India , Conservation Agriculture and Agricultural Mechanization Strategies

Cross fertilization of ideas
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Year	Cropping intensity (%)	Food grain productivity (t/ha)	Power available (kW/ha)	Power per unit production (kW/t)	Net sown area per tractor (ha)
1975-76	120	0.944	0.48	0.51	487
1985-86	127	1.175	0.73	0.62	174
1995-96	130	1.491	1.05	0.70	84
2004-05	135.7	1.652	1.47	0.89	47
2005-06	136.4	1.715	1.51	0.88	45
2006-07	138.1	1.756	1.58	0.9	42
2007-08	139	1.86	1.62	0.87	40
2008-09	139.02*	1.909	1.67	0.87	38
2009-10	139.22*	1.798	1.73	0.96	36

Cropping intensity and power availability on Indian farms

CSISA Punjab Hub – activities, adoption outcomes, needs & future plans

Cross fertilization of ideas as an informal partner
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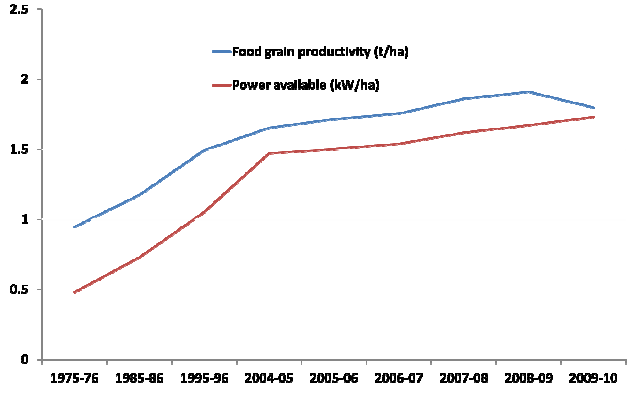
Agril. Mechanization in India

- **Demand** – Yes, farmer participatory, multi crop and multi task, options, owning v/s hiring,
- **Supply issues** – very good manufacturing, cost of production, common facility (tool Rooms etc) & cluster formation
- **Policy & institutional Issues** – Govt Support, subsidy with quality rider, promotion,Taxes, testing centers, Farm machinery service centre, new technology through co op societies

Productivity and Mechanization in India



Agril. Mechanization in India

- **Constraints** – Land Holding, Economic Condition, seasonal use , size & shape of Fields, terrain, mind set and machine v/s Labour
- **Best Practices** – AMS for Sustainable Agriculture
- **Way Forward** : Develop & promote CA Equipment & Strategies' accordingly but with clear cut messages no policy mismatch

Highly Mechanized Indian State – Punjab Case

- **1.2 % area**
- **95 % irrigated area**
- **11 % tractors**
- **190 % cropping intensity**
- **50% rice and 50 % wheat in the central pool**

At What Cost ?

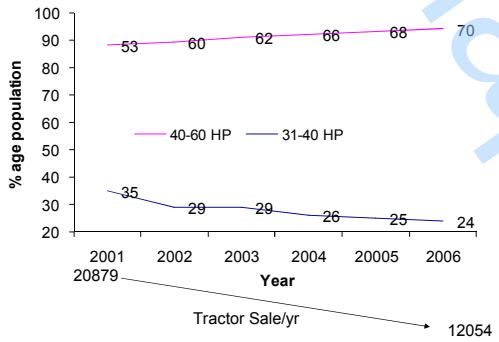
Conservation Agriculture

Three Principles	Three Benefits
• No/Minimum Tillage	✓ Enhanced Productivity
• Soil Cover with residue	✓ Richer Resources
• Crop Rotation	✓ Climate Adaptation

