Textile Exchange LCA Webinar:

Journey from Sustainable to Organic + Regenerative Cotton Production Systems

June 10, 2019

TextileExchange
Creating Material Change

Introduction

In today's webinar, we'll cover the value of organic production systems; some of the myths and misinformation; what LCAs are and are not; the importance of breaking the current Price Paradigm that is creating poverty, pollution and problems; as well as the development of clear and consistent messages as we move this industry forward.

Speakers:

- **La Rhea Pepper**, Managing Director | Textile Exchange
- **Evonne Tan**, Data Management & China Strategy Director | Textile Exchange
- **Lou Tarricone**, Senior Advisor | Pure Strategies, Inc.
- **Liesl Truscott**, European & Materials Strategy Director | Textile Exchange

Key Cotton LCA Studies

Presented by Evonne Tan, Data Management & China Strategy Director at Textile Exchange

Key Cotton LCA Studies

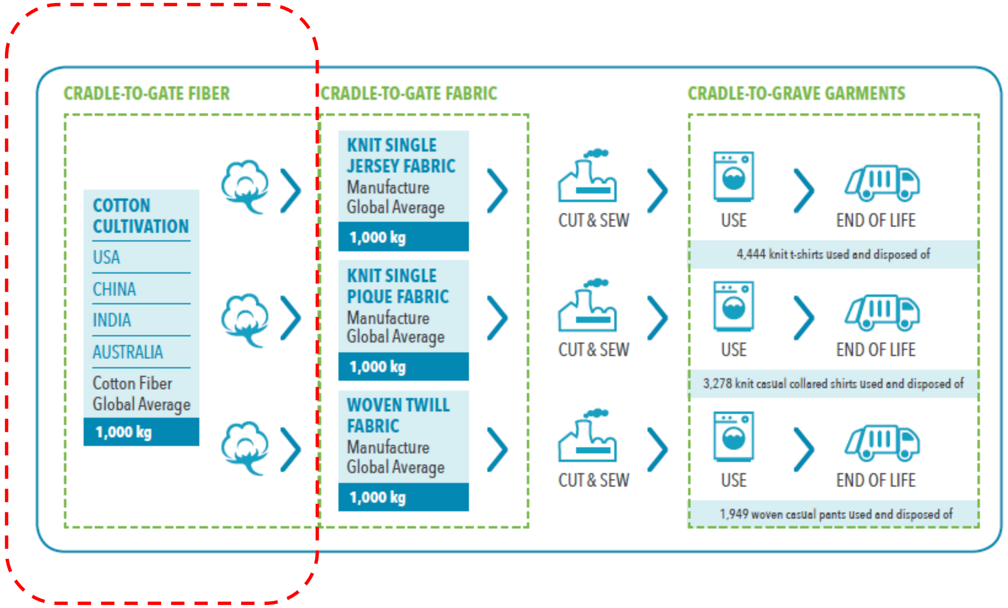
	Cotton Inc 2012	Cotton Inc 2017	Textile Exchange 2014	C&A 2018
Report Author:	thinkstep AG	thinkstep AG	thinkstep AG	Thinkstep Sustainability Solutions Pvt. Ltd.
Cotton cultivation: field preparation, planting, field operations, and harvesting				
Data type:	Primary data	Primary data	Primary data	Primary data
Geographical scope:	United States China India	United States China India Australia	India China Turkey Tanzania United States	(India)
Coverage:	66% of global cotton production	67.2% global cotton production	>95% global organic cotton production	
Time reference:	2005 - 2009	2010 - 2014	2011/2012 and 2012/2013 (depending on the region)	2016-2017
Ginning				
Data type:	Reference to national published studies	Reference to national published studies and primary data	Energy consumption: primary data for some regions and use of default value based on HARDIN 2012 when primary data was not available Waste: Default value	NA
Upstream data				
Data type:	Secondary data: Gabi	Secondary data: Gabi	Secondary data: Gabi	Secondary data: Gabi

