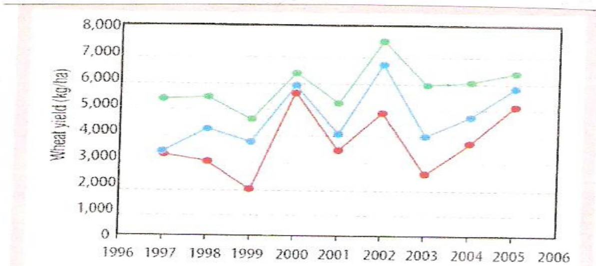
CIMMYT conducted research studies on wheat and maize in the El Batan region of Mexico based on three parameters:

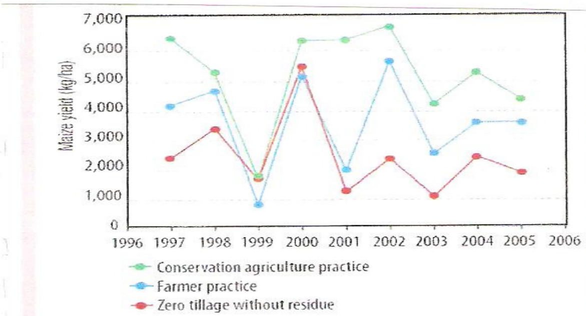
(i) adoption of conservation agriculture practice

(ii) conventional agriculture practice

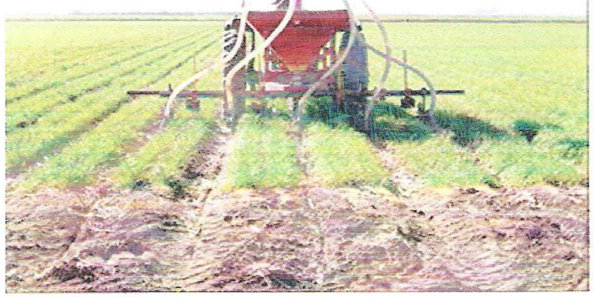
(iii) zero tillage practice without residue retention.

A comparison of wheat and maize yield obtained by them from 1996 to 2006 for these parameters is shown in the figure below. From the figure, it can be seen that over the years, with adoption of CA practice, yield has always been stable and higher as compared to conventional practices of heavy tillage, and also when zero tillage practices are pursued without retaining crop residue. In the long-run, CA systems have proven to be sustainable as they improve soil structure, save water, and reduce labour and energy costs.





Source: Concentration on Conservation: Agriculture that benefits farmers and the land. CIMMYT Annual Report 2007-2008



Bed planting in conservation system (Source: CYMMIT)

Crops sown in standing residues (Source: CYMMIT)

Constraints

- **Laser land leveleers**, **ridge furrow** making machine, **straw chopper/ shredder**, combine harvester, zero-till seed cum fertilizer drill are **out of the reach of the small farmers** until **custom hiring** is strongly introduced.
- **Straw** is a waste in Punjab, Haryana, Western UP and being burned or sold for animal feed and for glass and other packaging industries, brick kilns owners etc.
- No definite and proper system developed / evolved for **on farm and off farm organic residue recycling.**
- Use and efficiency of **bio fertilizers** yet to be properly organized and harvested.

Conservation Agriculture

Getting Agriculture to Work for People & the Environment

Knowledge Assessment and Sharing on Sustainable Agriculture: Lessons for India

Adapted from the KASSA project deliverables: Comparative critical analysis report of the four platforms (2006)

An EU-funded project Knowledge Assessment and Sharing on Sustainable Agriculture (KASSA)

Partners and Organisations Involved

The project comprised a worldwide consortium with partners from 18 countries, 28 institutions, and 31 teams working together for 18 months during the years 2005-2007 in a structured manner. The project was coordinated by Center for International Cooperation in Agricultural Research for Development (CIRAD) and represented four regional platforms: European, Mediterranean, Asian and Latin American; to analyse common practices as well as specificities.

