Biofertilizers, Biostimulants, Biopesticides:

Definitions, Differences & Challenges

Stephanie Roberts – FERTASA Biofertilizer Workshop,
15 November 2017

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Why Are We Here Today?

Why Do We Care About These Bio- Products?

Because by 2022 we expect….

Global Biostimulants Market 3.2 bn USD
Markets & Markets, 2017

400 million extra mouths to feed
Our World in Data, 2017

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Why Do We Care About These Bio- Products?

They can help to sustainably improve crop yields by reducing crop stress & improving nutrient use efficiency

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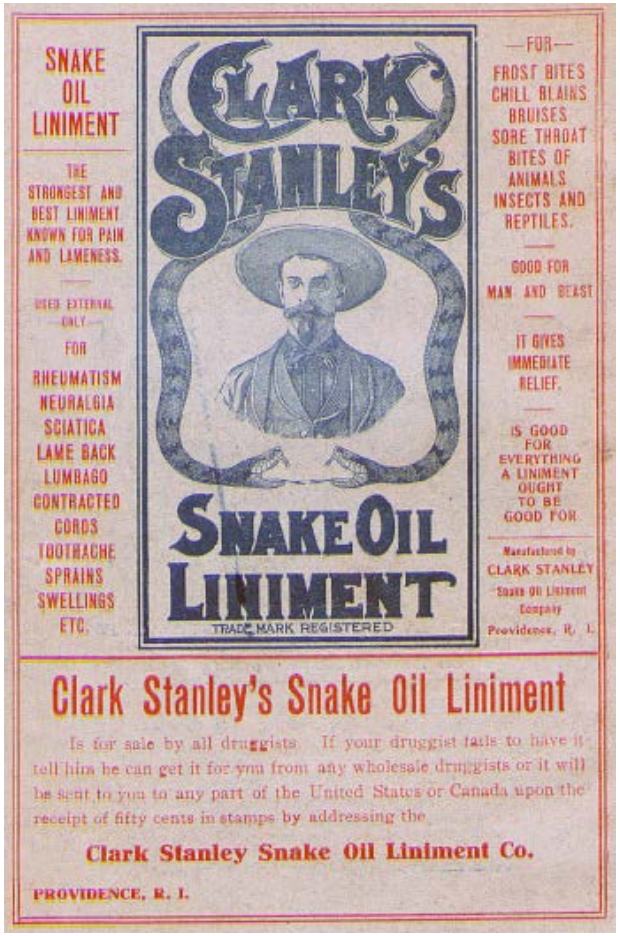
The Challenge of Perception

"Every grower has their own way of describing chemical products with dubious claims and a mysterious technical story: in the UK they say 'muck and magic'; it's 'snake oil' in my native United States; and 'agua de batata' (potato water) in Brazil."

John Brubaker, CEO Plant Impact, Agfunder News, 2016



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Definition of snake oil:

“A substance with no real medicinal value sold as a remedy for all diseases”

Kontrepsie laat mielies glo groei

Deur **Elaine Swanepoel** | **17 September 2017 00:00** | **Rapport**

Die antenna word gekoppel aan ’n foeliebakkie wat aan ’n rekenaar vasgemaak word.

Boere in Noordwes het glo miljoene rande opgedok vir kontrepsies wat energievelde in landerye skep om hul mielies beter te laat groei.

Die masjientjies, wat bestaan uit ’n antenna en ’n ou rekenaar met ’n foeliebak oor, is die breinkind van Paul Greyvensteyn, ’n 71-jarige kartograaf en voormalige boer van Klerksdorp.

Hy sweer by sy patent en sê sy produk is al suksesvol op meer as 50 000 ha gebruik teen ’n huurtarief van R200 per hektaar.

Maar nie al sy kliënte is oortuig nie.

