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No fertiliser? Where is the nitrogen going to come from?

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Outline of talk

1. The present situation
2. Current and future role of legumes
3. Manure management
4. Alternative sources
5. An organic approach
6. Conclusion

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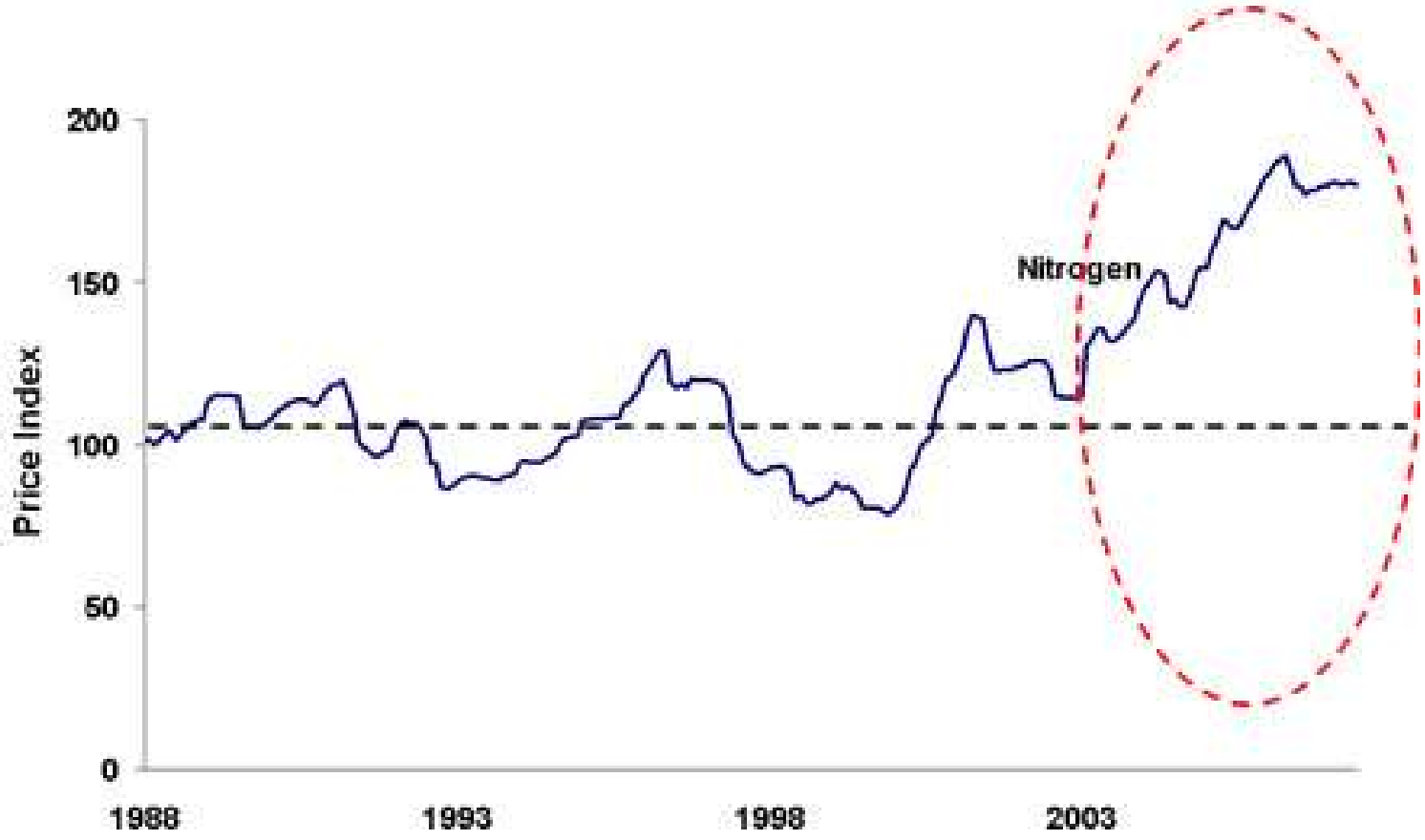
The present situation: Rising costs