Drivers identified for development and use of CA based on the perception of platform

Farm-level Drivers

- Reduces costs
- Reduces soil erosion and soil degradation
- Improved water productivity
- More flexibility and improved timeliness of operations
- Diversification and enterprise selection

Institutional & Social Drivers

- Dynamism and effectiveness of innovation systems in generating knowledge to adapt and improve CA practices
- Extent to which CA implements and technical services are generally available to farmers
- Leadership from farmers and farmer organizations in the transformation from Conventional to CA
- Occurrence of a 'crisis' resulting in a more rapid development of CA practices and implements

Policy Drivers

- Favourable macroeconomic policies
- Favourable Agricultural Sector policies
- Policies affecting farm size, agrarian structure, and land tenure
- Appropriate agricultural research policies
- Policies for training, communication and support for farmers' initiatives
- Technology management - residues, cover crops, crop rotation
- Weeds, pests and diseases
- Increased production costs
- Non-availability of CA implements
- Lack of subsidies and credit facilities
- Lack of Knowledge
- The problem of 'mindset'

CSISA Project Launched in South Asia

The Cereal Systems Initiative for South Asia (CSISA) is an initiative aimed to help six million farmers to boost crop yields and their incomes substantially. The project intends to take forward past cereal research achieved in the public and private sectors, aims to produce an additional five million tons of grain annually, and increase the yearly incomes of six million poor rural households by atleast $350. CSISA aims to reverse declines in annual cereal yield growth of recent years, decrease hunger and malnutrition, and increase food and income security in South Asia through accelerated development and deployment of new cereal varieties, sustainable management technologies and agricultural policies.

The project effort looks to embody itself through conservation agriculture principles while pursuing project goals and efforts. The focus of CSISA is to be on the small landholder farmer with improved food security and improved returns being the critical objectives. To achieve this, the project will have to work through a better understanding of livelihoods and mechanisms of improved stakeholder participation.

The initiative will build on past work in the region supported by CGIAR, including that of the Rice-Wheat Consortium for the Indo-Gangetic Plains, which has developed and promoted resource conserving technologies. The three year initiative will address needs of sustainable cereal production in India, Pakistan, Bangladesh, and Nepal. CSISA is led by the International Rice Research Institute (IRRI) and International Maize and Wheat Improvement Centre (CIMMYT) with funding support from Bill & Melinda Gates Foundation and United States Agency for International Development (USAID). Other International Agricultural Research Centers that will partner include International Food Policy Research Institute (IFPRI) and the International Livestock Research Institute (ILRI). It will also partner with national agricultural research organizations, education and extension systems.

Major objectives of CSISA include better crop management and post harvest technologies and practices; the development and dissemination of improved rice, wheat and maize varieties; and the creation of a new generation of agricultural scientists and professional agronomists. The program will focus initially in eight

Conservation Agriculture – Opportunities beyond Rice-Wheat Cropping System

Dr. Ashok Yadav, Dr. R.K. Malik & Dr. V. Kumar
CCS Haryana Agricultural University, Hisar

$1 = Rs. 50	Conventional Tillage	Zero-Till Seeding	Savings
Wheat seeding Rs./ha	3,500	500	3,000
Consumption of diesel L/ha (Rs/ha)	55 (1,705)	7.5 (232)	47.5
CO_2 Emission @ 206 kg/ha diesel consumed	143	19.5	

Table 1: Savings an account of zero-till wheat planting

wheat in zero-till fields was higher or comparable to yields in conventionally tilled plots.

