Soil Health Webinar
Getting the Best out of Compost

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RMCG

Integrated Crop Protection
PROTECTING CROPS

SoilWealth
NURTURING CROPS

Horticulture Innovation Australia

ahr applied horticultural research

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www.soilwealth.com.au

Topics

- What are composts?
- Aspects of compost - the good the bad and the ugly
- Compost and soil microbiology
- Economic considerations using examples from our Soil Wealth/ICP demo sites and case studies.

Composts are:

- All types of **completely decomposed** organic materials without a cellular structure.
- During the correct **active** composting process, organic materials are **pasteurised**, **microbially transformed** and **stabilised** under aerobic and thermophilic conditions for a period of not less than 6 weeks.

Main Composts Sources

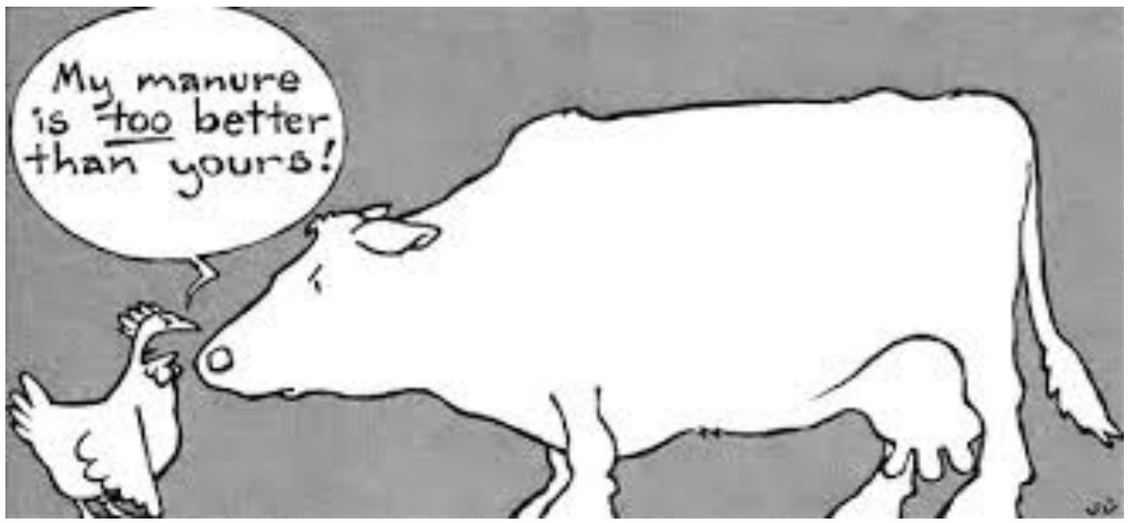
1. Plant based farm waste
2. Mushroom compost
3. Food wastes (Human Pathogen risk - HP)
4. Municipal green wastes (HP)
5. Wood, paper, textiles and other biodegradable C – sources
6. Animal manures (poultry, cattle, pig, sheep, horse etc.) (HP)
7. Municipal sludges (biosolids) (HP)

- Sources 1- 5 are usually composted
- Manures may be used without (proper) composting
- Biosolids are prescribed wastes prepared and used following EPA guidelines; they are not suitable for vegetables unless of Grade A, restrictions apply.

Composts are not Created Equally

Compost 'feed stocks' differ

- in nutrients, C, N, P, S, etc.
- in pH, salt level (EC)
- in carbon to nitrogen (C:N) ratio
- in microbial levels *(good, bad and ugly)*
- In potentially toxic metals or chemicals (*contaminants*)



It depends

Composts are not Created Equally

Composting methods can differ

- Temperature
- Humidity / moisture
- Oxygen supply
- Time

Time is on your side!

