Transformation of crop-livestock systems in Asia: the role of crop residues in improving productivity and enhancing sustainability in livestock intensification

Ma. Lucila A. Lapar, Dhiraj Singh, Braja Swain, Nils Teufel, Danilo Pezo, Edwin Villar, and Michael Blummel

59th National AARES Conference
Rotorua, New Zealand
10-13 February 2015

International Livestock Research Institute

Context

- Increasing demand for meat and milk.
- Increasing requirements for food grains (cereals, pulses, oilseeds).
- Decreasing land for fodder cultivation, but increasing availability of crop residues.
- Ruminant livestock in developing countries will have to depend increasingly on crop residues to meet their nutrient requirements. To make the ruminant production system efficient, crop residues will have to be processed.

ILRI
INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE

Transformation of crop-livestock systems: our Theory of Change

Impact: Improved livelihoods, welfare.

Development outcomes: More investments, more resilient systems

Research outcomes: Improved practices

Research outputs: evidence on-station and on-farm

ILRI
INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE

Transforming crop-livestock systems: our Theory of Change

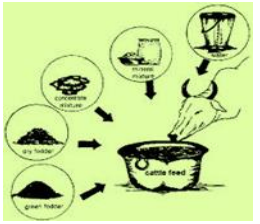
Impacts

Development Outcomes

Research Outcomes

Research Outputs

Trait	Mean	Range
N (%)	1.13	1.09 – 1.70
NDF (%)	70.5	66.3 – 74.0
ADF (%)	44.5	40.9 – 51.5
ADL (%)	5.0	3.8 – 6.0
ME (MJ/kg)	7.22	6.33 – 7.93
IVOMD (%)	50.1	44.6 – 54.3



Wealth from Waste

- Global production of straw and stover is estimated at about 2000 million tons per year.
- Most of straw and stover produced is used to feed livestock, the most efficient way of utilizing straw and stover.
- In some parts of the tropics, straw is used as bedding for animals, or else burned, which is considered a waste of significant amount of energy.
- Crop residues can be effectively, efficiently and economically utilized in the form of complete diets; potential to create wealth from waste in an environmentally friendly manner – crop residues when fed in the form of complete diets reduce greenhouse gas emission from ruminants while at the same time improving milk and meat production.

ILRI
INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE

Agenda for crop residue research

- Complete identification of crop residue resources
- Inventory in terms of quantities available, location, seasonality of supply, and chemical composition.
- Determination of nutritive value.
- Large scale feeding trials involving potentially viable farming systems

ILRI
INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE

Impacts of crop-residue based feed technologies

- Feeding trials, comparison between treated and non-treated, before and after

- Cost-benefit analysis.

Complete feed as a concept in practice

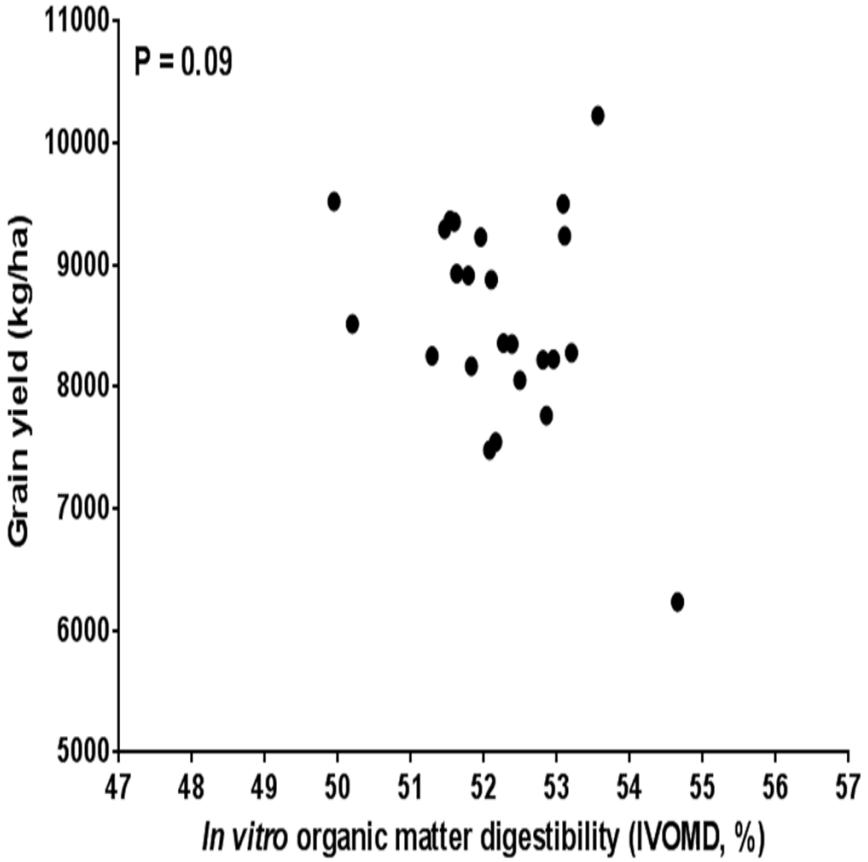
TABLE 1
Inclusion levels of different crop residues in complete diets of ruminants