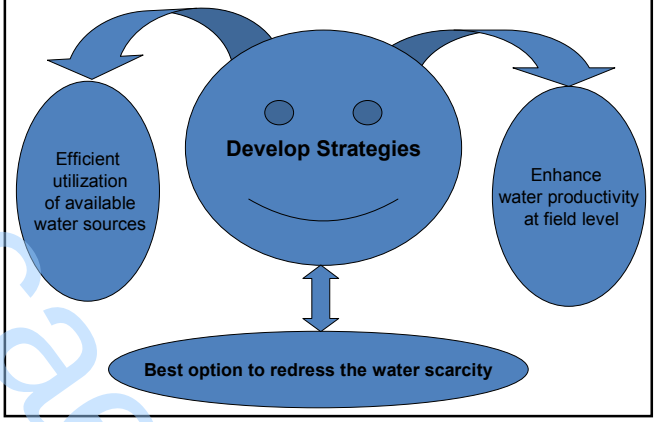
<<<<<<<<< Choosing Directions >>>>>>>>>

•Un-sustainbility can not be the option
•Systems need to be both biophysically and socio-economically sustainable.
•Sustainability also demands confronting climate change

Tractor Population = 4.2 Lacs



Water

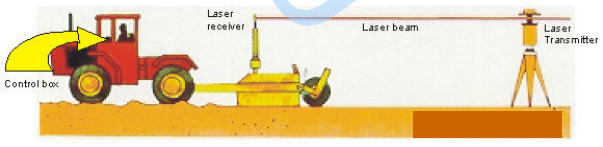


AMS v/s Issues

- Degradation of Natural Resources (Soil, Water & Environment)
- Stagnation in the crop Yield
- Declining Farmers Income
- Scarcity of Farm Labor
- Mechanization for small Farmers
- Climate change
- Sustainability of Agriculture

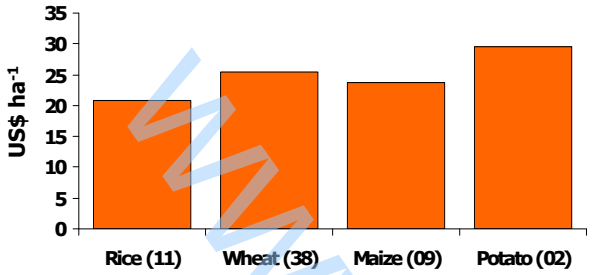
What is laser leveling?

- Laser land leveling is leveling the field within certain degree of desired slope using a guided laser beam through out the field.

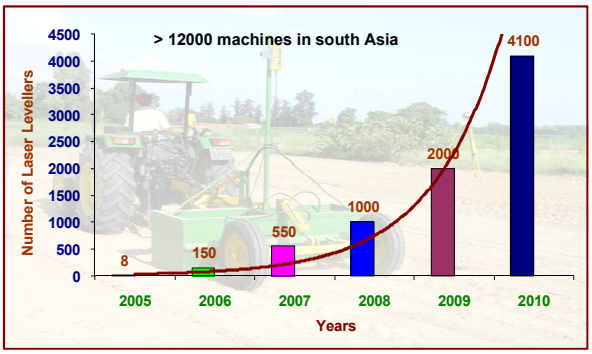


Bihar (N= 60)