Year	Area (in ha.)	Average Yield (Kg/ha.) Zero-tillage	Conventional tillage
2004-05	4	4,824	4,712
2005-06	12.5	3,989	3,816
2006-07	34	4,657	4,554
2007-08	78	4,580	4,210

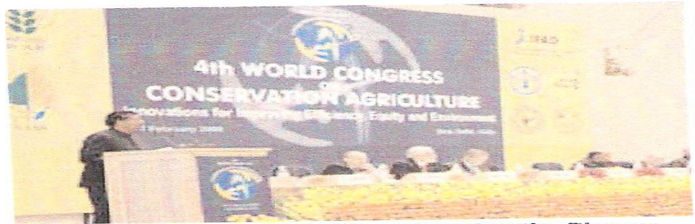
Table 2. Wheat yield in field trial in south western Haryana

Conservation Agriculture

Getting Agriculture to Work for People and the Environment

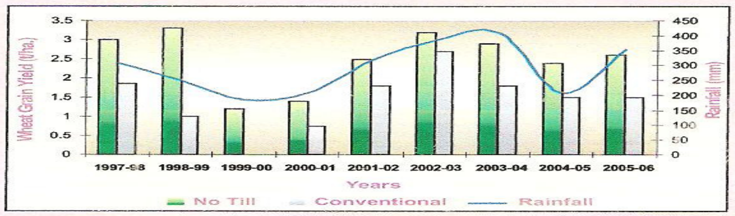
IVth World Congress on Conservation Agriculture: Innovations for Improving Efficiency, Equity and Environment

4th - 7th February 2009, New Delhi, India



Dr. Mangla Rai, DG, ICAR, addressing the Plenary

Grain yield at farmer's field under conventional and no-till (1998-2006)



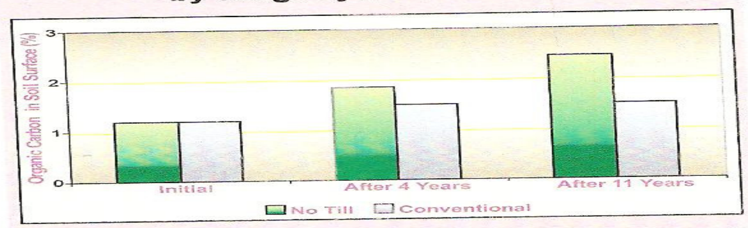
Grain yields reported from no-tillage pioneer farmers field showed increased yield obtained in dry as well wet years. In very dry years with less than 200 mm rainfall, farmers were able to produce 1.1 and 1.5 tonnes of wheat in two different locations where no-tillage fields were the only ones harvested in the entire region. In wet years, change in farmers perception was observed towards crop residue left in the field which was seen as an investment in their soil rather than wasted biomass.

Source: No-till System applied to North Africa Rainfed Agriculture: Case of Morocco (Q.EL Gharras, A. EL Brahli, and M EL Mourid, Lead Papers, Fourth Congress on Conservation Agriculture, pg 41-50, 2009)

INFOPIX

This section will present researched data in pictorial form from past studies for benefit of readers

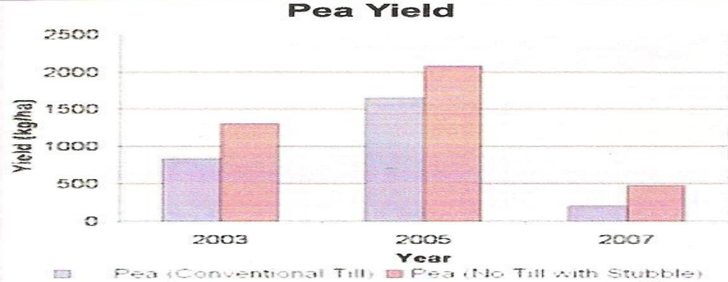
Soil Organic Carbon as affected by tillage system and time



Crop residues left on soil surface led to an increase in soil organic carbon (SOC) from 5.62 to 7.21 t/ha in 0-25 mm under no-tillage after 4 and 11 years (experimental field, at Sidi El Aïdi, Morocco). At the same horizon, SOC did not change under conventional tillage after the same periods. The results revealed that no-tillage soil had sequestered 3.5 and 3.4 t/ha of SOC more than the conventional tillage after 4 and 11 years. The figure illustrates that over 11 years the horizon gained 13.6% and 3.3% of its original SOC under no-till and conventional tillage respectively.