Opportunities

BETTER SOIL STRUCTURE

Better water holding capacity and drainage – more air

↕

MORE DIVERSE SOIL LIFE

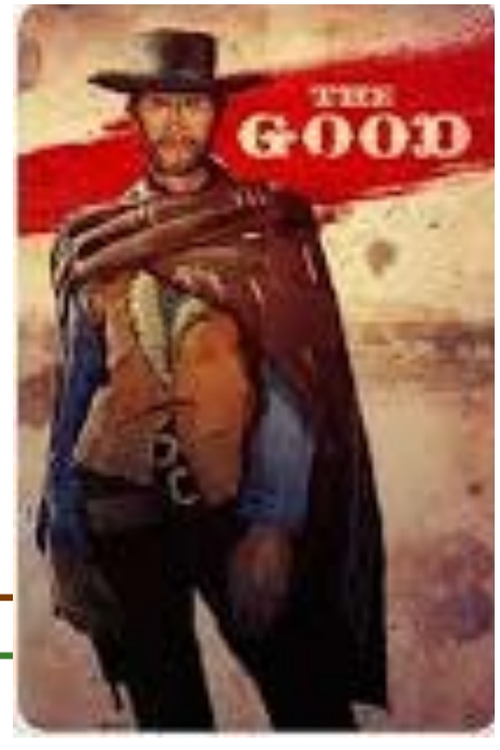
↕

BETTER NUTRIENT LEVELS, HOLDING & CYCLING

↓

Improved crop health

Reduced input and soil management costs:
e.g. fertilisers, pesticides, tillage



Compost and Soil Microbiology

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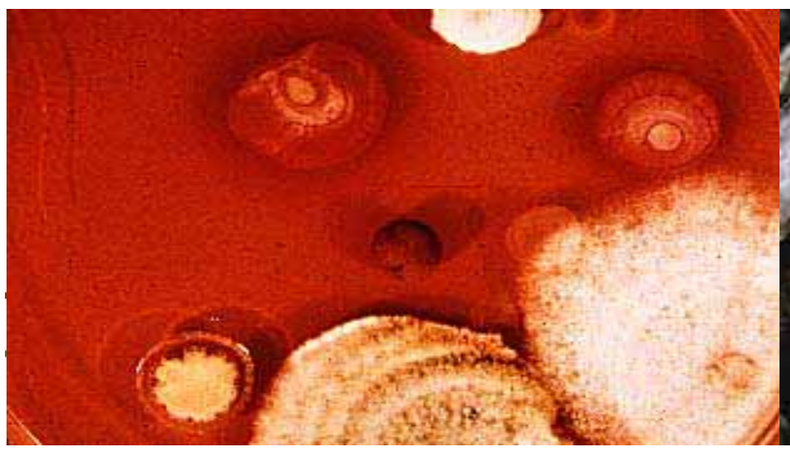
How does compost help "good" soil microbiology?

- **Provides structure to the soil, thus improving the soil microbes' habitat**
  - How does improved structure benefit soil microbes?
  - What is the benefit to my crop?

- **Provides soil microbes with an available food source**
  - Isn't there enough food in the soil for the microbes?
  - Why do I need to feed the microbes?



Compost and Soil Microbiology

- Compost helps increase soil microbe numbers and diversity
  - Is it quicker to add microbes to the soil?
  - Why not add just specific microbes that may be missing?
  - How do I know what is already in my soil?

- Compost helps reduce the “nasty” pathogenic microbes
  - How can compost achieve this?
  - How do I know the compost is good quality and what is in it?

Improved soil structure, available food source, increased microbe numbers and diversity, reduced pathogens

Increased crop health and potentially more marketable yield

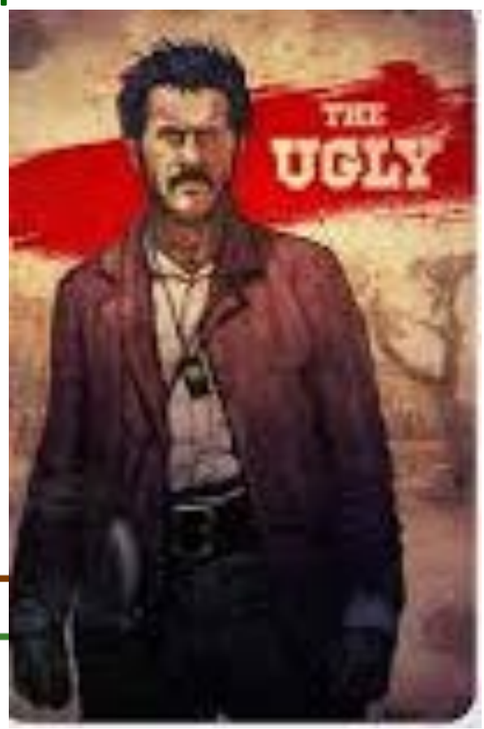
Challenges with Compost

- Variability of composts
- Using too much compost at once
- Unknown feedstock & treatment/finish
- Uneven application (esp. if not screened)
- Unbalanced nutrition
  - Only a small amount of nutrients is readily available straight up
  - Uncontrolled release of N and P can occur
  - P accumulation in soils can occur
  - Lack of Ca with continued use is possible
  - Potential high C/N effects – N draw down
- Costs of transport and spreading
  - Esp. per tonne if moisture % is high