Saving in Irrigation Costs under Laser Leveling over Traditional Leveling



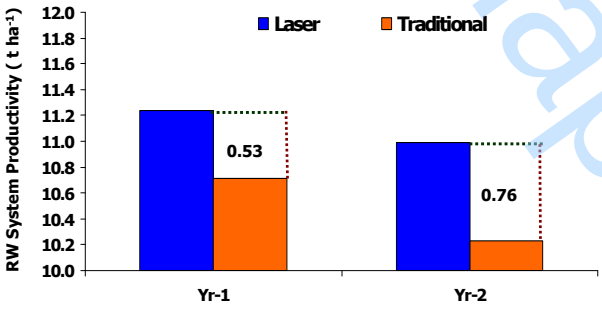
Source: Jat et al, 2009b



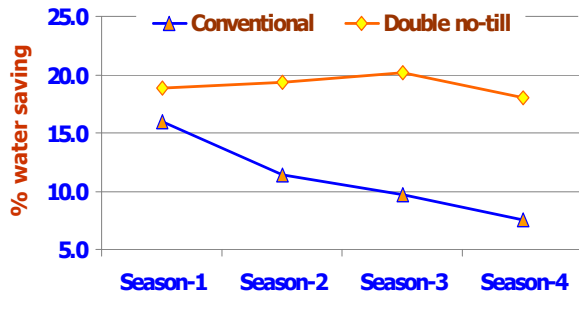
GROWTH OF LASER LEVELING IN PUNJAB

With Due Acknowledgement to Dr. Raj Gupta &CIMMYT

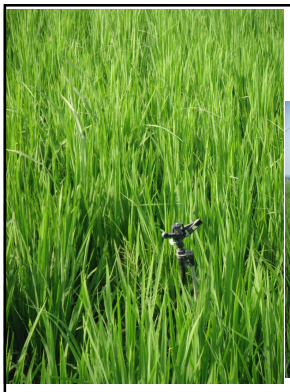
Land Leveling effects on RW system productivity



Water saving over time, effect of tillage (on-station)



Direct Seeded Rice



DSR with Sprinkler

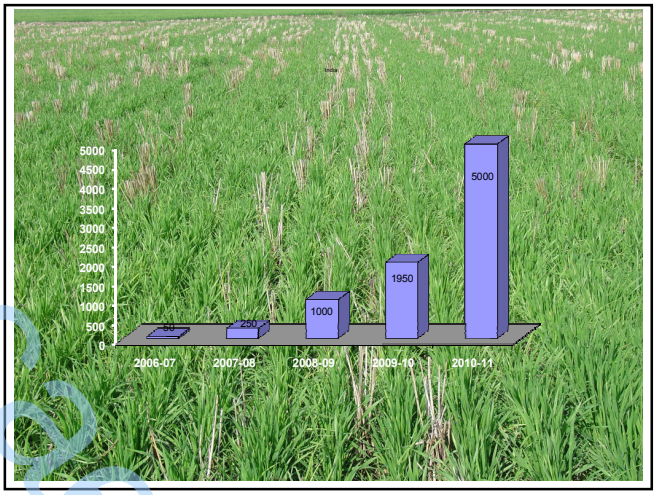
Date of Seeding : 14-06-10
Variety : Arize 6129
Seed Rate : 6kg/acre