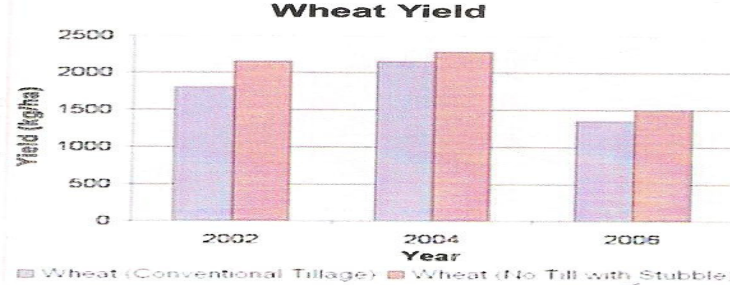
Source: Bessam, F. and R. Mrabet (2003) Long term changes in soil organic matter under conventional and no-tillage system in semi arid Morocco. Soil Use & Management, 19(2): 139-143.

Pea Yield



Source: Huang GB, Li LL, Zhang RZ, Unkovich M, Li G, Chan K, Bellotti W (2008), "Conservation tillage research on the Loess Plateau of China", paper presented at the 14th Australian society of agronomy conference, September 21-25, 2008, Adelaide, South Australia

Wheat Yield

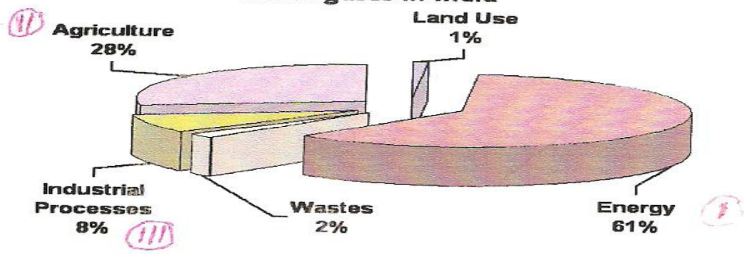


Conservation Agriculture
Getting Agriculture to Work for People and the Environment

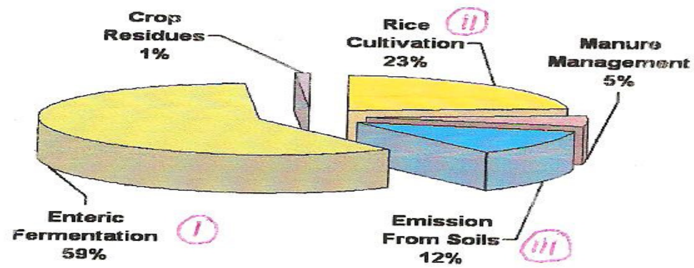
Conservation Agriculture as an Adaptive and Mitigation Strategy to Combat Climate Change

Dr. I.P. Abrol, Professional Alliance for Conservation Agriculture

Contribution of major sectors to emission of green house gases in India



Relative contribution of sub-sectors of agriculture to green house emissions in India



In what way does climate change impact agriculture?

According to the IPCC Third Assessment Report, the impact of climate change on agriculture will be mediated through a combination of one or more factors :

- Direct impact of changes in atmospheric composition (e.g. increased CO_2 concentration),
- Increased mean/maximum temperature, and
- Changes in availability of water due to changes in pattern and amount of rainfall, resulting in increased GHG emissions.

