AAP & WAAP & Interbull Congress 2023

Session 64

[Tailored vitamins and minerals premix for Tenebrio molitor farming]

30th August 2023

This project has received funding from the Bio Based Industries Joint Undertaking (JU) under grant agreement No 837750. The JU receives support from the European Union's Horizon 2020 research and innovation programme and the Bio Based Industries Consortium.

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What are premixes and why are they essential ?

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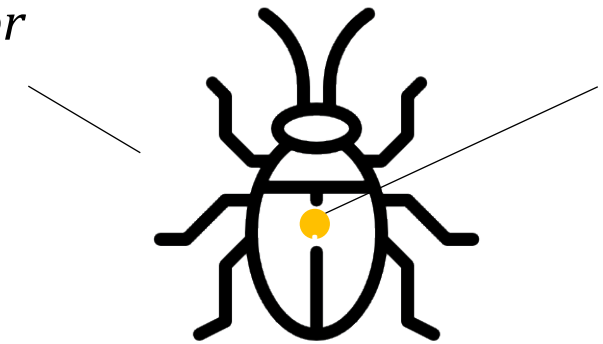
What are premixes of vitamins and minerals ?

- Mix of vitamins, minerals, trace-elements and sometimes completed with additives (plant extracts, amino acids, …)
- Small quantity but essential for development and normal body functioning
- Little or no synthesis by the body
- Must be provided by the feed to :
  - Achieve high production levels
  - Prevent nutritional deficiencies

Tenebrio molitor



Total quantity of vitamins and minerals

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Why are MG2MIX premixes for *Tenebrio molitor* stable ?

Know how

Premix formulation

Protected vitamins
Selected trace elements
(Quarantine heavy metals and dioxin)

Carrier limestone
Homogeneous size of particle
Very low humidity

Clay
Capture residual moisture

Anticaking
Flowability quality
Premix homogeneity

Antioxydant
Protection against chemical reactions and better shelf life

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Why are MG2MIX premixes for *Tenebrio molitor* stable ?

Avoid production losses
(dust ; caking ; dosing precision)

Protecting vitamin stability

Ensure operator safety
(less dust)

Reducing
ENVIRONMENTAL & **FINANCIAL** losses

Better feed **STABILITY** & **QUALITY**

Protecting your
TEAMS & **USERS**

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Vitamins and minerals needs of *Tenebrio molitor*

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Synthesis from literature

Micro-nutrients needs for *Tenebrio molitor* (% of diet)

Vitamins (µg/g dry diet)	
Vitamin A	-
Vitamin D	-
Vitamin E	-
Vitamin K	-
Vitamin B1	1 – 25
Vitamin B2	2 – 12.5
Vitamin B3	16 – 50
Vitamin B5	8 – 25
Vitamin B6	2 – 12.5
Vitamin B9	2.5
Vitamin B12	-
Biotin	0.16 – 0.25
Vitamin C	-

Minerals	
Sodium	-
Potassium	0.17 – 0.29 %
Calcium	80 µg/g
Magnesium	0.4 mg/g
Chloride	-
Phosphorus	-

Trace-elements	
Iron	-
Zinc	6 mg/kg
Selenium	-
Copper	-

- In insect nutrition, the qualitative nutrient requirement is widely studied (essentiality by dietary deletion), however, very little is known on their quantitative requirement.
- Digestible nutrient requirement of insects is neglected in insect nutrition
- Requirement will differ with life stages of insects but most studies focused either on larvae or adults but not both.
- Insects do not exhibit deficiency symptoms when they lack specific nutrient in their diet rather they reduce their overall growth. This could also lead to death if extended for long periods of time.

Sources : Fraenkel and Leclerc, 1950-70

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Experimental design

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Objectives and groups

- To evaluate the efficacy of some vitamin-mineral premixes on the performances (growth rate, feed consumption, feed efficiency, mortality…).
- To investigate if there is any difference in performances between the optimal levels (according to literature) and the maximum level of different groups of micronutrients.
- Impact of Magnesium and Calcium levels, as constituents of the Premix's Carrier, on the rearing performances.