Some More Efforts

Residue Management

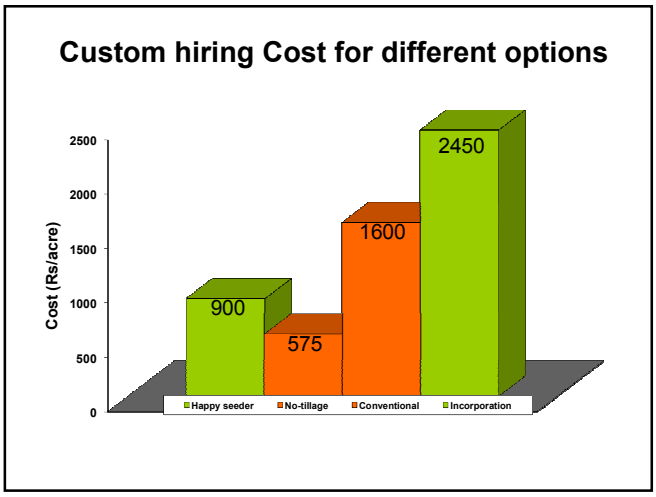
POSSIBLE STRAW MANAGEMENT PRACTICES

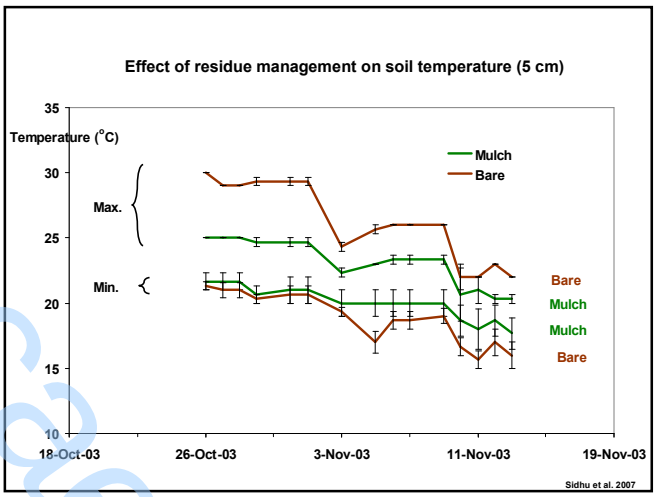
- Collection
- Straw incorporation (most difficult)
- Burning
  - Complete burning (mostly practiced)
  - Partial burning
- Straw Mulch

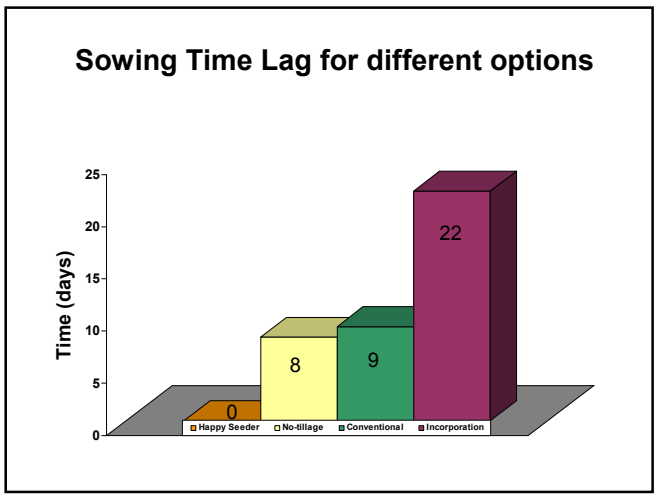


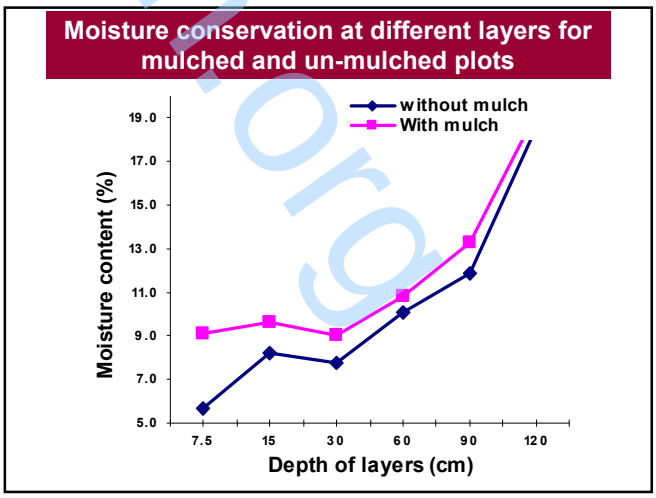
Mostly Practiced Rice Residue Management Technique