Projected Climate Change Impact (IPCC, 2007)

CLIMATE RELATED CHANGE	LIKELY IMPACT
Warmer and fewer cold days and nights; warmer and more frequent hot days and nights over most land areas	Decreased yield in warmer and increased yields in colder regions; increased pest incidence
Warm spells and heat waves increasing in frequency over most land areas	Reduced crop yields due to heat stress, adverse impact on health and productivity of livestock, increased danger of wild fires
Increased frequency of heavy precipitation events over most areas	Damage to crops; increased soil erosion; increased problems at time of cultivation due to water logging etc.
Area affected by frequent drought will increase	Reduced crop yields from crop damage and failures, increased livestock deaths, accelerated land degradation/soil erosion, reduced arable land, migration
Intense tropical cyclone activity increase	Damage to crops/trees/coastal ecology
Increase in incidence of high sea level	Salinization of estuaries and fresh water systems, loss of arable land, increased migration

Source: FAO (2008)

Adaptation Strategies to Cope with Climate Change

LIKELY IMPACT ON AGRICULTURE	POSSIBLE ADAPTIVE STRATEGIES
Greater vulnerability of production systems through: • Direct impact of increased temperature • Indirect impacts on water availability resulting from increased incidence of droughts and higher intensity rains	• Promote agro-biodiversity (plant and animal) including agroforestry that can impart greater resilience to changing environmental conditions and stresses • Develop and promote adoption of drought resistant/ flood and salinity resistant crops, and livestock breeds with greater ability to withstand stressed environments • Develop, adapt and promote soil, crop and water management practices aimed at efficient use of available water resources in a watershed; to enhance use efficiency of nutrients • Develop and promote practices for improved livestock nutrition and managements to cope with stress

CA Practices as Mitigation and Adaptive Strategies to Combat Climate Change		
Elements of Conservation Agriculture	**How will CA mitigate GHG emission**	**How will CA contribute as an adaptive strategy**
• Develop and promote management practices that are based on following key principles • Minimum soil disturbance, e.g. through no-tillage • Keeping soil covered, e.g. by maintaining crop residue, growing cover crops, etc. • Adopting diversified crops and sequencing	• Reduced CO_2 emission due to tillage induced oxidation of soil organic matter • Increased CO_2 sequestration through building soil organic matter/increased biomass • Reduced N_2O emissions by enhancing the use efficiency of nitrogenous fertilizers • Reduced CH_4 emission through opportunities to better manage livestock and rice paddy	• Moderating the impact of high atmospheric temperatures on soil temperatures and plants by soils cover providing crop residues etc. • Reducing the adverse impact of stress/drought or excess water periods through enhanced in-situ storage, reduced runoff and erosion, reduced water losses through evaporation

Recognizing the main sources, efforts at mitigation of GHG emission need to focus on:

- Sequestering atmospheric CO_2 through enhanced storage in soils
- Enhancing agricultural/livestock productivity so as to reduce pressure on deforestation and denudation
- Emphasis on reduced dependence on non-renewable energy sources by improving use efficiency of inputs through available management options.