Category	Grouped variables	Groups
Accessory Vitamins	Vitamin A, D3, E and K3	The variables were grouped in two different levels: High and Low
Core Group	Thiamin, Riboflavin, Niacin, Calcium Pantotenate, Piridoxin, Biotin, Folic Acid, L-Carnitine, Inositol, Phosphorus, Potassium, Iron, Zinc, Chloride, DL-Methionine	The variables were grouped according to different levels, based on increasing doses, in the following groups: A0, A, B,C
Trace Elements	Sulfur, Copper, Manganese, Selenium, Iodine	The variables were grouped in two different levels: High and Low

10 treatments and 3 replicates per treatment

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Results

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Indicators Groups Significance

Growth and Feed Conversion Indicators - Groups Significance					
Gropus	**Individual Mean Weight**	**Cumulated Mass TW**	**Cumulated Mass DM**	**FCR DM/TW PHYSIO**	**FCR DM/DM PHYSIO**
Core	0,265	0,005	0,016	0,052	0,069
Minerals	0,542	0,591	0,246	0,496	0,187
Vitamins	0,209	0,427	0,227	0,183	0,114
Magnesium	0,179	0,003	0,003	0,001	0,003
Calcium	0,981	0,946	0,564	0,477	0,37

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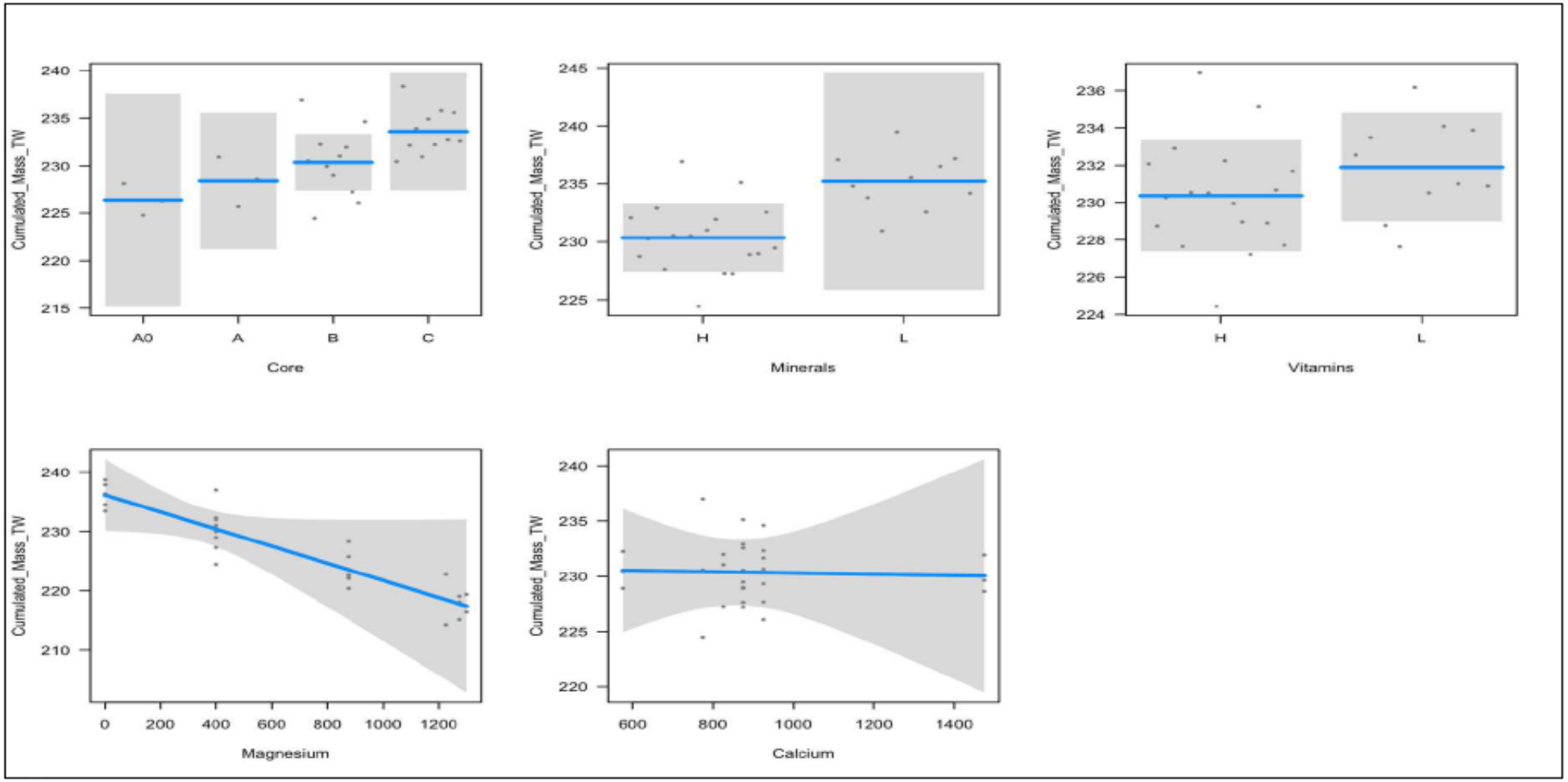
Cumulated Mass TW with statistical significance



Gropus	Significance - Cumulated_Mass_TW
Core A	0,580
Core B	0,465
Core C	0,374
Minerals	0,317
Vitamins	0,352
Magnesium	0,060
Calcium	0,946

