Can integration of crops and livestock contribute to sustainability in agriculture?

Alan J. Franzluebbers
Ecologist
Watkinsville GA
—Yes
—No
—Maybe

Under what circumstances?
Who would be involved?

- Farmers
- Landowners
- Agribusiness
- Farm advisors
- Researchers
- Environmentalists
- Food processors
- Marketers
- Health professionals
- Politicians
What would integration entail?

- Cropland
- Marginal land
- Fences
- Equipment
- Agrochemicals
- Understanding
- Cooperation
- Creativity
- Questions / research
- Patience
Why are integrated crop / livestock systems needed?

**Production**
- Farms operating on marginal profit
- Economic vulnerability with specialized production
- High cost of fuel and nutrients
- Pests become greater with monocultures
- Yield decline could be overcome with rotation

**Environment**
- Nutrient recycling could be improved in both systems
- Conservation of soil and water possible with sod-based management systems
Where could integrated crop / livestock systems be developed?

— Everywhere
— Nowhere
— Depends...
...environmental considerations

Legend
- **Green**: Warm, humid region: ≥ 750 mm, ≥ 12 °C
- **Red**: Warm, dry region: < 750 mm, ≥ 12 °C
- **Light Blue**: Cool, dry region: < 750 mm, < 12 °C
- **Dark Blue**: Cool, humid region: ≥ 750 mm, < 12 °C
...soil / landscape considerations

http://southwest.library.arizona.edu/azso/fig040.jpg
Credit: Paul Mirocha
...socio-cultural considerations

- Capital investments
- Market opportunities
- Transportation routes
- Neighbors
- Natural resource availability
When could integrated systems be appropriate?

— Never
— Always
— Depends...
...threat of litigation

...threat of animal health decline

Sharon and Dick Thompson accept an environmental excellence award in 2002 from Iowa Governor Tom Vilsack.

Dick Thompson
Boone County, Iowa
Practical Farmers of Iowa
www.practicalfarmers.org

http://www.sare.org/publications/naf2/thompsond.htm
...market opportunities more palatable
...Mother Nature shares hints
...Mother Nature shares hints

www.sustainableranching.com

Franzluebbers (2010) Four farms in the USA. Ch. 48, Rainfed Farming Systems, Springer
...economic conditions right
...economic conditions right
How could integrated systems look?

Grazing of winter cover crops following grain and fiber crops in the southeastern USA

What are best species – individually and in mixtures?
How could integrated systems look?

Sod-based rotations of perennial pastures with several years of grain and/or fiber crops

Are historical rotations applicable or do improved tillage / rotation systems need to be developed for Midwest, Great Plains, Southeast, Northeast, etc.

http://www.ers.usda.gov/AmberWaves/June06/Features/images/feature2.jpg
How could integrated systems look?

Mixed forages…

Steve Groff (Cedar Meadow Farm)
Lancaster County, Pennsylvania

Gabe Brown (Brown’s Gelbvieh Ranch)
Burleigh County, North Dakota

How could integrated systems look?

Mixed forages…

Crimson clover / cereal rye / hairy vetch

Oat / pea

Photo credit: Corey Cherr, University of Florida
http://eorganic.info/files/u36/crimson_rye_vetch_JMSweb.jpg

Photo credit: Mark Schonbeck, VA Assoc. Biol. Farming
http://eorganic.info/files/images/2-oatspeas.smaller.JPG

Photo credit: Corey Cherr, University of Florida
http://eorganic.info/files/u36/crimson_rye_vetch_JMSweb.jpg
How could integrated systems look?

Replacement of bare fallow in Oklahoma (Srinivas Rao)

‘GA-2’ pigeon pea
60 days after planting following wheat harvest

25 d of grazing in August 2008
How could integrated systems look?

Interseeding in grain crops...

No-tillage corn in a kura clover living mulch system
(Ken Albrecht, University of Wisconsin)

Black medic growing under flax (left) and oat (right).

A self-seeding legume growing under flax.

http://www.umanitoba.ca/outreach/naturalagriculture/index.html
How could integrated systems look?

Manure application...
How could integrated systems look?

Pasture raised animals...

Pastured Poultry
Grass-Fed Beef
Pastured Pork

www.ayrshirefarm.com
How could integrated systems look?

Integrated crop / livestock / woodlot in Mississippi (Glover Triplett)

Drilling corn into standing ryegrass of tree alleys
How could integrated systems look?

Integrated crop / livestock / woodlot in Mississippi (Glover Triplett)

Fertilizing corn emerging through desiccated cover crop
How could integrated systems look?

Integrated crop / livestock / woodlot in Mississippi (Glover Triplett)

Cattle introduced onto corn at late roasting stage
How could integrated systems look?

Works on steep areas that would not be considered usable because of erosion potential or in areas that are too small to be profitably farmed in conventional fashion.

Integrated crop / livestock / woodlot in Mississippi (Glover Triplett)
What about current issues of concern?

### Profitability

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What about current issues of concern?

FIGURE 5: Schematic representation of the soil degradation process

What about current issues of concern?

Water quality

Nutrient trading
What about current issues of concern?

Soil carbon sequestration

Greenhouse gas emissions

USDA-ARS GRACEnet
What about current issues of concern?

Healthy food

Scenic landscapes

USDA-ARS
Summary

Integrated crop / livestock systems

Conservation of soil and water resources is a necessity in our world of ever-changing and competing human activities.

Meeting the food and fiber demands of a growing world population will only become more difficult with competing energy and natural resource commitments.

Integration of crops and livestock has great potential to improve resource efficiency of agricultural production around the world.

Sod-based crop rotations effectively improve soil and water quality.

Cover crops offer unique opportunities to integrate livestock grazing with cropping systems.

Some cases of integration have been developed, but much more research is needed to optimize systems within unique local and regional conditions.
In conclusion

How does (3P + T) translate to a sustainable agriculture?

People

Production

Time

= 3P + T
In conclusion

Balance

Production

Nutrients

Energy

Long term future

People

Time

Protection of Environment

Water

Genetics

Land

Soil

Nature

Chemicals

Labor

Policy

Profit

Culture

In conclusion
In conclusion

Is it time for a change in direction?

What are the goals and how do we get there?