GHG Mitigation Opportunities

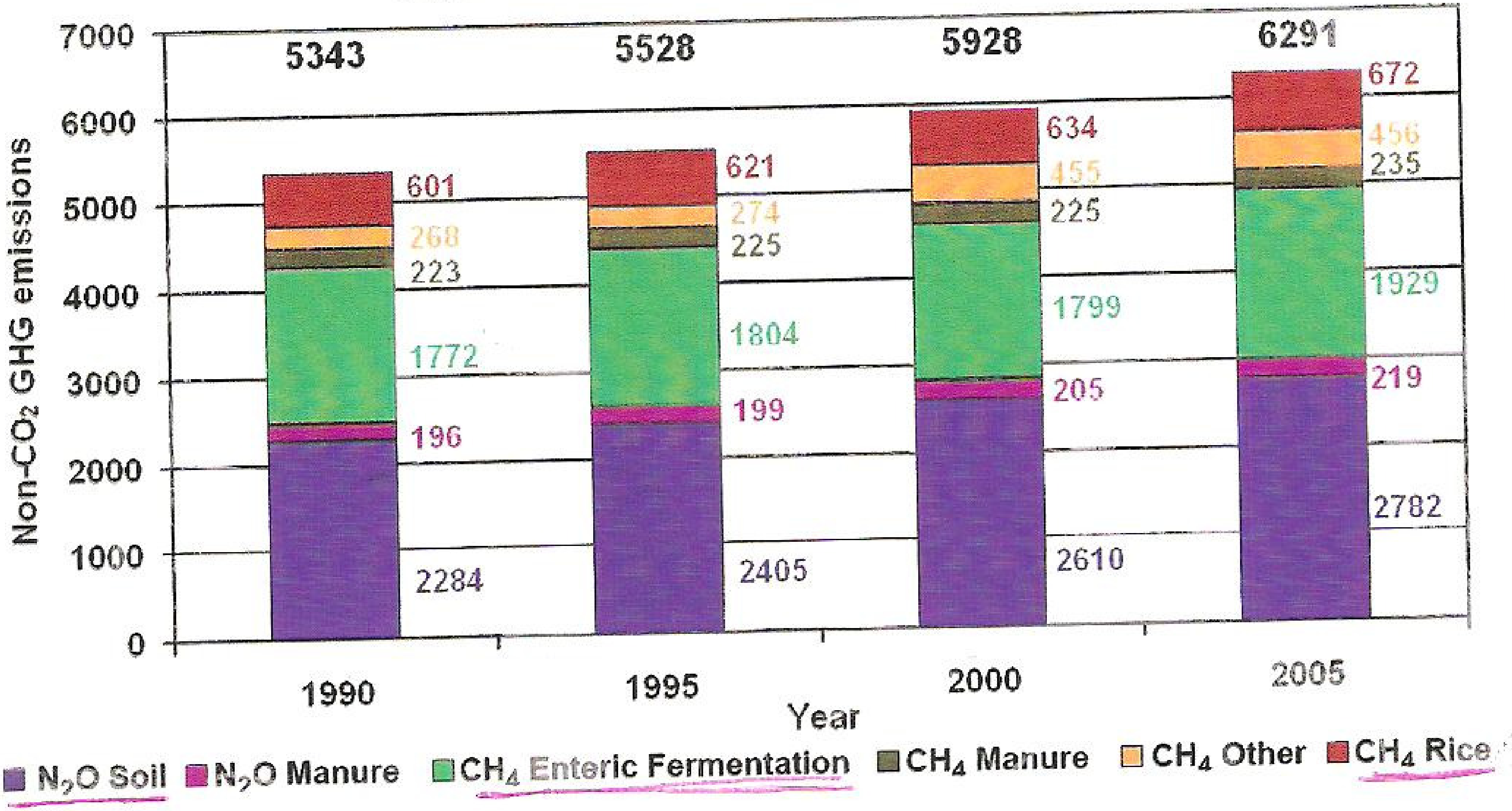
GHG MITIGATION STRATEGY	*OPPORTUNITIES*
Enhance carbon sequestration in soils and biomass	• *Improved crop and grazing land management emphasizing agro forestry, cover crops, crop residue management* • *Restoration of degraded lands*
Reduce CO_2 emissions	• *Reduce biomass/crop residue burning* • *Reduced tillage system, recycling bio wastes* • *Efficient use of energy to reduce dependence on fossil fuels*
Reduce CH_4 emissions	• *Improved rice cultivation technologies* • *Improved livestock and manure management* • *Reduce biomass burning*
Reduce N_2O emissions	• *Develop and promote technologies for improved use efficiency of fertilizers* • *Enhance biologically mediated N_2 fixation in agricultural systems*
Reduce dependence on non renewable energy sources	• *Promote energy efficient technologies* • *Reduce use of chemical fertilizers and pest control chemicals through integrated management approaches*

IV World Congress on Conservation Agriculture

Conservation Agriculture and Environment

Non-CO_2 Greenhouse Gases by Source in the Agriculture Sector

Source: Louis V. Verchot and Virendra P. Singh, 2009



CSISA Project Launched in South Asia

The Cereal Systems Initiative for South Asia (CSISA) is an initiative aimed to help six million farmers to boost crop yields and their incomes substantially. The project intends to take forward past cereal research achieved in the public and private sectors, aims to produce an additional five million tons of grain annually, and increase the yearly incomes of six million poor rural households by atleast $350. CSISA aims to reverse declines in annual cereal yield growth of recent years, decrease hunger and malnutrition, and increase food and income security in South Asia through accelerated development and deployment of new cereal varieties, sustainable management technologies and agricultural policies.