Die toestel moes atmosferiese energie in voedingstowwe vir plante omskep en peste verdryf. Dit sou gewasse laat groei

The Challenge of Perception

Dictionary

snake oil

snake oil

noun NORTH AMERICAN *informal*

a substance with no real medicinal value sold as a remedy for all diseases.
"some kelp products are snake oil, but the good ones promote plant growth"

- a product, policy, etc. of little real worth or value that is promoted as the solution to a problem.
  "the new tax plan was denounced as snake oil"

Translations, word origin, and more definitions

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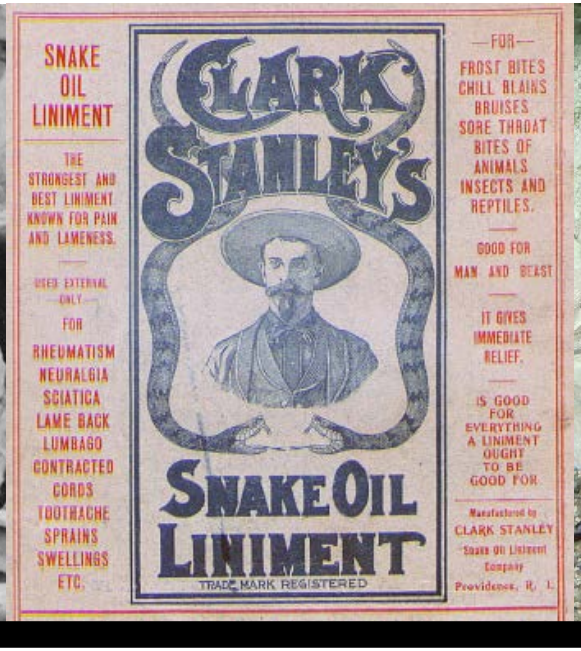
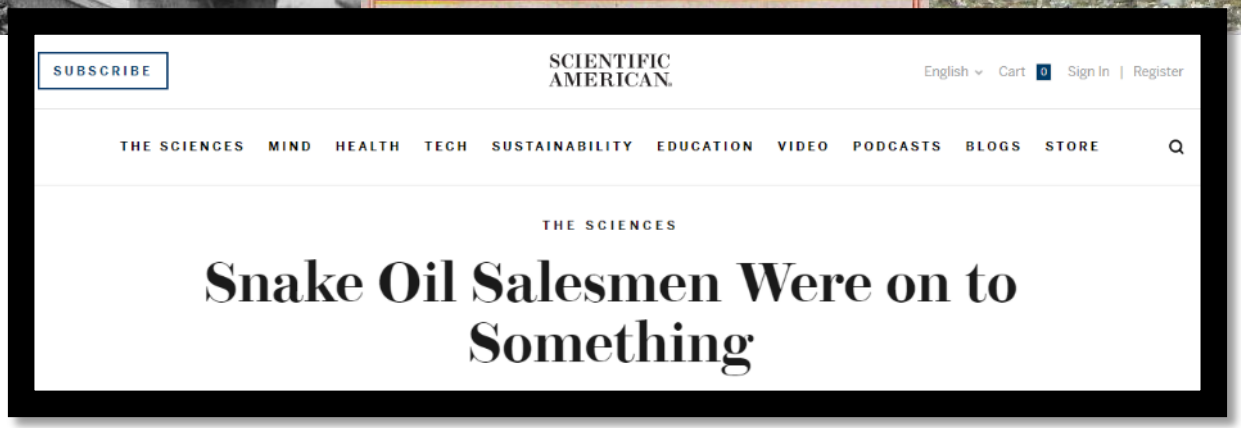
Why Does This Perception Exist?

- Origins in the organic industry
- Industry-driven R&D
- Fake products
- Genuine products don’t always work

A Lesson from Snake Oil…





Graber 2007, Scientific American

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The Purpose of Group 3

Biostimulants
Biofertilizers

Remedy → Fertilizer

Biopesticides

Ensure that only proven biostimulants & biofertilizers are marketed to farmers

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Group 3 Definition

"A natural or synthetic substance or organism/s that improve/s the growth or yield of plants or the physical, chemical or biological condition of the soil"

What is a Biostimulant?

