



Amadori

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NEXTGEN PROTEINS

Black soldier fly meal inclusion in broiler and turkey diets: effects on growth performances, meat quality and health

Presented by Christophe TRESPEUCH

MUTATEC
Bioconversion by insects

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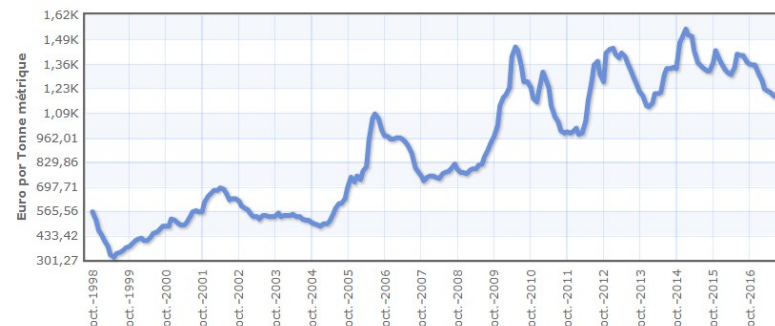
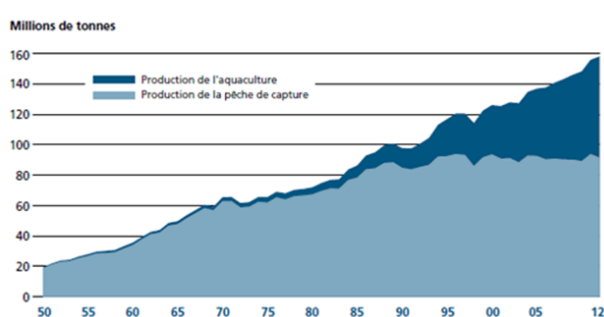
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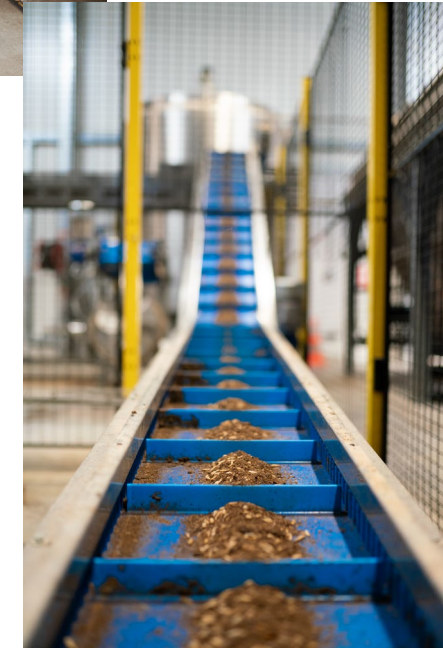
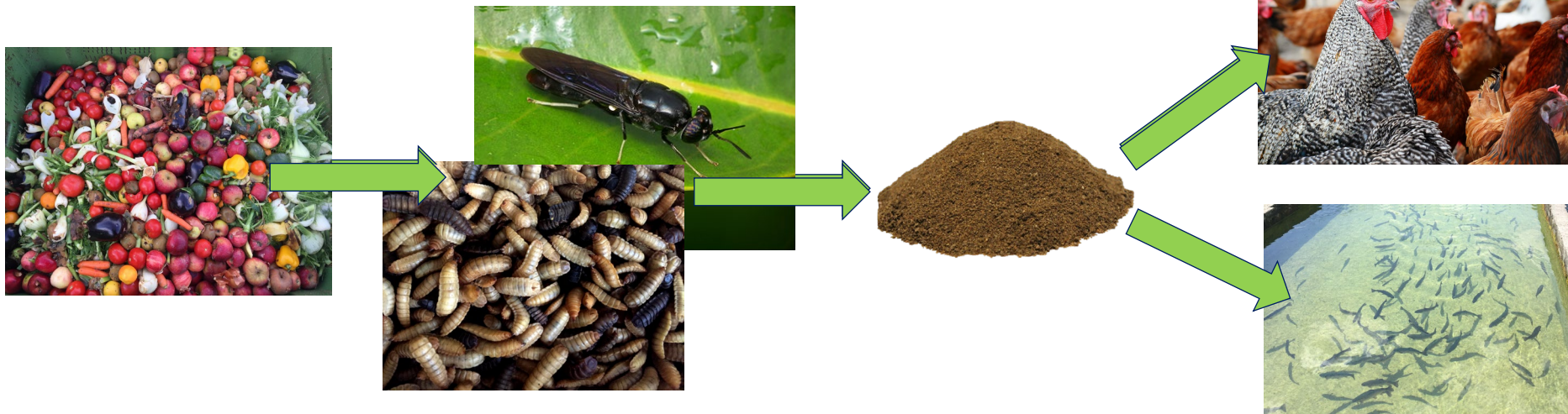
Introduction