Source: HGCA 2009

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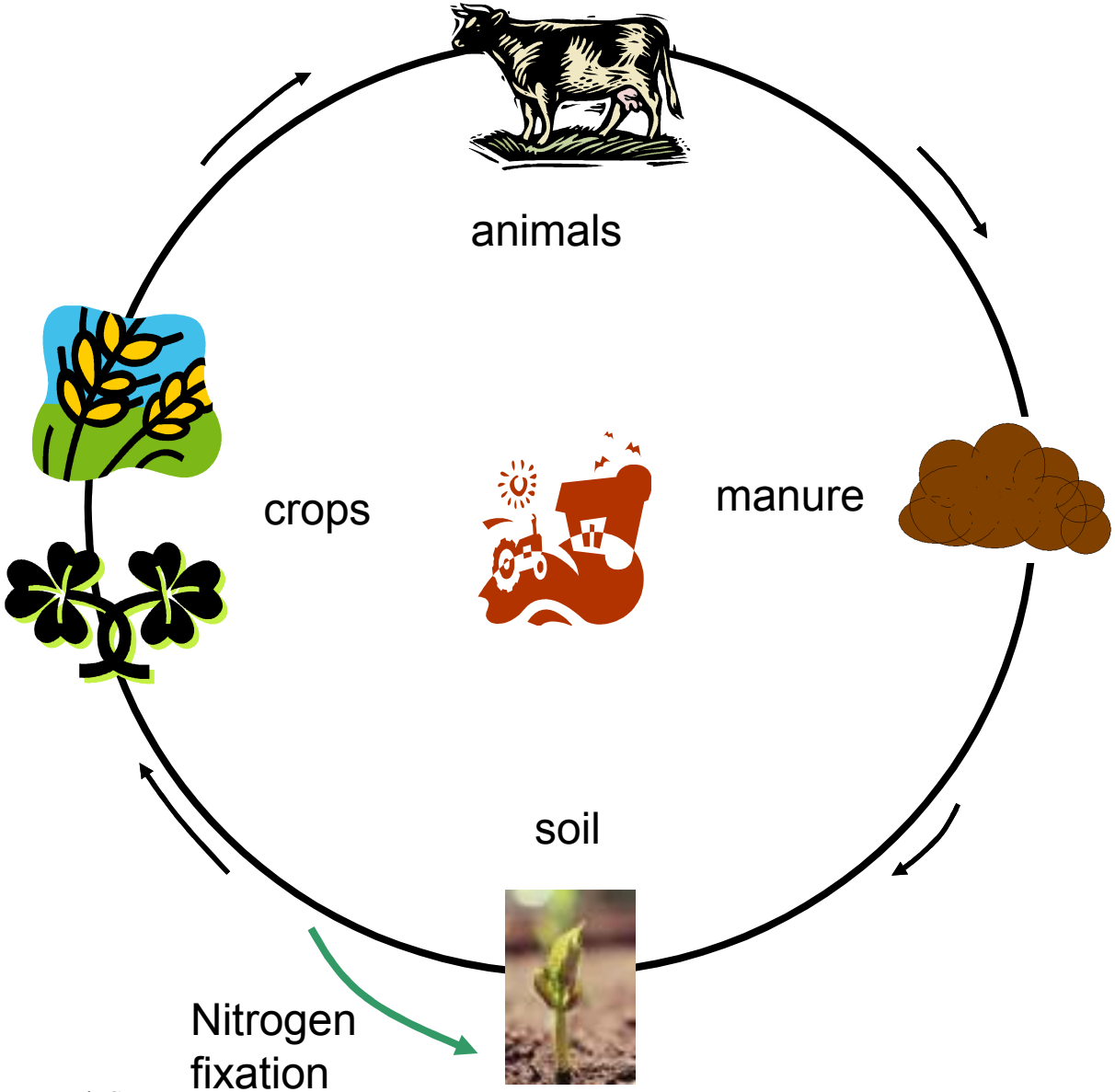
The future: a self contained unit