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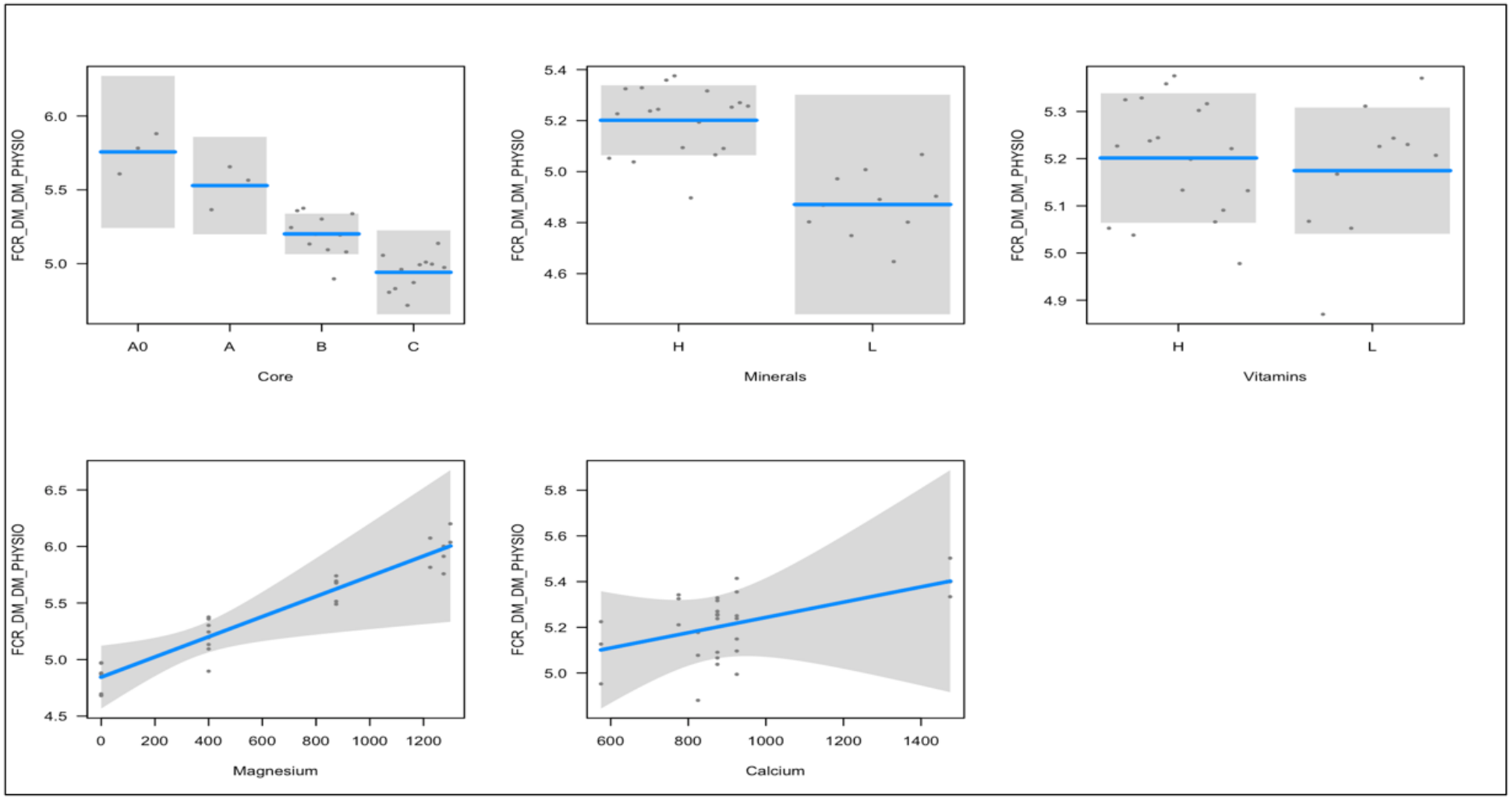
FCR DM/DM



Gropus	Significance - FCR_DM_DM_PHYSIO
Core A	0,178
Core B	0,035
Core C	0,037
Minerals	0,145
Vitamins	0,721
Magnesium	0,014
Calcium	0,370

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Conclusion

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Conclusion

- The Core group (B vitamins and minerals) has an effect on the physiological and economical performances
- No impact of higher level of fat soluble vitamins
- No impact of higher levels of minerals
- High contents of magnesium seem to have a detrimental effect on the physiological and economical performances
- Further investigation are needed to understand the interaction between calcium and magnesium and think about the carrier of the premix
- Recipe of the premix is validated and will be included in the diet of Tenebrio molitor at Ynfarm

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Thank you for your attention

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