Key Cotton LCA Studies

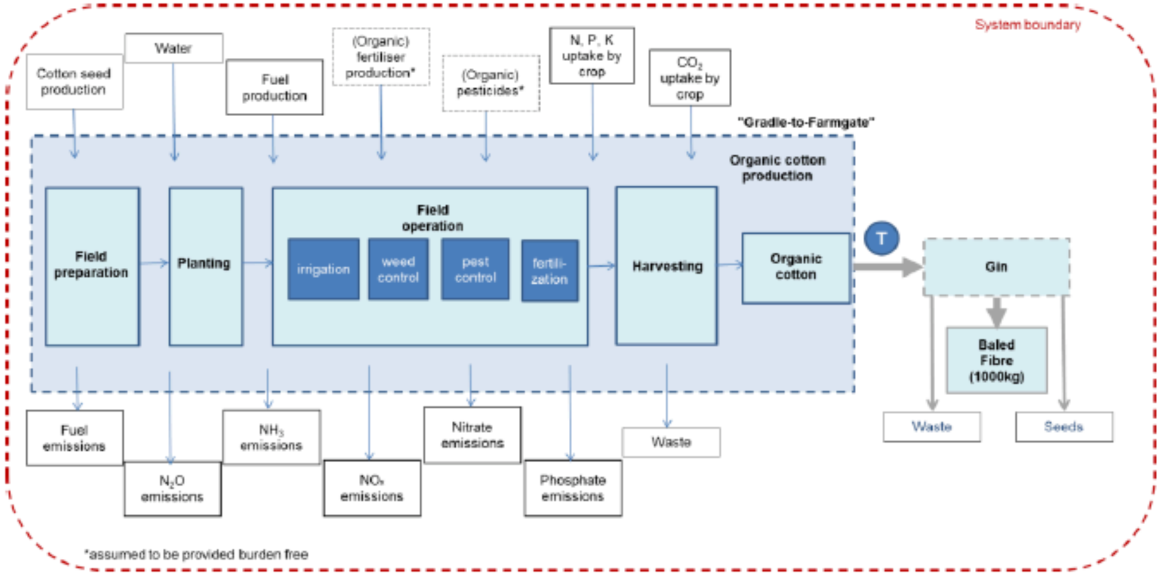
	Cotton Inc 2012	Cotton Inc 2017	Textile Exchange 2014	C&A 2018
Fiber	Conventional cotton	Conventional cotton	Organic cotton	Conventional cotton Organic cotton BCI cotton
Functional unit	1,000 kg of fiber	1,000 kg of fiber	1,000 kg of fiber	1,000 kg of seed cotton
Scope	Cradle to gin gate*	Cradle to gin gate*	Cradle to gin gate	Cradle to farm gate
Geographical scope	Global	Global	Global	Local (state of Madhya Pradesh)
Exclusions	Human labor Construction of capital equipment Maintenance and operation of support equipment Production and transport of packaging materials	Human labor Construction of capital equipment Maintenance and operation of support equipment Production and transport of packaging materials	Human labor Animal labor Transport of agricultural equipment Certification; extension, farm visits Production and transport of packaging materials Construction of capital equipment	Human and livestock labor Construction of capital equipment Maintenance and operation of support equipment Production and transport of packaging materials
Cut-off criteria	< 1% of the cumulative mass < 1% of the cumulative energy	< 1% of the cumulative mass < 1% of the cumulative energy	<2% to one of the selected impact categories	<1% of the cumulative mass <1% of the cumulative energy <1% of the whole impact of an impact category
Allocation of environmental burden	Economic allocation : 84% fiber – 16% seed	Economic allocation : 84% fiber – 16% seed	Economic allocation : 84% fiber – 16% seed	Economic allocation : 84% fiber – 16% seed

LCA System Boundaries

Cotton Inc 2017



Textile Exchange 2014



Cultivation of the cotton plant until farm gate, the transport of the seed cotton to the gin, the ginning operations until the fibre is packaged in bales and is ready for shipping.

Inclusion: seed production*, cotton cultivation, production of operating materials, production of operating materials, energy production and utilization, fuel production and utilization, water supply, use and consumption, transportation of operating materials and product.

* Textile Exchange LCA only

LCA Impact Potentials

They are approximations of environmental impacts that could occur if the emissions would
(a) follow the underlying impact pathway, and
(b) meet certain conditions in the receiving environment while doing so.

In addition, the inventory only captures that fraction of the total environmental load that corresponds to the chosen functional unit (relative approach).
LCIA results are therefore relative expressions only and do not predict actual impacts, exceeding of thresholds, safety margins, or risks.

LCA Results : Cotton Inc & Textile Exchange

	Cotton Inc 2012	Cotton Inc 2017	Textile Exchange 2014	Cf. 2012	Cf. 2017
GWP [kg CO_2- Equiv.] with credit		-113	-562		
GWP [kg CO_2- Equiv.] without credit	268	1,326	978	-265%	26%
Primary energy demand from fossil sources - [MJ]	15,000	13,720	5,759	62%	58%
Acidification Potential [kg SO_2- Equiv.]	18.70	26.40	5.70	70%	78%
Eutrophication Potential [kg Phosphate- Equiv.]	3.80	7.80	2.80	26%	64%
Ozone depletion potential [kg R11- Equiv.]	7.60E-06	4.74E-08			
Photochemical Ozone Creation Potential [kg Ethene- Equiv.]	0.41	0.16			
Blue Water Consumption [m3] **	2,120	1,559	181	91%	88%
Blue Water Use [m3] **	2,740	2,235	716.	74%	68%
Human Health Particulate [kg PM2,5- Equiv.]		1.80			
Abiotic Depletion Potential [kg Sb-Equiv.]		0.00			
Land occupation indicator LOI [sqm*yr]		10 634			

* A credit of 1,540 kg CO_2 eq. was taken to account for the carbon stored in the fiber in the agricultural phase that will be later released in the EoL phase
**: excludes precipitation
***: includes precipitation

LCA Results : C&A Foundation

	Conventional	BCI	Organic
GWP [kg CO2- Equiv.]	680.20	688	338.50
Primary energy demand from fossil sources - [MJ]	25,500	25,600	20,900
Acidification Potential [kg SO2- Equiv.]	12.68	12.41	0.57
Eutrophication Potential [kg Phosphate- Equiv.]	1.92	1.66	-0.02
Ozone depletion potential [kg R11- Equiv.]	6.90E-09	7.18E-09	1.85E-09
Blue Water Consumption [m3]	344	367	140
Blue Water Use [m3]			
Eco-toxicity (CTUe)	9,000	11,700	0.14
Human Toxicity (CTUh)	0	0	0

It All Comes Down To Soil!