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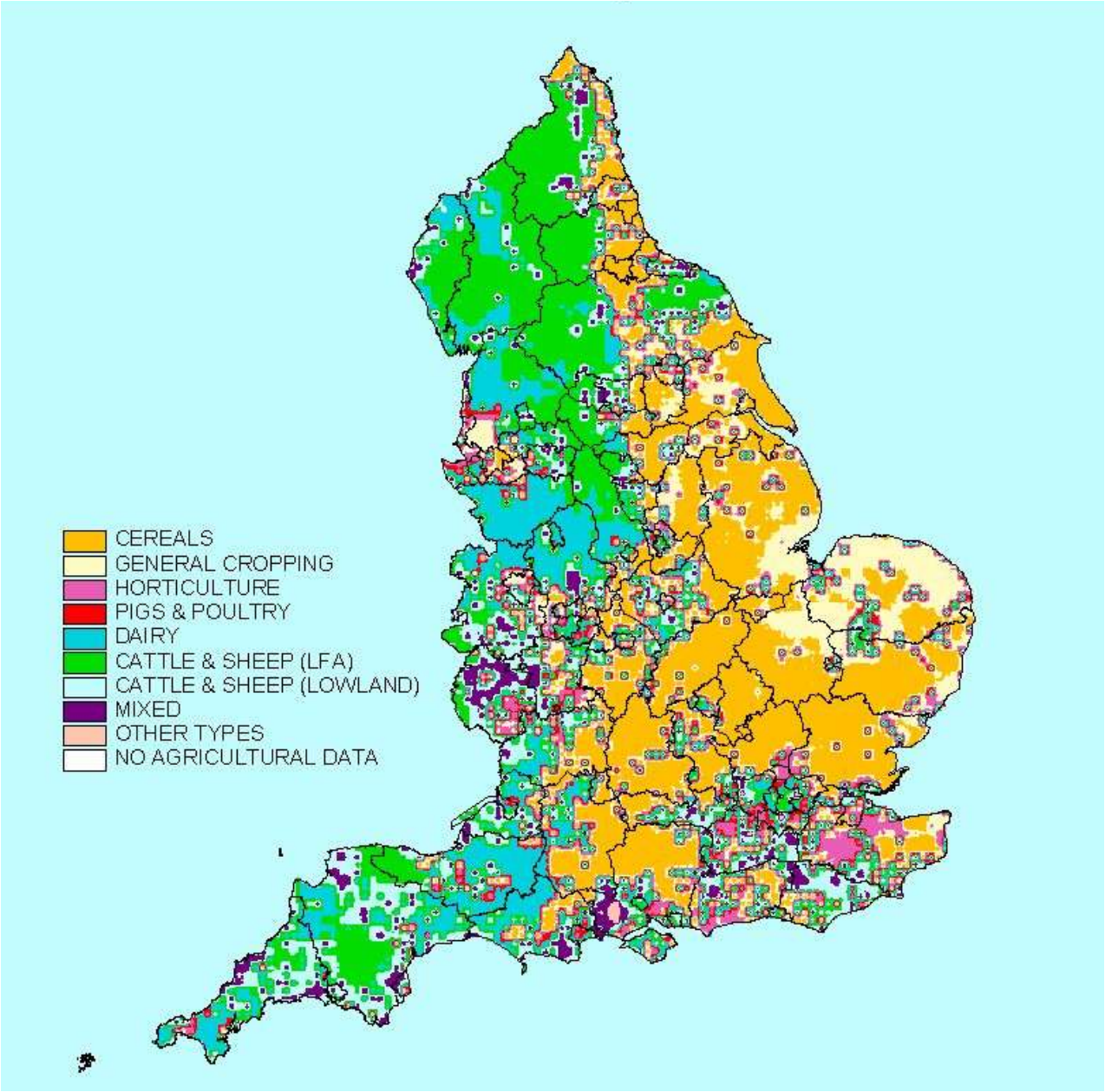
Present: Agricultural Census. Dominant farm type by 5km grid squares



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Source: Defra website (2009)

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- Smil, (2001) estimates that 40% of humanity is fundamentally dependent on the Nitrogen currently provided by synthetic fertilisers

- Population in 2050 – expected to be 9 billion

- Can we replace the Nitrogen from fertiliser with other sources?

Yes...