PIL in High Court

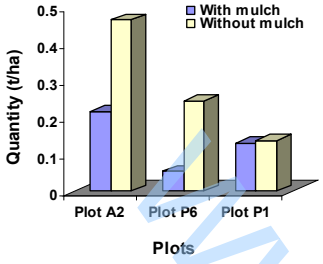




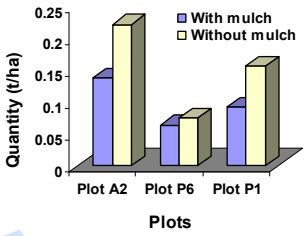




Weed matter growth in mulched and un-mulched plots

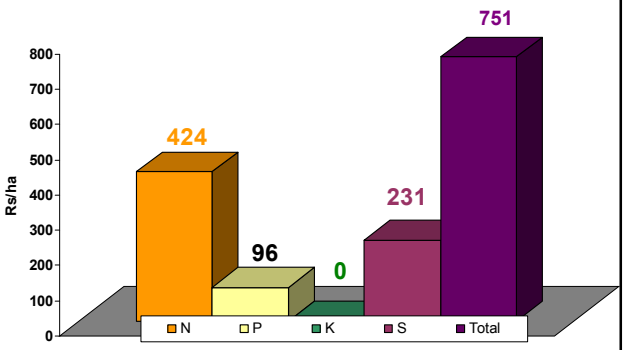


Weed matter after 45 days of sowing

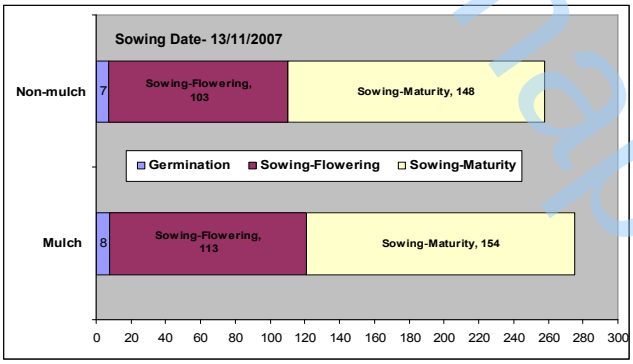


Weed matter after 90 days of sowing

Value of Nutrient Lost in Burning Rice Straw per ha



Wheat Phenology 2007-08

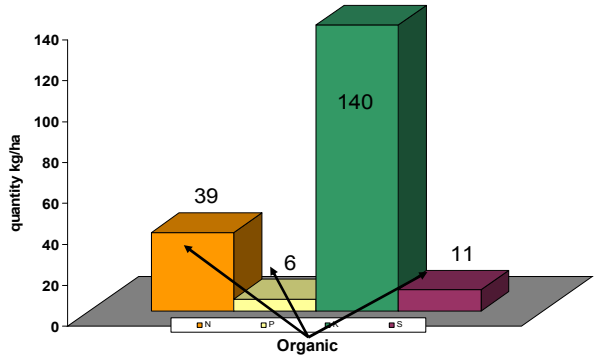


Source :Dr. Yadwinder Singh

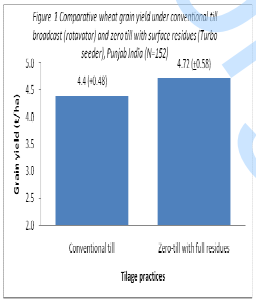
Canopy temperature under various tillage option

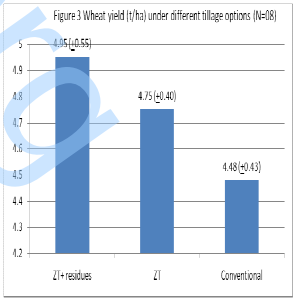
Wheat Varieties	Canopy Temperature (°C)			
	Turbo Happy Seeder	Zero till	Conventional	Rotoseeder
DBW 17	30.1	30.6	31.8	32.8
PBW 550	29.5	30.7	31.7	33.9
HD 2894	31.5	32.5	32.9	33.2
Average	**30.37**	**31.27**	**32.13**	**33.30**
No. of observations	43	10	18	5

Quantity of Nutrient available in Rice Straw in one hectare



Rice Residue Management





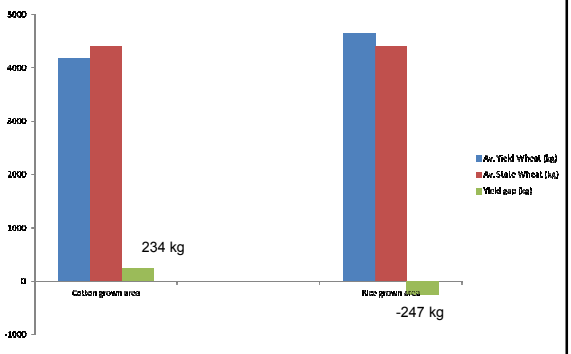
Performance of wheat during last three conjunctive years