The project effort looks to embody itself through conservation agriculture principles while pursuing project goals and efforts. The focus of CSISA is to be on the small landholder farmer with improved food security and improved returns being the critical objectives. To achieve this, the project will have to work through a better understanding of livelihoods and mechanisms of improved stakeholder participation.

The initiative will build on past work in the region supported by CGIAR, including that of the Rice-Wheat Consortium for the Indo-Gangetic Plains, which has developed and promoted resource conserving technologies. The three year initiative will address needs of sustainable cereal production in India, Pakistan, Bangladesh, and Nepal. CSISA is led by the International Rice Research Institute (IRRI) and International Maize and Wheat Improvement Centre (CIMMYT) with funding support from Bill & Melinda Gates Foundation and United States Agency for International Development (USAID). Other International Agricultural Research Centers that will partner include International Food Policy Research Institute (IFPRI) and the International Livestock Research Institute (ILRI). It will also partner with national agricultural research organizations, education and extension systems.

Major objectives of CSISA include better crop management and post harvest technologies and practices; the development and dissemination of improved rice, wheat and maize varieties; and the creation of a new generation of agricultural scientists and professional agronomists. The program will focus initially in eight

Conservation Agriculture – Opportunities beyond Rice-Wheat Cropping System

Dr. Ashok Yadav, Dr. R.K. Malik & Dr. V. Kumar
CCS Haryana Agricultural University, Hisar

$1 = Rs. 50	Conventional Tillage	Zero-Till Seeding	Savings
Wheat seeding Rs./ha	3,500	500	3,000
Consumption of diesel L/ha (Rs/ha)	55 (1,705)	7.5 (232)	47.5
CO_2 Emission @ 206 kg/ha diesel consumed	143	19.5	

Table 1: Savings an account of zero-till wheat planting

wheat in zero-till fields was higher or comparable to yields in conventionally tilled plots.

Year	Area (in ha.)	Average Yield (Kg/ha.) Zero-tillage	Conventional tillage
2004-05	4	4,824	4,712
2005-06	12.5	3,989	3,816
2006-07	34	4,657	4,554
2007-08	78	4,580	4,210

Table 2. Wheat yield in field trial in south western Haryana

Benefits

- Reduced production costs (labour fuel, machinery wear and tear).
- Crop residue left on the surface (reduce run off and soil erosion, conserve rain water in –situ and over a period enhance O.M.
- Improving soil fertility and capacity of soil to retain and supply moisture).
- The nature and extant of benefits on farming prevalent : inter- cropping, agro-forestry strengthen ecology for sustainable agriculture.
- Better utilization of time and space.
- Farmers income enhanced.

How to make CA working

- Scientific soundness of principles guiding CA practice is not in doubt.
- Wide spread adoption is a challenge to both scientific and farming communities alike.
- Change in the mind set needed.
- Farmers to adopt integrated approach.
- Scientists to understand, appreciate and respect the farming community ' s experience and knowledge will be decisive to promote CA practices.
- **Emergence of farmers led movement** backed by efforts of scientific community that will create a demand led research programme.

VISIONSPEAK

Rattan Lal
Director, Carbon Management and Sequestration Center, Ohio State University

"If every farmer who grows crops in the United States would use no-till and adopt management practices such as crop rotation and planting cover crops, we could sequester about 300 million tons of soil carbon each year."

10 Principles of Sustainable Soil Management - Dr. Rattan Lal

From food security to climate change to energy demands, the world faces a myriad of critical sustainability issues, all whose potential solution may lie right beneath our feet. Rattan Lal, an Ohio State University soil scientist with the Ohio Agricultural Research and Development Center, suggests that soil and its resources are the answer, and sustainability can be achieved through the realization of 10 basic management principles.