Soil carbon sequestration has the potential to offset fossil- fuel emissions by 0.4 to 1.2 gigatons of carbon per year, or 5 to 15% of the global fossil-fuel emissions.[1]

Soil organic matter holds 10 to 1,000 times more water and nutrients than the same amount of soil minerals.[2]

The manufacture and use of fertilizers was identified as a significant (>50%) of the Primary Energy Demand in cotton production.[3]

Most farmers can increase their soil organic matter in three to 10 years if they are motivated about adopting conservation practices to achieve this goal.[4]

1. Science AAAS, Soil Carbon Sequestration Impacts on Global Climate Change and Food Security, R. Lal, et al.
2. USDA, Conservation Resource Brief: Soil Quality, Nr 0601, 2006.
3. Cotton Inc., LCA Update Of Cotton Fiber And Fabric Life Cycle Inventory, 2017
4. USDA, Unlocking The Secrets In The Soil.

Regenerative Agriculture

Presented by Lou Tarricone, Senior Advisor at Pure Strategies, Inc.

Soil loss afflicts many growing regions globally

- 70% of the worlds soil are degraded. In the US, half of the historic soil organic carbon has been lost and continues to decline[1].
- Conventional cultivation practices disturb and degrade the soil with tillage, bare soil surfaces, chemical inputs, and continuous monoculture crop production.

Building Soil Health Has Many Benefits

- Reduced soil erosion.
- Improved water infiltration.
- Enhanced fertility.
- Increased biological activity.
- Greater pest suppression.
- Better crop rooting and soil condition.
- Cooler soil temperature.

Photo: USDA

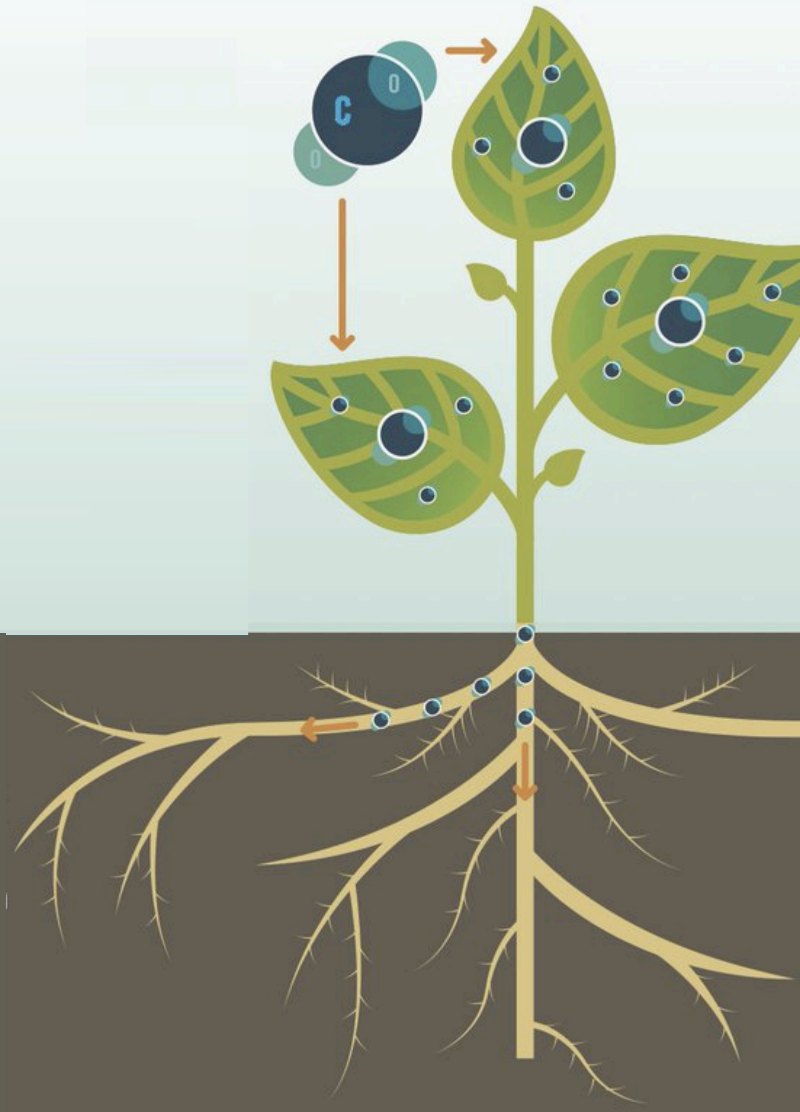
Soil Sequestration

1. **Photosynthesis**: process to change atmospheric CO2 in carbon based sugars

2. **Nutrient Exchange**: carbon-based sugars feed plant bacteria and fungi living in the soil

3. Capture Carbon: Root sugars & organic matter converted into more stable materials that help store carbon

4. Restoring Balance: Increasing microorganisms in the soil increases carbon and in turn soil health



Source: Rodale Institute

Four Principles of Soil Health

Use plant diversity to increase diversity in the soil	Manage soils more by disturbing them less
Keep plants growing throughout the year to feed the soil	Keep the soil covered as much as possible