By allocating land to legume rotations and adopting low input systems

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Nitrogen fixation by different crops (kg/ha)

White clover/grass	150-200
Red clover/grass	230-460
Lucerne	300-450
Field beans	150-390
Peas	105-245
Lupins	100-150
Source: Kahnt (1983) adapted	

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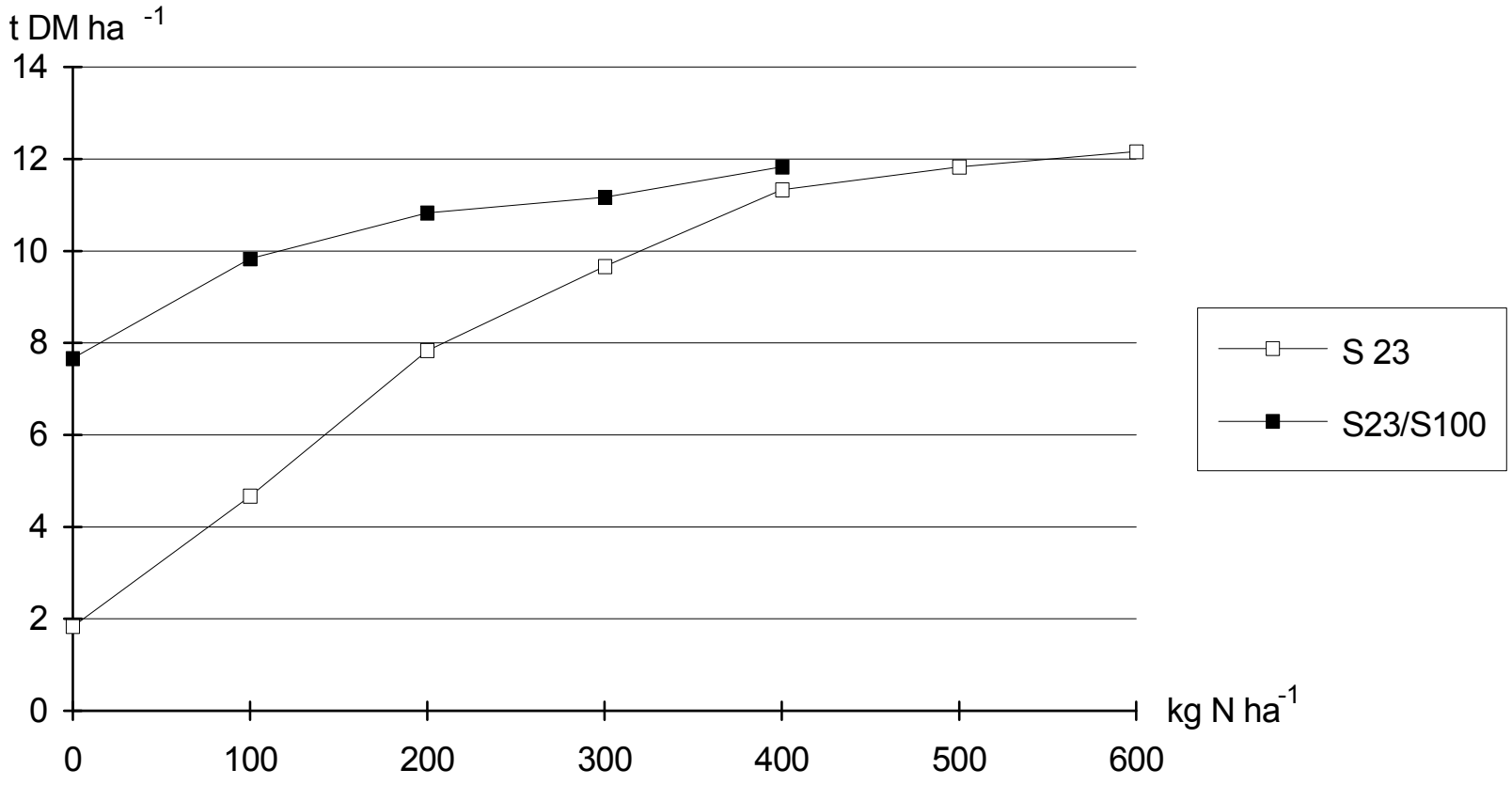
Clover content can increase yield from grass

Nitrogen fertiliser production response curves for perennial ryegrass only (S23) and perennial ryegrass/white clover mix (S23/S100)



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Organic milk N budgets (kg/ha)