Districts	Year (locations)	Yield (t/ha)		% increase*
		CT	HS	
4	2007- 08 (46)	4.59	4.73	3.02
2	2008- 09 (14)	4.34	4.54	4.61
12	2009 -10 (94)	4.35	4.48	3.15
	Mean (154)	4.46	4.58	3.20

* *Over conventional*

Germination

Moong Yield was 1.6 t/ha



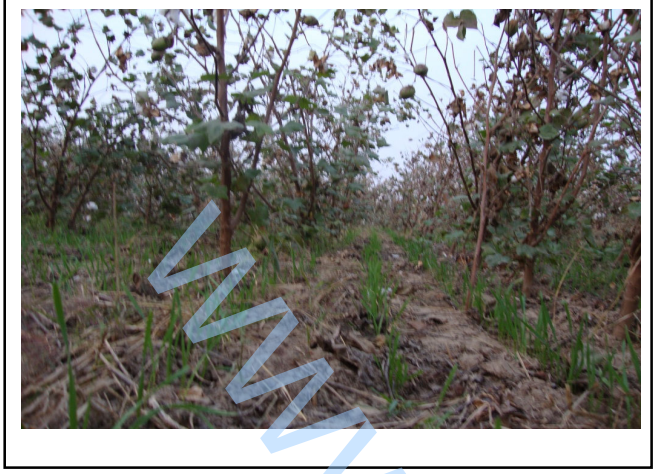
Yield (kg/ha) gap of wheat in cotton grown and rice grown areas

New CA Seeder Prototype

Newly Developed Prototype

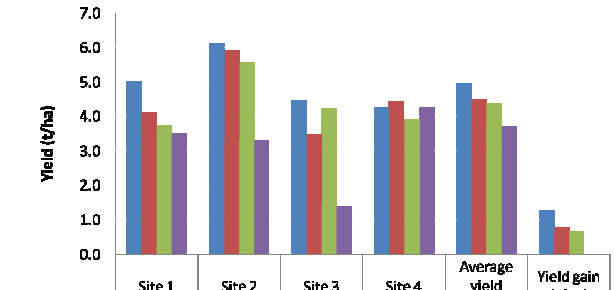
Easy Seeder – New CA Seeder Prototype

Sowing wheat on date 11-11-09



Comparison of Relay & Conventional Crop

Farmer removing the cotton sticks



	Site 1	Site 2	Site 3	Site 4	Average yield (t/ha)	Yield gain (t/ha)
Relay Seeder	5.0	6.1	4.5	4.3	5.0	1.3
Hand drill	4.1	5.9	3.5	4.5	4.5	0.8
Broad casting	3.8	5.6	4.3	3.9	4.4	0.7
Conventional	3.5	3.3	1.4	4.3	3.7	0.0