"Biostimulants are products that stimulate natural processes in the plant or around the roots to enhance nutrient uptake, nutrient efficiency, increased tolerance to abiotic stress, and crop quality, vigour and yield."

SABO
South African Bioproducts Organisation

Not a replacement for a balanced fertilizer programme

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Typical Biostimulants

Marine Macroalgae Extracts e.g. Kelp

Plant Extracts e.g. Brassinosteroids

Protein Hydrolysates & Amino Acids

Humic & Fulvic Acids

Elicitors = Remedy

What is a Biofertilizer?

"Biofertilizers are micro-organisms that stimulate natural processes in the plant or around the roots to enhance nutrient uptake, nutrient efficiency, increased tolerance to abiotic stress, and crop quality, vigour and yield."

The same thing as a biostimulant except live microbes are involved

Typical Biofertilizers

AMF (Arbuscular Mycorrhizal Fungi)

Free-living N-Fixing e.g. *Azosporillum*

Hormone-releasing e.g. *Bacillus*

P-solubilizing e.g. e.g. *Pseudomonas*

Widely known as PGPR's
(Plant Growth Promoting Rhizobacteria)

Typical Microbial Biopesticide

Trichoderma spp.

Bacillus spp.

Bacillus thuringiensis

Beauvaria bassiana

Distinction between microbes that fertilize vs. those that control pests & diseases

Grey Areas

Trichoderma, Bacillus spp. Group 3 or Remedy?

- Display both pathogen antagonistic & plant symbiotic effects *(Lopez-Bucio et al., 2015)*
- Depends on claims to be made

Grey Areas

Kelp – Group 3
vs.
Synthetic PGR's - Remedy

- Biostimulant effect of kelp not limited to hormones *(Urbani et al., 2016)*
- Synthetic PGR's more risky

Grey Areas

Biofertilizers - Group3
vs.
Legume Inoculants - Remedy

- Biofertilizers enhance chemical fertilizer
- Legume inoculants replace chemical fertilizer

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Grey Area

Group 1 & 2 Fertilizers + Biostimulants

"**fertilizer group**" means the category under which a particular fertilizer falls. Fertilizers are categorised as follows:

Group 1 which is a fertilizer containing a total equal to or greater than 100 g/kg of N, P or K or any combination thereof; **or**
Group 2 which is a fertilizer containing a total of less than 100 g/kg of N, P or K or any combination thereof or any other recognised plant nutrient(s) in acceptable amounts as indicated in Tables 1 – 9 and 13 – 15;
Group 3 which is a fertilizer containing natural or synthetic substance(s) or organism(s) that improve(s) or maintain(s) the growth or yield of plants or the physical, chemical or biological condition (fertility) of the soil; and "soil Improver" has the same meaning;

Act 36 of 1947, Regulations Relating to Fertilizers, 8 Sep 2017

Summary

- Challenge of negative perception of bio- products
- Group 3 protects reputation of legitimate biostimulant/biofertilizer products
- Biostimulants are substances that enhance crop growth, but are not recognised as essential plant nutrients
- Biofertilizers are live microbes - primary effect to enhance crop growth
- Biopesticides are live organisms - primary effect to directly control crop pests & diseases
- Helpful to plants or soil – Register as a Group 3 Fertilizer
- Harmful to pests or high risk – Register as a Remedy

Challenges Going Forward

- Verification of actives
- Representative crops for claims
- Clarify remedy vs. fertilizer
- Agree on acceptable evaluation techniques

Brief Condition (Figure 1. order, left to right)	Average Brief Weight (grams/brief) 5 replications
Control – non-buried	58.5 a
No-till soil with cover crops	28.4 c
Mulch (reduced) till soybeans	48.3 b
Conventional tilled corn	50.8 b
Stats:	
Pr>F	0.001
CV	7.47
LSD(.05)	4.9

*Brief averages with different lower case letters are significantly different.

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"Tighty Whitie" demonstration, 2016 Soil Health School, Aberdeen, SD (SDSU Extension)

Final Thoughts

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