- **FAO** recommends **insects** : demographic increase, limited resources, raise of animal-origin products demand, need to feed farmed animals
- **Feed** producers are searching for **sustainable** raw materials :
 - aquaculture is growing <=> fishmeal (price, volumes)
 - poultry farming is growing <=> soybean meal (importation, deforestation)



MUTATEC, the “Bioconversion by insects” company

- Founded in 2015
- **Pilot** installation - Châteaurenard (France)
- **Industrial** scale – Cavaillon (France)
- Challenges :
 - Supply of raw materials = leftovers of the food industry
 - Animal nutrition applications



The project :



Transformation of Biomass into Next Generation Proteins for Food and Feed

21

Partners

10

European Countries

8

Million Euros

48

Months

Animals

Broiler
Turkey
Salmon
Seabream

Parameters

Digestibility
Growth performances
Effects on health
Effects on quality

<https://nextgenproteins.eu/>

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 862704.



Trials carried out during the project

- Determination of nutrient digestibility coefficients
(in collaboration with UNITO, partner of SUSINCHAIN project)
- Experimental dose-response trials - BROILER
- In-field validation trial - BROILER
- In-field validation trial - TURKEY



Experimental dose-response trial – BROILER #1

Experimental design:

- - BD
 - - BD + Muramidase
 - - 9%BSF (15-44 d)
 - - 18%BSF (15-44 d)
 - - 9%BSF + Muramidase (15-44 d)
 - - 18%BSF + Muramidase (15-44 d)
-
- Each group 7 replicate pens of 25 birds (total of 1050 groups)





Experimental dose-response trial – BROILER #1

- Growth performances impaired by the inclusion of insect meal
- No substantial effect on meat quality traits and occurrence of footpad dermatitis
- Large variations of plasma and ceca metabolome
- No huge variation of ceca microbiota at 21 days of age

Observation : it was difficult for the broiler to eat as the feed stuck their beaks.

→ The mashed form of the feed may explain the impairment of the growth performances.

	n	BW (g)	DWG (g/bird/d)*	DFI (g/bird/d)*	FI (kg/bird)*	FCR	Mortality (%)
<i>Main effects</i>							
Insect meal							
0%	14	3,207 A	70.8 A	115.4 A	5.206 A	1.630 B	1.49
9%	12	3,004 B	66.4 B	112.4 A	5.079 A	1.695 B	2.78
18%	12	2,492 C	54.5 C	102.3 B	4.622 B	1.884 A	4.51
Enzyme							
NO (0%)	20	2,877	63.2	109.9	4.963	1.757	2.92
YES (0.1%)	18	2,962	65.4	110.8	5.002	1.702	2.78
<i>Interactions</i>							
CON	7	3,205	70.6	113.6	5.135	1.610 C	2.38
CON+E	7	3,210	71.0	117.1	5.277	1.650 C	0.60
9%IM	6	3,001	66.4	113.8	5.133	1.716 BC	1.39
18%IM	7	2,441	53.2	102.8	4.645	1.939 A	4.76
9%IM+E	6	3,007	66.3	111.0	5.025	1.673 C	4.17
18%IM+E	5	2,564	56.3	101.7	4.591	1.807 B	4.17
SEM		101.6	2.33	3.70	0.15	0.06	0.13
<i>P-value</i>							
Insect meal		<0.001	<0.001	<0.001	<0.001	<0.001	n.s.
Enzyme		n.s.	n.s.	n.s.	n.s.	0.04	n.s.
Insect meal*Enzyme		n.s.	n.s.	0.08	0.09	<0.01	n.s.