Yield Comparison of Relay Seeding of wheat in standing cotton

Relay Seeding of Wheat In Standing Cotton in Current Season

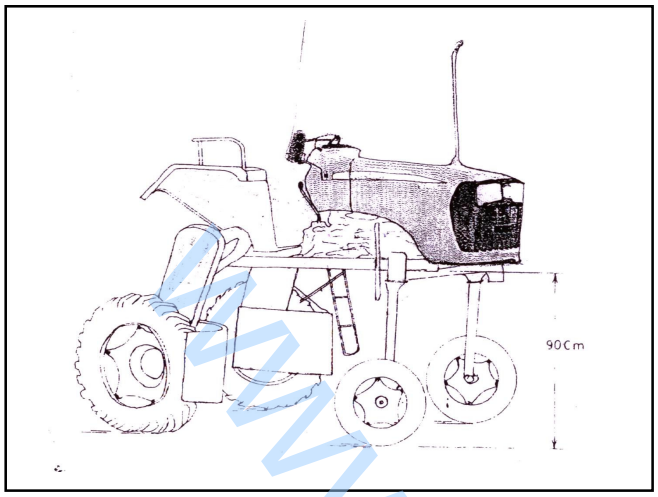
S.No.	Village	Lat.,	Long.	Variety	DOS	DOS (FP)	Saving of Days
1	Gehri Butter	30.11608 N	074.88899 E	DBW 17	10-11-2010	21-12-2010	41
2	Jodhpur Romana	30.15721 N	074.93042 E	DBW 17	11-11-2010	19-12-2010	38
3	Jodhpur Romana	30.13931 N	074.92664 E	DBW 17	12-11-2010	19-12-2010	37
4	Gehri Butter	30.09837 N	074.87917 E	DBW 17	19-11-2010	15-12-2010	26
5	Jodhpur Romana	30.14428 N	074.91803 E	DBW 17	14-11-2010	07-12-2010	23
6	Gehri Butter	30.11071 N	074.88699 E	DBW 17	16-11-2010	14-12-2010	28
7	Jodhpur Romana	30.15897 N	074.92627 E	DBW 17	17-11-2010	17-12-2010	30
8	Gehri Butter	30.10112 N	074.88165 E	DBW 17	18-11-2010	07-12-2010	19
9	Jodhpur Romana	30.14533 N	074.91614 E	DBW 17	19-11-2010	02-12-2010	13
10	Bathinda	30.18811 N	074.95247 E	DBW 17	26-11-2010	16-12-2010	20

Yield Comparison of Relay Seeding of wheat in standing cotton

Treatments	Wheat grain yield (t ha^{-1})			Cost of cultivation (US$ ha^{-1})	Net profit (US$ ha^{-1})	B:C ratio
	2009-10	2010-11	Mean			
T_1	4.97a	4.84a	4.91a	430	1353a	3.15
T_2	4.51a	-	4.51a	430	1123b	2.61
T_3	4.39a	4.64a	4.52a	430	1124b	2.61
T_4	3.52b	4.33b	3.93b	463	978c	2.11

Within a column, means followed by the same letter are not significantly different at the 0.05 level of probability by the Duncan's multiple range test (DMRT)

Source : Paper submitted in 5th World Congress of Conservation Agriculture incorporating 3rd Farming Systems Design Conference, September 2011 Brisbane, Australia www.wcca2011.org



Some Specifications

	Normal Tractor	High Clearance Tractor
Ground Clearance (cm)	45 cm	110 cm
Weight (Kg)	2000 Kg	2350 Kg
Turning Radius	270	302
Seeding Speed	3.5 km/hr	17% less
Track Width	135 cm	202 cm

Future Needs & What Next

- Can we run Happy seeder in wet rice straw
- Can we apply Nitrogen mechanically in straw mulch
- Multi-crop ZT Planter for 2WT
- Laser Land Leveler for 2WT
- Capacity building of scientists Manufactures, Farmers

Opportunities

- Very good Liaison with manufacturer
- Global market for need/farm size based machinery
- Custom hiring single window service is emerging for small & Marginal farmers
- Govt. should come forward to provide subsidies (with qualifier) on all CA /new machinery

Future Needs & What Next

- Global challenges of mechanization for S/M size
- How Indian machinery manufacturing skills/strengths
- Cluster formation / better quality & Cost
- Multi-crop ZT Planter for 2WT
- Laser Land Leveler for 2WT
- Capacity building of scientists Manufactures, Farmers

“Lot of changes are necessary to adopt conservation agriculture but the biggest change is in the mind.”

Franke Dijkstra

Pioneer Brazilian zero tillage farmer. Started 35 years ago.

Conservation Agriculture

Agriculture of the Future

Future of the Agriculture