U.S. Cotton Measured Carbon and Water Gains

	Soil organic carbon[1] sequestration rate (Mg C/ha/y)	**Cropland water infiltration**[2] (mm at 200 min)	**Cropland water retention**[2] (cm3/cm3)
Conventional	Baseline for comparison to other practices*	55	18.4
No Till	0.39	120	24.3
Cover Crops	0.45	100	20.5
Crop Rotation	0.43	Not measured	Not measured

*typically a net carbon loss

[1] Franzluebbers, A.J., et al. Evaluating soil organic carbon sequestration potential in the Cotton Belt with the soil conditioning index. Journal of Soil & Water Cons. V 67, No. 5: 378-389. 2012.
[2] McClure, A. et al. Cover Crop Quick Facts, W417. University of Tennessee Extension, 2017

More detail on soil health – Wrangler study 2018

- Focused on using land conservation practices in cotton growing.
- Published in April 2018, based on 47 scientific papers.
- Reviewed by USDA NRCS, The Nature Conservancy, and the Soil Health Institute.

Conservation tillage

Partially adopted

Soil carbon loss in agriculture is directly related to the intensity of tillage activities.

Conservation tillage includes a range of practices that reduce soil disturbance and retain plant residues at various levels during the year to cover the field surface.

Conservation tillage practices in cotton production include:

- **No-till:** Less than 10 percent of the row width is disturbed to seed through residue from a previous crop.
- **Strip till:** Less than 30 percent of the row width is disturbed, leaving a narrow strip (6-8 inches wide) of tilled soil in which to plant the seed.

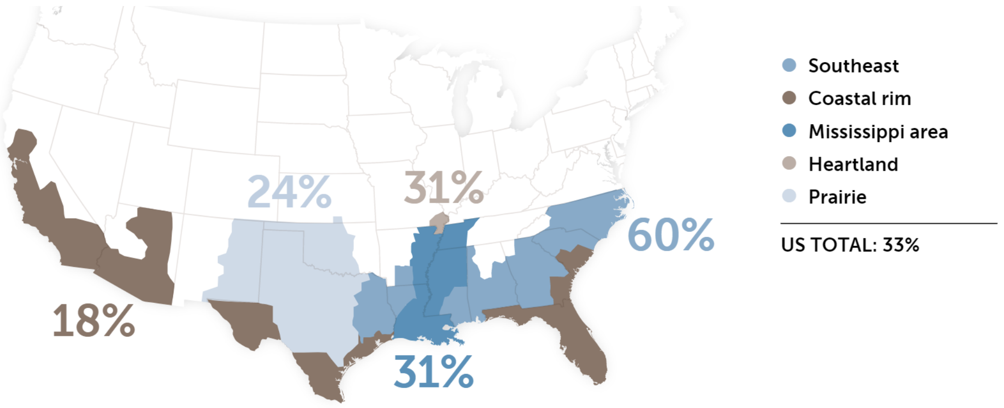
Conservation tillage

- Conservation tillage borrows from nature's method of managing the land – with little disruption.

- Keeping plant residue on the soil surface protects the soil against erosion, minimizes water evaporation, and increase organic matter near the surface.

- By reducing the number of passes required, time and money are saved.

Regional percentage of cotton acres planted with conservation tillage:

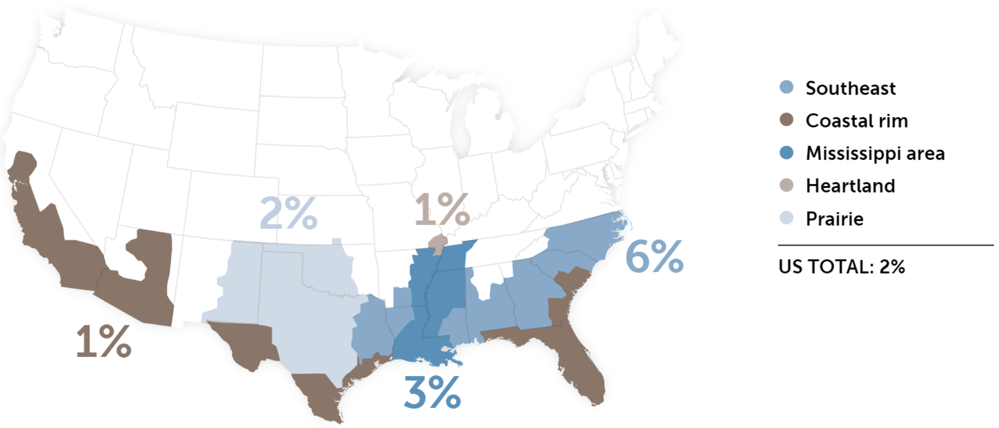


Cover crops

Limited adoption

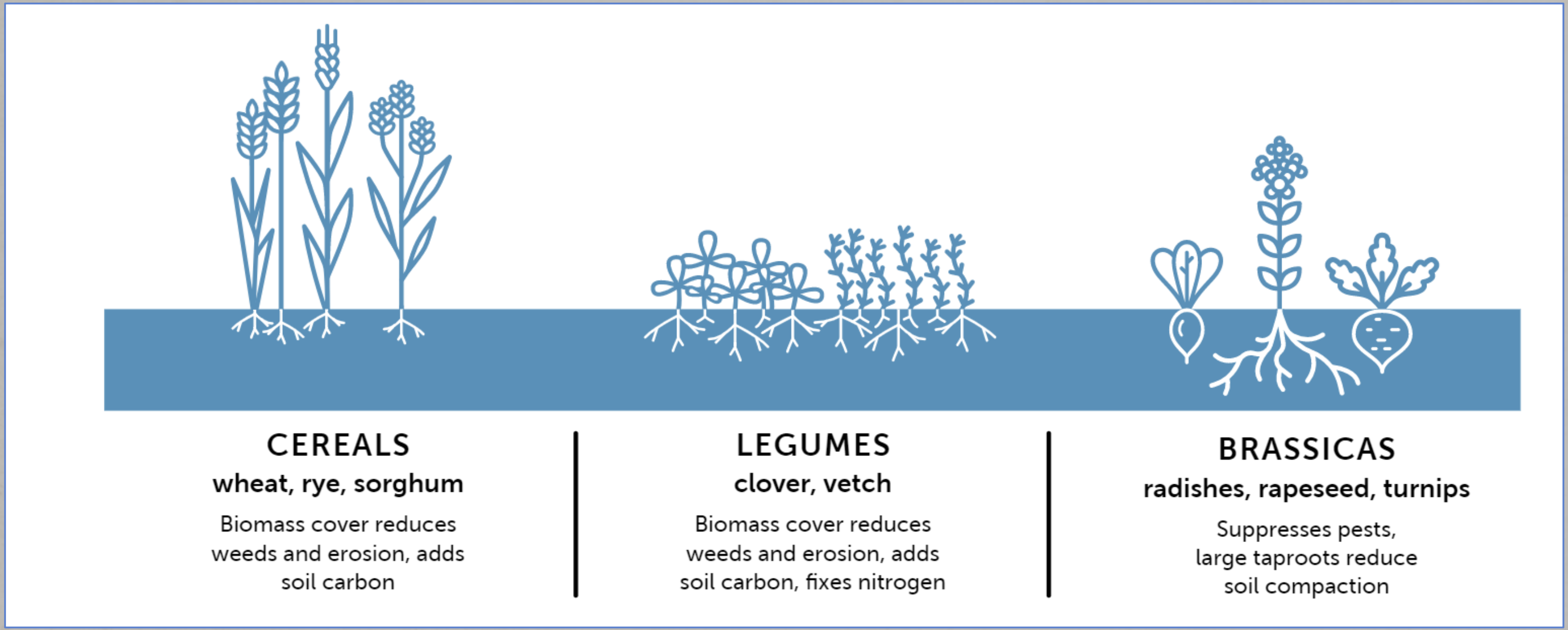
- When a cash crop is not growing, producers can add diversity to their system through cover crops.
- Cover crops are not typically harvested, but instead are terminated prior to cotton planting.
- Cover crops:
  - Produce biomass above and below the ground
  - Reduce erosion and nutrient loss
  - Enhance the soil structure and composition

Regional percentage of cropland acres planted with cover crops:



Cover crop examples

A mixture of cover crop species can be beneficial:

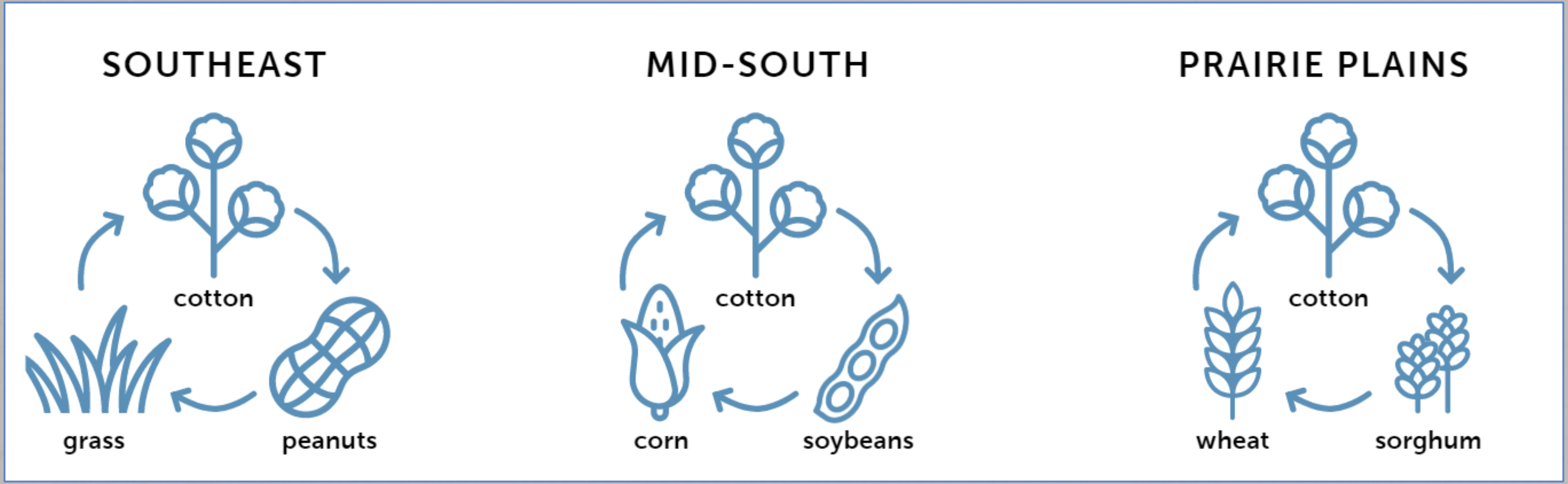


Crop rotations

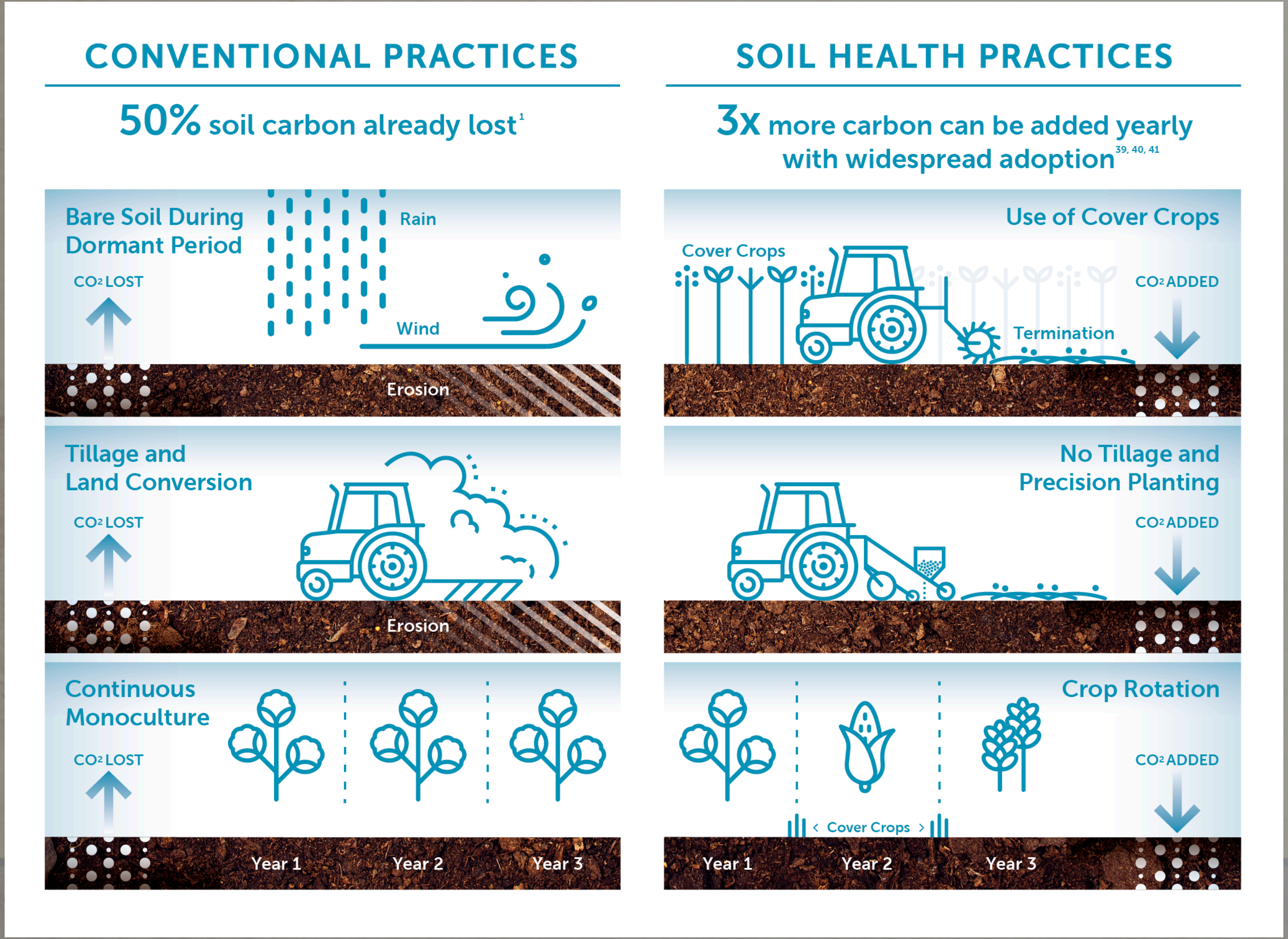
Well adopted

- Crop rotations are well-accepted approach to manage pests and diseases and reduce the demand for herbicides.

- Diverse crops also provide nourishment to the biological community below ground.



Implementing these practices results in climate change mitigation



- Combining practices increases the benefits
- Economic
  - Reduced input costs
  - Lower risks from weather & pests
  - Higher yields
- Environmental
  - Microbe & nutrient community
  - Soil structure & content
  - Water absorption & retention

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Beyond the LCA: The Broader Landscape

Liesl Truscott, European & Materials Strategy Director at Textile Exchange

LCAs in Agriculture

Systems are complex

- Modeling of natural, living and open systems is difficult and ever changing.
- Environmental systems are complex, dynamic and only partly understood.
- Many farms are small-scale in structure and may vary significantly from one farm to another.
- There is a high variability of processes due to geography, climate, availability of inputs, farmer know-how, etc.
- Input-output models do not capture landscape impacts.
- Social and economic aspects are not part of an LCA.

Contextualizing LCA

How to leverage an LCA

- Globalized averages – issues and hotspots.
- Application at the farm level.
- Different contexts call for different responses.
- Impact measurement is a long-term game.
- Striving for an holistic understanding of how best to respond.