Potential Problems

- Potential off-site effects
  - Water quality – leaching and run-off
  - Greenhouse gases (N_2O, CO_2)

- Potential **food safety issues** with ‘not finished’ compost (bacteria, viruses, protozoa etc.)
  esp. with vegetables in contact with soil, eaten raw
  - When manures are used
  - When grass clippings from parks are used



Potential Risks

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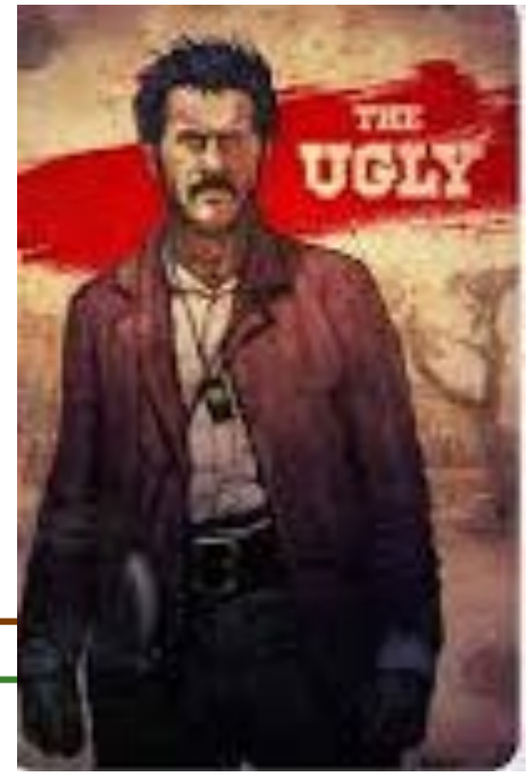
Accumulation of 'contaminants'

- Heavy metals
- Soluble salts
- Pesticide residues (esp. herbicides)
- Weed seeds
- Impurities (plastic, glass, rocks)



Records from Compost Producer

- Feedstocks used
- Temperatures and lengths of time
- Date/time of turnings
- Moisture content (e.g. max 30% w/w)
- Full fertility and contaminant analysis (on dry matter basis)

Ask for a detailed product specification sheet and use recommendations

Australian Standard AS4454 (2012)
composts, soil conditioners and mulches

Pasteurisation

- >55°C for at least 3 consecutive days
- 'Appropriate' turning to achieve the required exposure

If compost feedstock contains manures, animal, food and or grease trap waste:

- >55°C for 15 consecutive days or longer and
- the windrow shall be turned at least 5 times during that period. This is consistent with the US EPA 503 Rule.

Apply the above rule if feedstocks are not known

Treatment Options if AS4454 is not used:

Other options for pasteurisation:

- ≥55°C for at least 15 days in windrows with at least five turnings or
- ≥65°C for at least 7 days in windrows with at least two turnings or
- ≥60°C for at least 7 days in an aerated static pile with insulating layer (no turning)
- ≥60°C for at least 2 days for in-vessel systems or
- ≥70°C for at least 1 hour for in-vessel systems.

Adequate On-farm Records by Growers

Keep batch records of:

- Feedstock and production details of compost
- Analytical details
- Paddocks or blocks and crop(s) an identified batch has been applied to
- Application date and method
- Application rate (t/ha)
- Planting date(s)

This is really important to protect against food safety related issues

Human Pathogen Indicators

If compost feedstocks and composting procedures are unknown, composts should not be used directly ahead of crops that get in contact with soil and are eaten raw, unless tested.

AS4454 requires that all products shall fully comply with the chemical, physical and pathogen contaminant provisions specified for products suitable for unrestricted use as expressed in applicable government guidelines.