	Ty Gwyn (org)	Lodge (con)
N fixation	110	9
Fertiliser	0	234
Feed	68	169
Total inputs	192	423
Milk	40	66
Total outputs	50	74
N surplus	142	349

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Cost of production - Silage

	£/tonne/DM
Grass grown conventionally	105
White clover	80
Red clover	76
Lucerne	77
Grass – white clover	79
Grass – red clover	76
Grass – lucerne	78

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Doyle and Topp (2004) adapted

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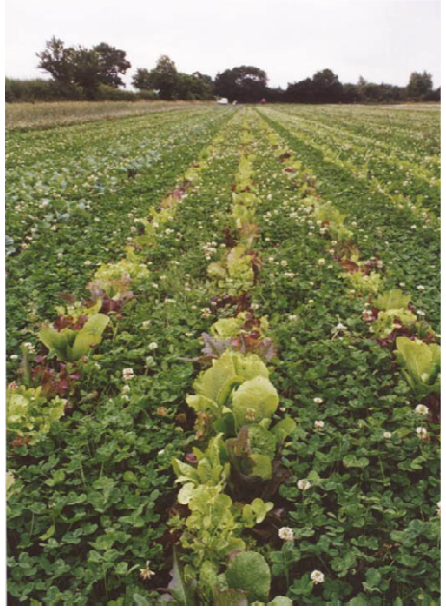
Intercropping and undersowing

- Intercropping provides continual source of N
- Help to keep down weeds
- Pest reduction
- Suited to smaller scale/market garden systems



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- Swede, some cabbages, parsnips, turnips and lettuce performed well with the yields of the best varieties similar to organic expectations

- Alliums, carrots, legumes and some brassicas such as brussels sprouts were not suited to this system

- Advantage of winter cover crop and N supply to following crop

- Easy to re-establish the strips in the following spring

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Undersowing

- Provides cover over winter, reducing nutrient losses significantly
- Efficient land-use
- Reduces weed competition for the cash crop
- Slight reduction in yield

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Manure and Slurry management

- Storage systems to reduce N loss – 4-6% under cover compared with 10-14% unprotected
- Time of year spread – should be in the late winter or spring to avoid leaching losses and minimise pollution
- Most of N loss occurs at spreading
- Low rates of spring application much better than high summer rates
- Band spreading or shallow injection most efficient in terms of reducing N losses. (Misselbrook *et al.* 2002)

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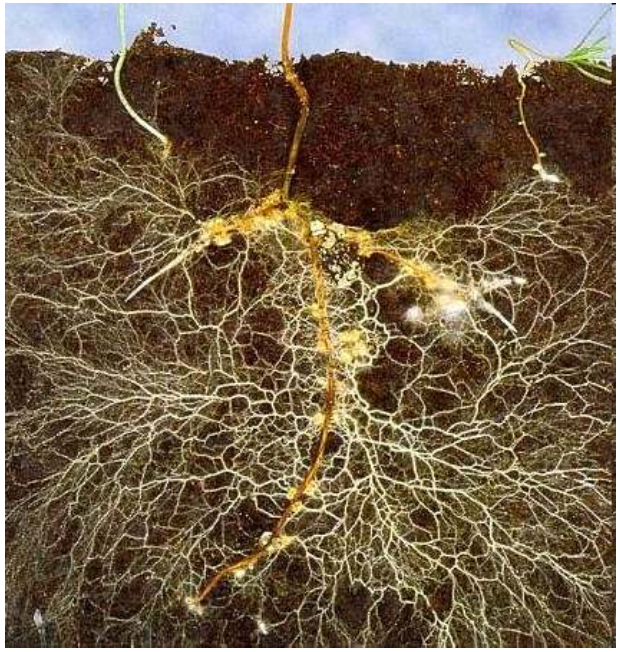
Areas currently in development

- Contribution of Mycorrhizae Fungal mycelia which penetrate the plant roots
- Reduced tillage
- Agroforestry systems



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Cultural shift within agriculture

- Feeding the soil rather than the plant
- Forage based diets for ruminants
- Need to make more land available for growing of legumes
- Groups of farmers to join together "mixed farming at a distance"