Towards A Holistic Assessment

Organic Agriculture is a production system that sustains the health of soils, ecosystems and people. It relies on ecological processes, biodiversity and cycles adapted to local conditions, rather than the use of inputs with adverse effects. Organic Agriculture combines tradition, innovation and science to benefit the shared environment and promote fair relationships and a good quality of life for all involved.

IFOAM Organics International

Systems thinking in life cycle assessment

- Life Cycle Sustainability Assessment (LCSA)
- Environmental (E-LCA)
- Social (S-LCA)
- Life Cycle Costing (LCC)

Systems thinking in life cycle assessment

- Deepening and broadening
- Socio-economic indicators
- Beyond a snapshot in time
- Stakeholder involvement and decision-making

Challenges and ongoing considerations

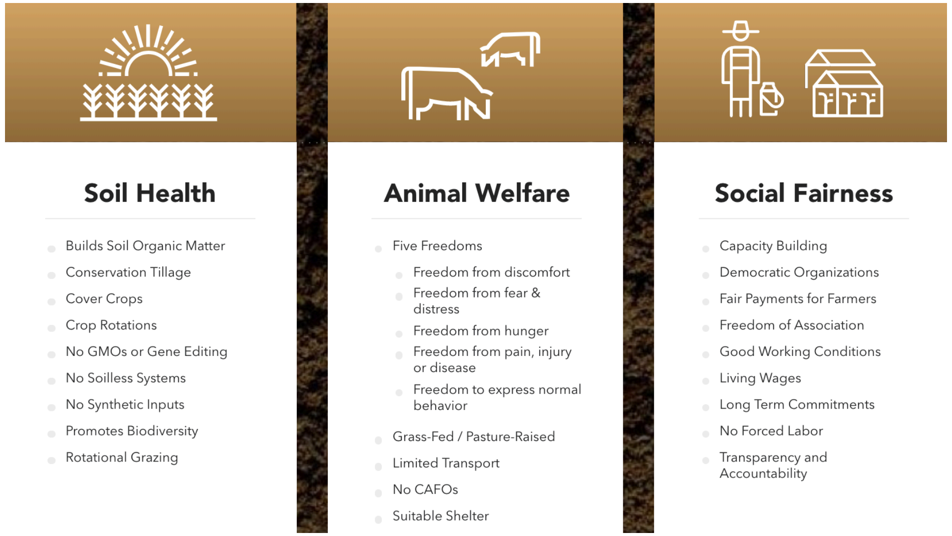
Regenerative Agriculture is a system of farming principles and practices that increases biodiversity, enriches soils, improves watersheds, and enhances ecosystem services. Regenerative Agriculture aims to capture carbon in soil and aboveground biomass, reversing current global trends of atmospheric accumulation. At the same time, it offers increased yields, resilience to climate instability, and higher health and vitality for farming and ranching communities. The system draws from decades of scientific and applied research by the global communities of organic farming, agroecology, Holistic Management, and agroforestry.

Regenerative Agriculture

Further challenges and considerations

- Our vision is maturing
- The burden of data collection
- How the data is interpreted and used
- Informing decision-making and policy
- Proving impact

Regenerative Organic Certified:



What's Next for LCAs

LCAs need to broaden and deepen

- Capture more of the important indicators but just as importantly the interactions between them.
- Go beyond farm system impacts – to factor in the wider landscape and regional context – and inform policy.
- Use global LCA data "respectfully" – it's a useful tool.
- Regional LCAs and better still supply chain level LCAs can help understand region or farm specific risk and inform action plans.
- Bringing the social and economic factors into the assessment is critical to a proper sustainability assessment – we just need the tools and the know-how to do it.
- Data is critical - but **seeing is believing** – go visit! Learn from the experts on the ground and take a holistic, "systems approach" to the way YOU think about the issues and make decisions.