This provides assurance that AS4454 compliant products are suitable for broader agricultural use. www.recycledorganics.com

Guidance levels for testing for human pathogens[1]:

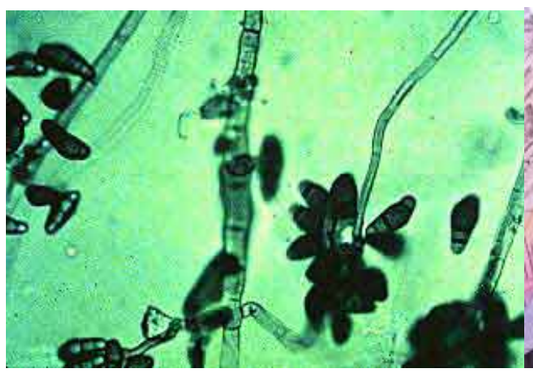
Indicator pathogen	Limit for Grade A
E.Coli	<100 cfu/g
Helminth Ova	<1 cfu / 4g
Salmonella	<1 cfu / 50g
Listeria	<1 cfu / 50g
Camylobacter	< 1/25g
Enteric viruses	<1 pfu/4g

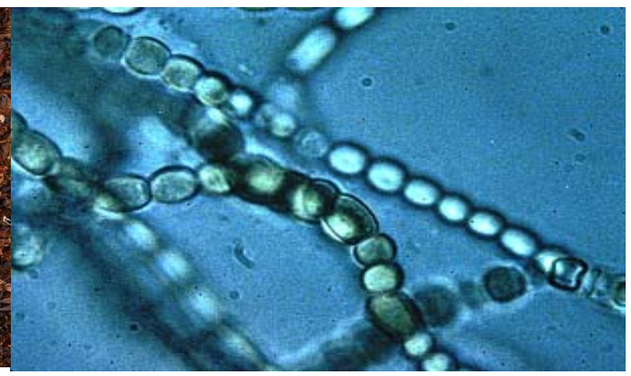
[1]Limits from: NWQMS, 2004. Guidelines for Sewerage Systems Sludge (Biosolids) Management. National Water Quality Management Strategy. Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ) and Australian and New Zealand Environment Conservation Council (ANZECC), Canberra.

Economics

Consider your objectives / purpose of using compost

- **Recap of main benefits:**
  - Increased organic matter
  - Improved soil structure and soil health
  - Adding nutrients to soil and keeping them there for crops
  - Increased water holding capacity of soils
  - Better root growth
  - Better soil life and disease suppression



Economic Considerations

- **Compost can add nutrients to the soil**
  - But you need to adjust crop nutrition plans - to maximise economic benefits
  - Consider the C:N ratio - this influences the timing of N available
  - Can be slow release - so consider benefits over the rotation

- **Improved soil structure may reduce input costs**
  - Crop protection
  - Tillage costs
  - Irrigation costs

Economics – Case Study 1

Baldivis Farms, WA

For details refer to the case study on www.soilwealth.com.au

- **Costs**
  - 20m³/ha @ $84/m³ delivered to Baldivis Farms:
  - $1,680/ha compost

No compost

With compost

Economics - Case Study 1

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Baldivis Farms, WA

- **Benefits**
  - Yield increase of 30%
  - $2,240/ha fumigants not required
  - $477/ha value of nutrients (NB reduced fertiliser by 10%)
  - Beds are more stable
  - Less greening on carrot shoulders
  - Easier to harvest
  - Reduction in sandblasting of young seedlings

Economics - Case Study 1

Baldivis Farms, WA

- **Substantial economic benefit in this crop**
- **Questions**
  - Would the benefits continue over time?
  - How many years did Sam apply compost to the paddock before benefits occurred?

Economics - Case Study 2

Centre West Exports, WA

For details refer to demo site information at:
http://www.soilwealth.com.au/demo-sites/gingin-wa/

- **Treatments and costs**

Compost	Application rate	Compost, freight, application costs ($/ha)
Premium compost	30 m^3/ha	$2,777
Premium compost	50 m^3/ha	$4,537
Humicarb compost	30 m^3/ha	$1,997
Humicarb compost	50 m^3/ha	$3,237
No compost	Nil (control)	nil

Economics - Case Study 2

Centre West Exports, WA

- **Costs**
  - **Compost ($2K to $4.5K / ha)**
- **Benefits**
  - No marketable yield benefits
  - Carrot size distribution - potential benefits
  - Soil DNA assays for carrot pathogens - suggest potential longer term benefits – disease suppression
  - Nutrients – reduced fertiliser required