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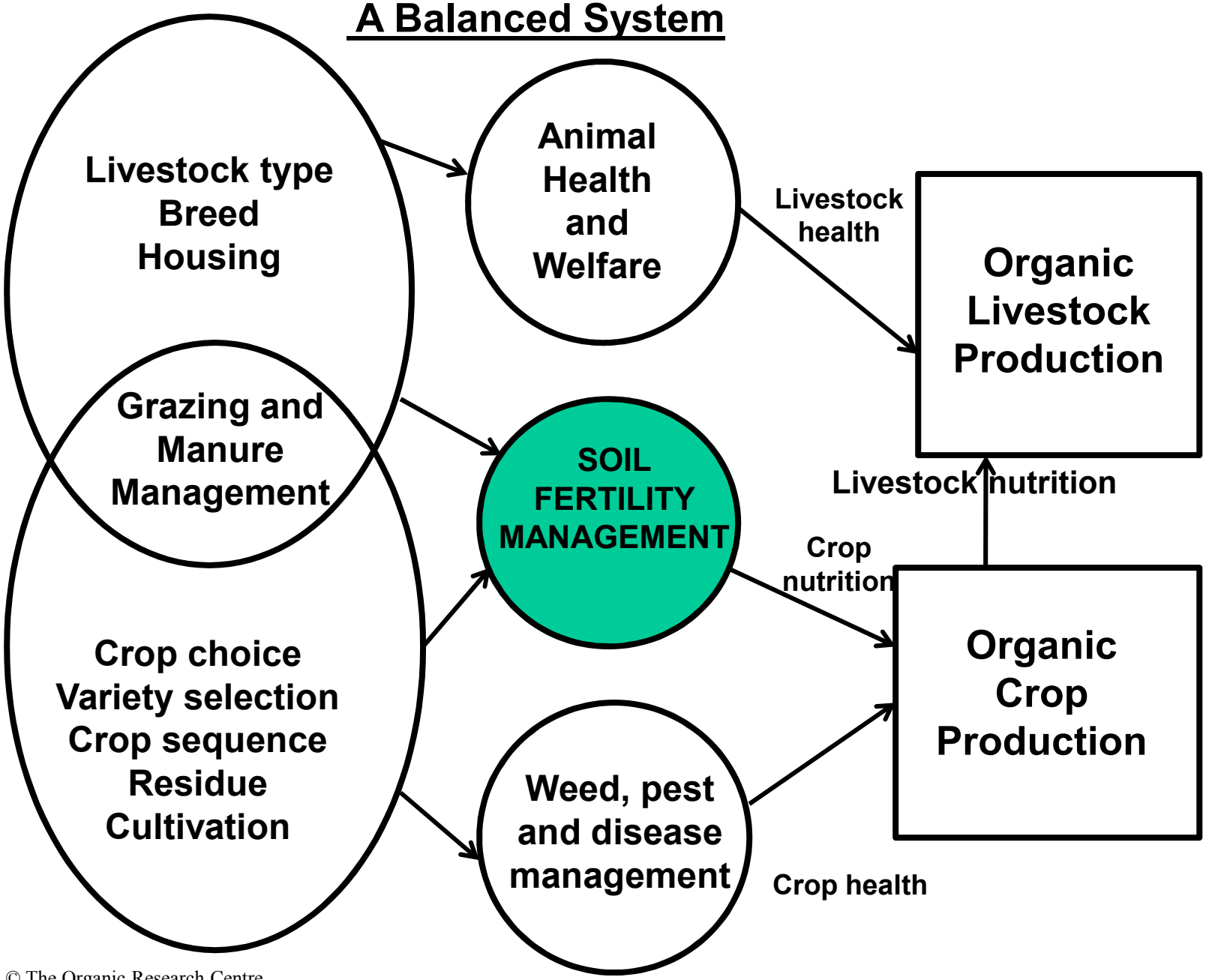
An Organic Approach: A Balanced System



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Source: Watson *et al.* (2002)

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Conclusion

- It shouldn't take a similar crisis in nutrients as Global warming to drive us to action.
- Need to act now to implement real change before it is too late
- The responsibility lies not only with farmers but society as whole to make this shift
- In order to do this we need to take individual responsibility to recycle our so called 'waste'

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