Myths

Presented by La Rhea Pepper, Managing Director at Textile Exchange

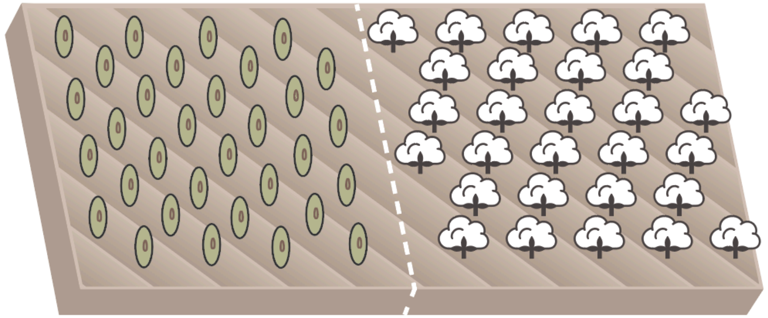
Comparing Yields: 360 Acres of Land

Textile Exchange

West Texas
3.6 million acres of cotton mono crop culture

360 acres of land is 360 acres of cotton

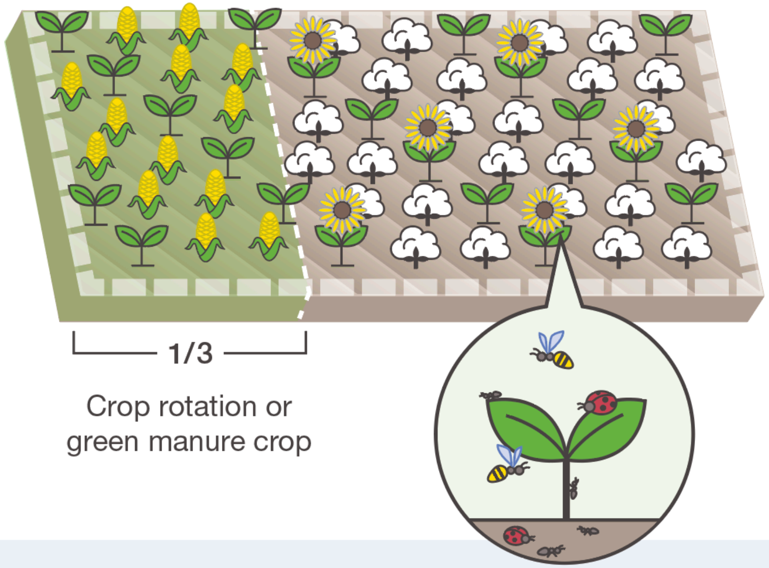
In some regions
optimal rotation 50% soy / 50% cotton



180 acres of soy

180 acres of cotton

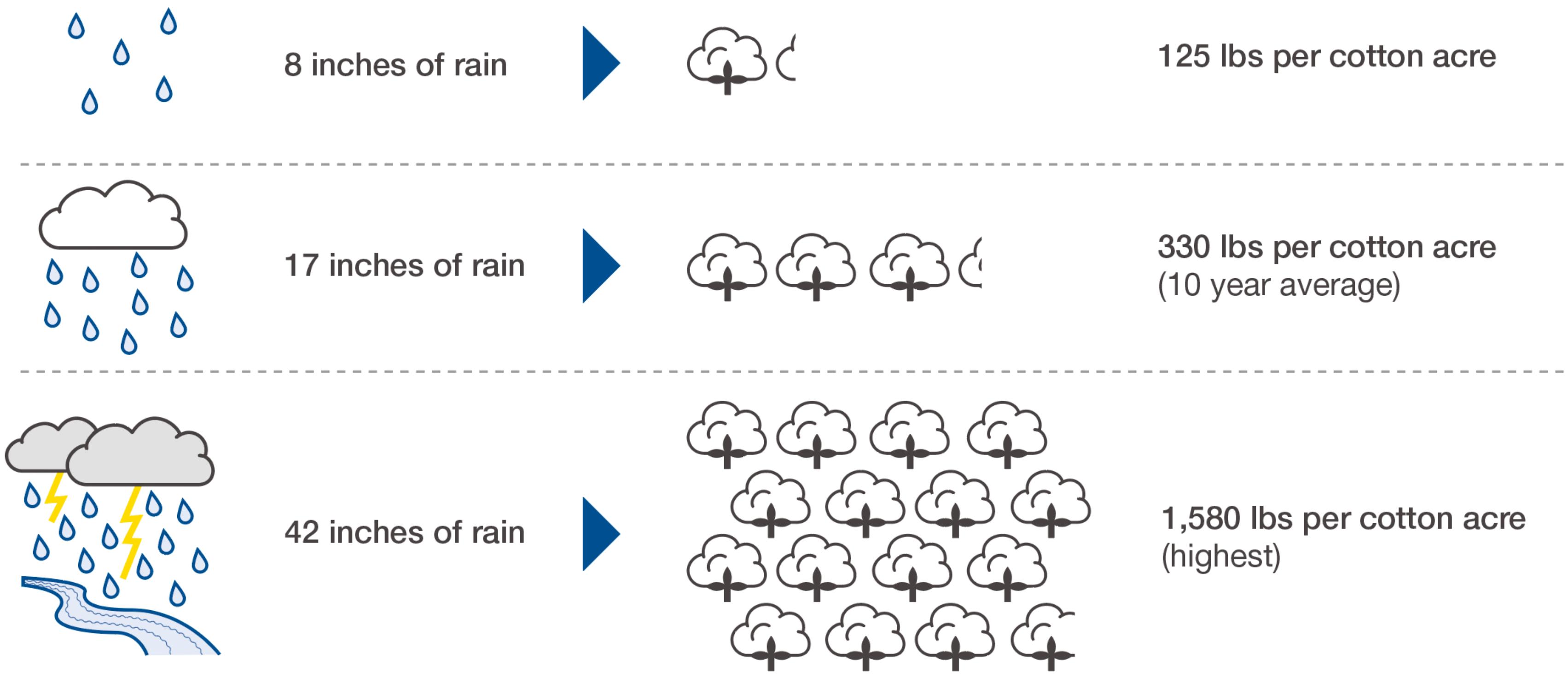
360 acres of cotton
1st in buffered insectory strips / 225 cotton acres



Organic production:

- Minimum 50 ft buffer zones
- Insectory strips
- Minimum 1/3 crop rotation

Snapshot in Time: La Rhea's Personal Experience



Organic by Design vs. by Default

My yields match or exceed my conventional neighbours

Conclusion

Presented by La Rhea Pepper, Managing Director at Textile Exchange

Q&A

Thank you

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Anti-Trust Statement

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