"We are dealing with 10 global issues at the moment: food security; availability of water; climate change; energy demand; waste disposal; extinction of biodiversity; soil degradation and desertification; poverty; political and ethnic instability; and rapid population increase. The solution to all of these lies in soil management," says Lal, with the School of Environment and Natural Resources. "It doesn't mean that agriculture is the only solution, but it plays a major role in addressing these issues."

Lal synthesized years of scientific literature on soil degradation and the positive impacts of restoration and developed 10 basic principles of sustainable soil management. The principles, published in the January/February 2009 issue of Journal of Soil and Water Conservation, as well as the journal Agronomy for Sustainable Development, are meant to encourage policymakers to support soil amendment practices.

"I'd like to see policymakers implement policies which will encourage the adoption of such practices as conservation agriculture, integrated nutrient management, crop rotation, agroforestry - techniques that the scientific community knows would sustain soils and agricultural practices", Lal says.

Lal's principles of sustainable soil management are:

- Soil degradation is a biophysical process, but driven by social, economic and political forces. Minimizing degradation and enhancing restoration depends on addressing the human dimensions that drive land misuse.
- When people are suffering from poverty, they pass that suffering on to the land. The stewardship concept is important only when the basic needs are adequately met.
- You cannot take more out of the soil than what you put in it without degrading its quality. Outputs must balance inputs, says Lal.
- Marginal soils cultivated with marginal inputs produce marginal yields and support marginal living.
- Plants cannot differentiate between organic and inorganic inputs; therefore, it is a matter of logistics in making nutrients available in sufficient quantity, in the appropriate form, and at the right time for optimum growth and yields.
- Mining carbon has the same effect on global warming, whether it is through extractive farming (tillage) or through the burning of fossil fuels.
- Soils can be a source of carbon extraction or a sink for carbon storage, depending on how the soil is managed. If used as a sink, the soil has the capacity to store three gigatons of carbon a year, translating into a reduction of 50 parts per million of carbon dioxide in the atmosphere over the next five decades.
- Even the most elite crop varieties developed through biotechnology and genetic engineering cannot extract water and nutrients from the soil where they do not exist. "This principle is very important. There are those who argue that genetically engineered varieties will solve production problems. Not necessarily true", Lal says. "Improvements can only be realized if crops are grown on well-managed soils."
- Improved soil management is the engine of economic development in rural communities, especially in developing countries.
- Traditional knowledge and modern innovations go hand-in-hand. One cannot solve current global issues without the other. "We can develop upon traditional knowledge, but those who ignore modern innovations must be prepared to endure more sufferings", Lal says.

Lal says he developed the soil management principles to draw attention to the United Nations Millennium Development Goals — a commitment to solve and/or improve upon eight global issues by 2015. The issues include poverty and hunger, universal education, gender equality, child health, maternal health, HIV/AIDS, environmental sustainability and global partnerships.

"The UN defined these goals in 2000 and now we know that none of these goals will be met by 2015. Why? Because soil and agricultural management are not being addressed", Lal says. "If we do not address these issues now by paying more attention to how we can sustain the soil, then 20 years from now we will be talking about the very same things."

Source: Journal of Soil & Water Conservation, January 2009


Agriculture cannot wait
the
ndian scientists have responded energetically co- the challenge posed by continuing food shortages. Their researches
nto various aspects of agricultural developmable, co-ordinated with international activity in this field, have led to
iew cropping patterns and are achieving rema able, unprecedented increases in crop yields and farm incomes.
Foremost among those who believe that
can transform Indian agriculture is Dr.
of the Indian Agricultural Research Institute
can transform Indian agriculture is Dr.
of the Indian Agricultural Research Institute
can transform Indian agriculture is Dr.
of the Indian Agricultural Research Institute


THANK YOU