Crop residue	Percent in complete ration
Sugar cane bagasse	20
Sorghum straw	20–46
Dry mixed grass	30–75
Sunflower straw	30–50
Sunflower heads	33–50
Wheat straw	50
Fallen teak leaves	17.5–70
Mango leaves	30–60
Rice straw	40–50
Cotton straw	45

ILRI
INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE

Straw quality and price relationship estimates

- Investigate released rice and maize cultivars for variation in food-fodder traits (in recent Bihar comparisons almost 10 percent unit in IVOMD)
- Investigate pipeline maize, rice wheat hybrids/OPV for variations in food-feed traits
- Investigate breeding material in rice, wheat



Relationship between stover IVOMD and grain yield in 24 pipeline maize hybrids grown at 4 locations in India

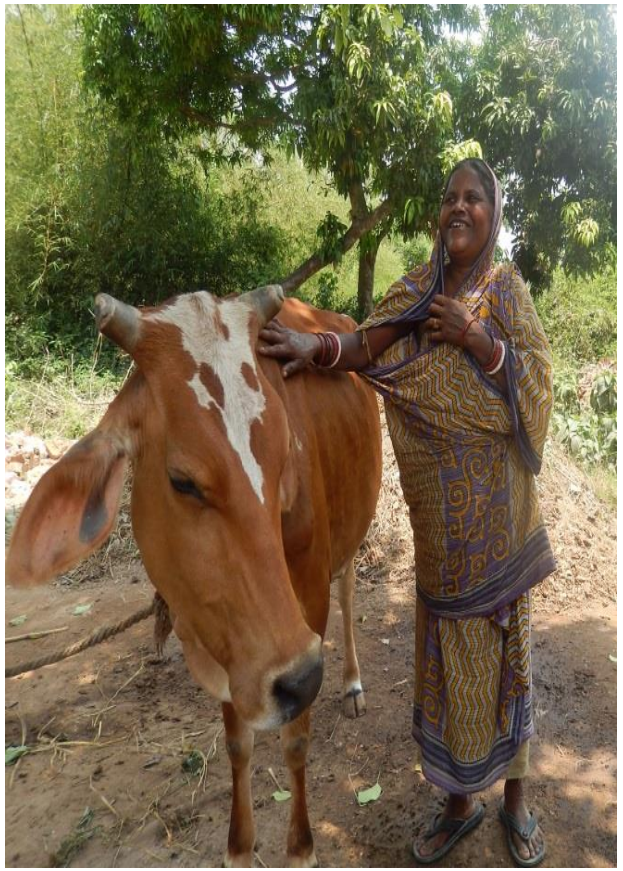
Feed quality estimates to design least-cost feed ration

- Comprehensive price quality relationship surveys
- Explore feed quality control mechanism
- For example in a survey of Bihar commercial feed products feed cost to produce an additional kg of milk could vary from 9 to 17 Rs
- Moving targets, changing feed prices and new feed ingredients
- Need to combine ration design and feeding practice (Ration Balancing, feed/fodder substitution)

ILRI
INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE

Improving efficiency of rice and wheat straw feeding

- Feeding chopped rice straw improves digestibility, enhances efficiency in energy conversion, increases milk yield by 0.3-0.5 kg/animal/day
- Chopped rice straw with supplementation of area specific mineral mixture further increases milk yield by 0.4-0.7 kg/animal/day and improves fat %, serum calcium, copper and zinc status of the dairy animal.
- Economic benefits: additional $50-79/animal/year, of which 30% accrues from reduced feed costs



Promoting underutilized crop residues

- Maize stover as green and dry fodder
- Urea-treated maize stover
  - milk yield: +0.6l/d
  - milk quality: fat: +3%, SNF: +1%
  - concentrates: -15%
- Additional income of $13 income per animal/month.

Utilizing locally available crops and residues

- Cassava hay and cassava chips for home-made concentrate feed
- Reduce feed costs in dairy production
- Milk yield increase: 180 kg milk/day from 15 milking cows
- Average net income of $50-70 per animal/month.

Critical elements for scaling out

- Suitable and affordable technologies are necessary.
- Strong linkage with markets are needed; partnership with the private sector
- Effective institutions matter.
- Enabling policies make a difference.
- Empowerment through community participation and dialogues.

ILRI
INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE

International Livestock Research Institute

Better lives through livestock

Animal agriculture to reduce poverty, hunger and environmental degradation in developing countries

ILRI
www.ilri.org

International Livestock Research Institute