Experimental dose-response trial – BROILER #2

Experimental design:

- - BD
- - 9%BSF (15-44 d)
- → PELLET DIETS
- Each group 9 replicate pens of 17 birds



Experimental dose-response trial – BROILER #2



Growth performance results

Trait	Group [†]				P-value	
	BD		BSF			Group
	Mean	SE	Mean	SE		
Entire feeding trial (0-42 d)						
Body weight (g/bird)	3494	28.2	3495	40.2	0.99	
Daily weight gain (g/bird/d) [§]	81.80	0.67	81.80	0.95	0.99	
Daily feed intake (g/bird/d) [§]	117.4	1.10	117.9	0.94	0.72	
Feed intake (kg/bird) [§]	5.068	0.04	5.075	0.04	0.91	
Feed conversion ratio [§]	1.479	0.01	1.484	0.01	0.65	
Mortality [†] (%)	6.53	0.05	7.84	0.04	0.61	

- The inclusion of 9% BSF did not have adverse effects on growth performance
- No adverse effects on welfare and meat quality

In-field validation trials - BROILER

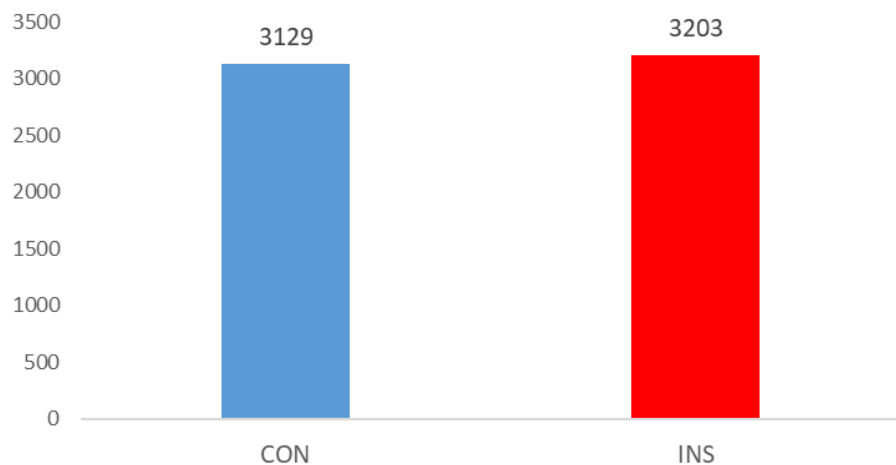
Experimental design:

- - BD
- - 9%BSF (15-44 d)
(pellet diets)
- 3 300 broilers per treatment

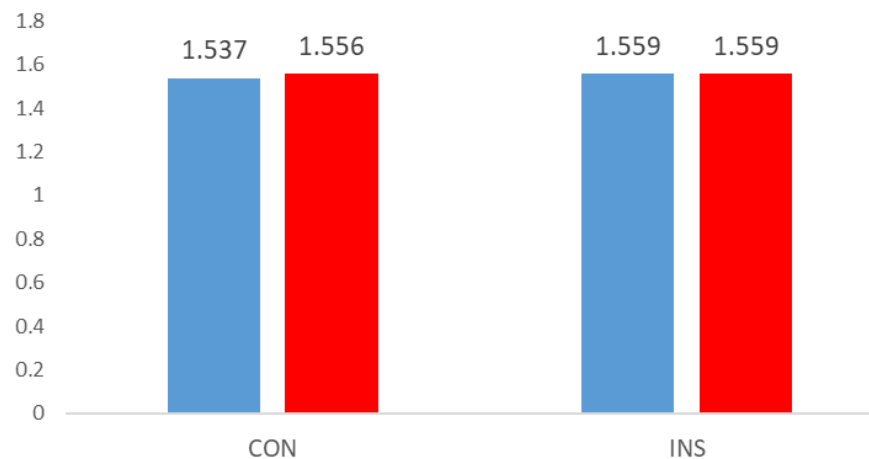


In-field validation trials - BROILER

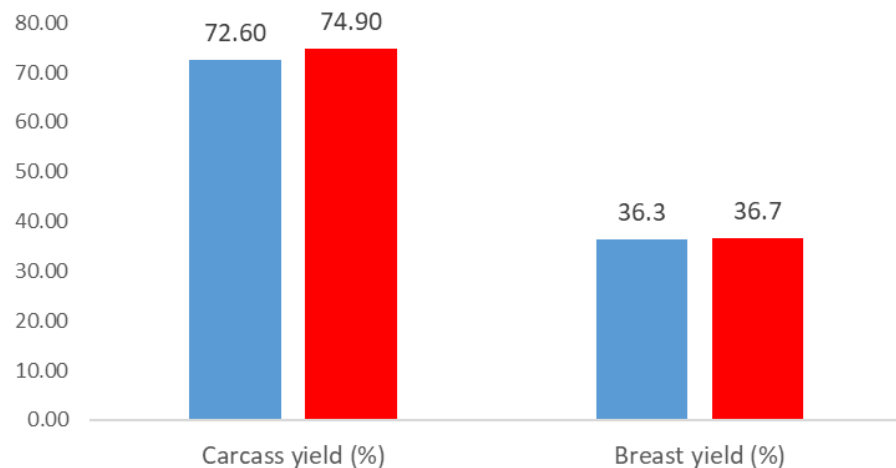
Body weight (g/bird)



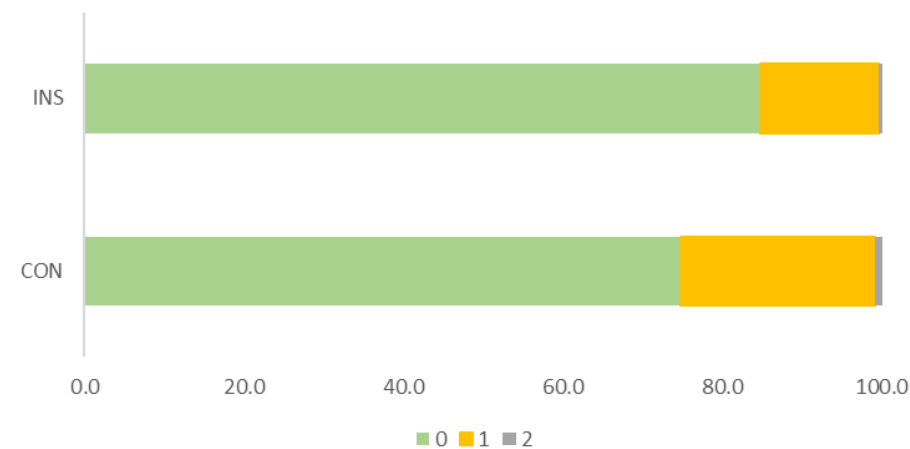
FCR and standardized FCR



Processing yields (%)



FPD occurrence (%)



In-field validation trials - TURKEY



Experimental design:

- - BD
- - 5%BSF (64-105 d)
(pellet diets)
- 756 female turkeys per treatment



In-field validation trials - TURKEY

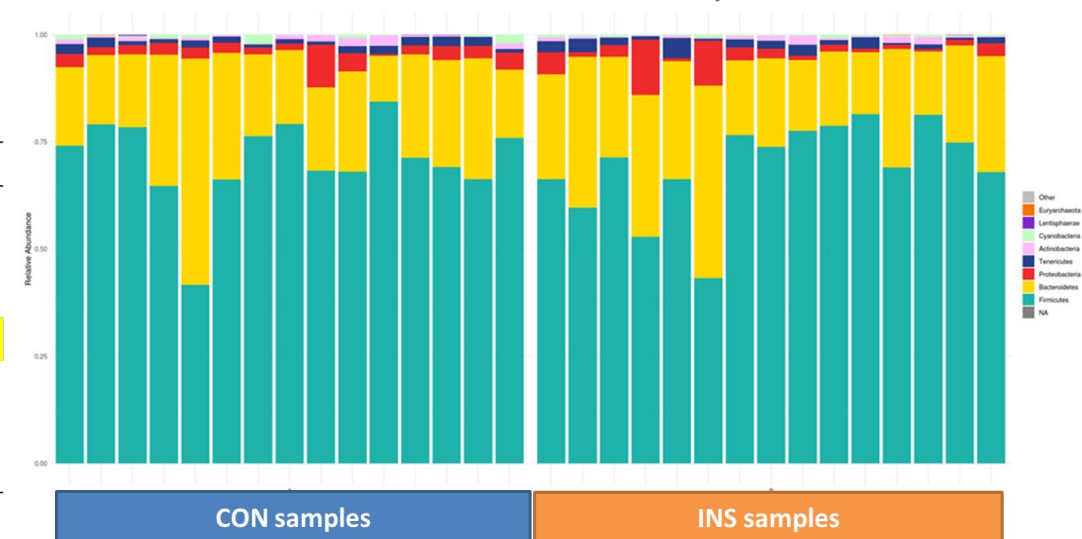
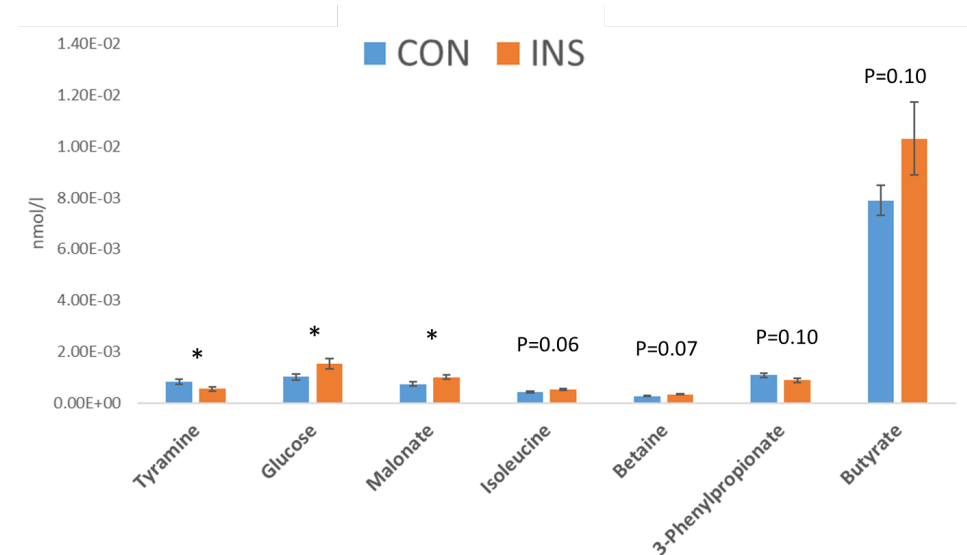
Productive performance (0-105 d)

	CON	INS	SEM	P-value
Body weight (g/bird)	10,057	10,173	103.9	0.04
Daily weight gain (g/bird/d)*	95.2	96.2	0.83	0.03
Daily feed intake (g/bird/d)*	203.9	204.7	1.93	n.s.
Feed intake (kg/bird)*	21.40	21.52	0.23	n.s.
Feed conversion ratio*	2.141	2.127	0.01	0.03
Mortality (%)	0.00	0.79	0.06	n.s.

Meat quality

	CON	INS	SEM	P-value
Ultimate pH (pHu)	5.66	5.66	0.01	n.s.
Lightness - L*	50.57	49.59	0.27	n.s.
Redness - a*	3.89	3.88	0.15	ns
Yellowness - b*	2.83	1.95	0.22	<0.05
Drip loss (%)	0.89	0.85	0.02	n.s.
Cooking loss (%)	17.87	18.96	0.34	n.s.
Shear force (kg)	2.36	2.28	0.08	n.s.

Ceca metabolome and microbiota



Conclusions

- It can be concluded that broilers and turkeys (female) can achieve optimal productive performance when BSF meal is included at 9 and 5% respectively during grower and finisher phases
- Results obtained at experimental level were confirmed by in-field trials
- To go further :
 - some trials on broilers with BSF fat have been done by our partners with promising results.
 - a trial on turkey with BSF meal as nutraceutical (1,5% inclusion) has been done with promising results that could be further investigated

Thank you



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<http://mutatec.com>

**Special thanks to the project and all the
partners for helping us grow**