Economics - Case Study 2

Centre West Exports, WA

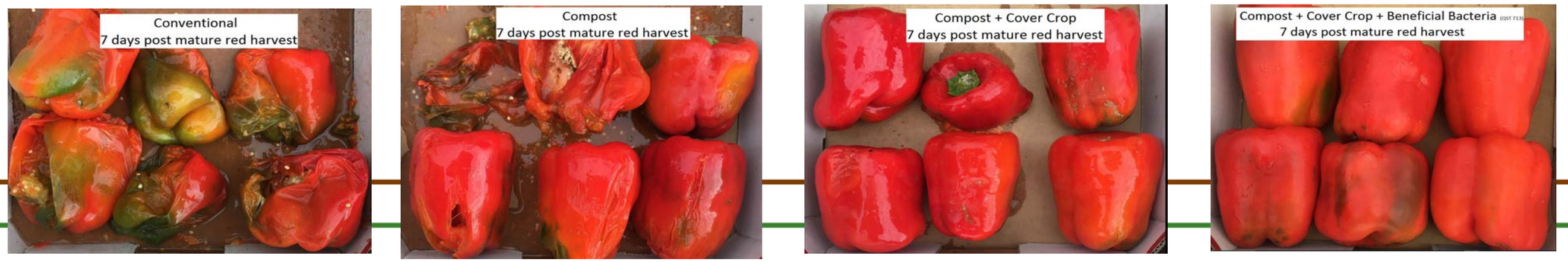
- **No economic return in the year of application because of:**
  - Compost transport costs to this location
  - Only modest benefits from crop yield / quality improvements
  - Fertiliser cost savings not realised in the trial
- **Questions:**
  - **How long does beneficial effect last?**
  - **Risk management benefits of disease inoculum reduction in soil?**
  - **How can transport costs be reduced?**
  - **Is it possible to get benefits with lower rates or band placement?**

Economics - Case Study 3

Bowen, North Queensland

For details refer to demo site information at : http://www.soilwealth.com.au/demo-sites/bowen-qld/

Capsicum - combined harvests				
	Mean number fruit per plant	**Average fruit weight (g)**	**Yield (t/ha)**	**Economic BENEFIT of Soil Wealth practice $/ha (over conventional)**
Conventional	9.40	254	34.0	-
Compost	9.87	272	36.4	**$5,360.00**
Compost + Cover crop	10.17	278	37.1	**$7,200.00**
Compost + Cover crop + Beneficial Bacteria (strain QST 713)	10.20	286	38.1	**$9,495.00**



Economics - Case Study 4

Cowra, New South Wales

For details refer to demo site information at : http://www.soilwealth.com.au/demo-sites/cowra-nsw/

- Spinach yield was 22% greater

Treatment	Spinach yield (bedtop)
Fallow + compost	13.89 t/ha
Fallow	11.31 t/ha

- Most likely a response to N from compost
- Possible that control would have yielded sim was applied

Economics

- **Consider other practices to change when using compost:**
  - Tillage, irrigation, crop protection requirements
  - Soil nutrient monitoring, crop nutrition planning and inputs
- **Consider the longer term benefits**
- **Remember costs, risks and benefits will vary with each situation**
  - Different quality compost
  - Different conditions, practices, systems and challenges
  - Different cost structures (scale, cost of compost, transport costs, machinery costs, costs of other inputs)

Recommendations

- Develop a relationship with a reliable supplier working according to Australian Standard AS 4454 (2012) - or
- Get relevant production information
- Avoid prescribed wastes (e.g. biosolids unless properly treated, tested and classified as per EPA regulation)
- Avoid raw manure ahead of fresh produce in contact with soil and eaten raw

Check out

http://www.compostforsoils.com.au/

http://www.recycledorganics.com/publications/

And fact sheets and other information on:

www.soilwealth.com.au

In Summary

- Using compost requires an understanding of many production aspects
- Using compost routinely is a change of the production system, not of just one input!

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Thank You

to all growers, advisors, compost suppliers and the project team who managed the trials and case studies

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Nutrient budgeting

- Account for N, P, K, S and Mg as well as C/N
  - C:N ratios should be 25:1 - 30:1
- Convert analysis results from [mg/kg] to kg/m^3 or [kg/t] **wet** compost or manure you use per hectare to know nutrient inputs
- Nutrients will become available over 2-3 years:
  - Up to 15% of total N will be available in year 1
  - 20-40% of total P
  - 80-100% of total K