NutriForum 24

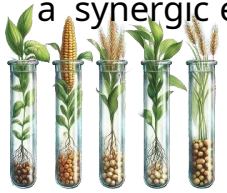
SANIPHYT

Rendimiento Natural

INDTECH

Use of plant extract for bacterial control and their efficiency in breeding

- Natural solution from plants
- Main extraction process
- How plant can manage bacterial breeding issues
- A combination of maceration and essential oil for a synergic effect and a better efficiency

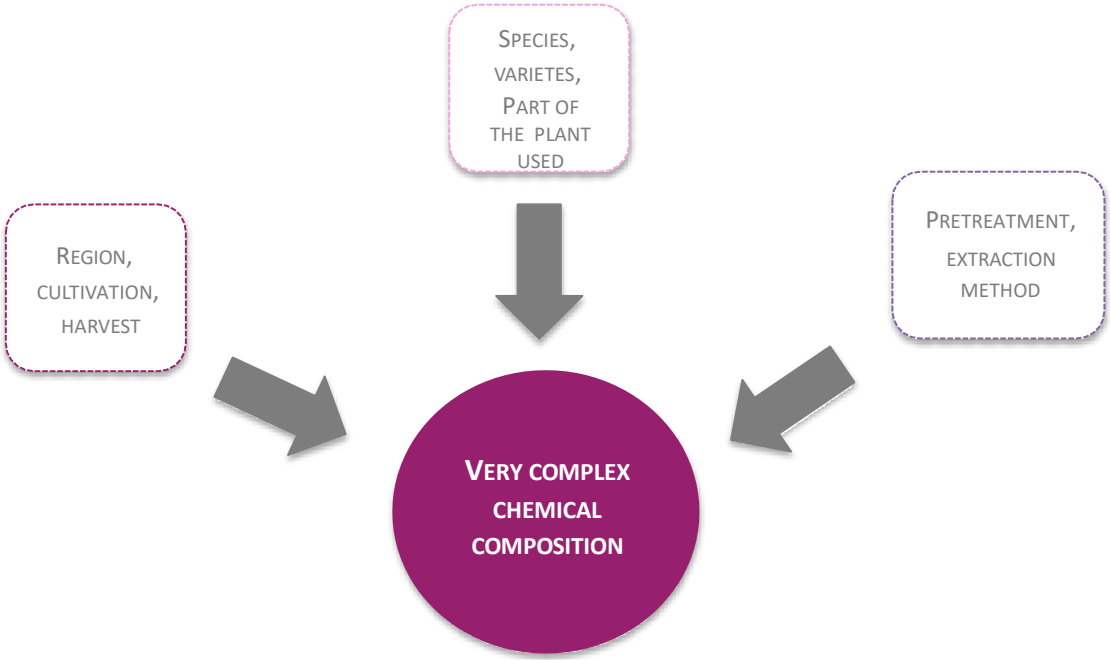


Antibiotic growth promoters, how to replace them ?

Natural solution from plants

Main extraction processes

Richness and diversity of plant extracts



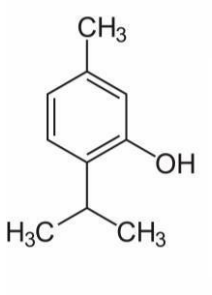
Selectivity of extraction process

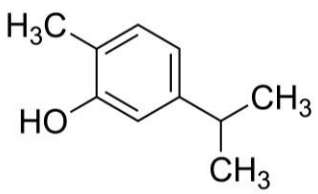
Example of Rosmary

Extraction process	Type of extract	Extract composition	Type of extracted molecules
Hydrodistillation	Essential oil	α-pinene, 1,8-cineole, camphor	Hydrophobic volatile molecules
Hydroalcoholic maceration	Tincture	Rosmarinic acid	Hydrophilic molecules
Supercritical CO_2 extraction	Lipophilic extract	Carnosol	Lipophilic molecules

Hydrodistillation : Getting a concentrated of the plant

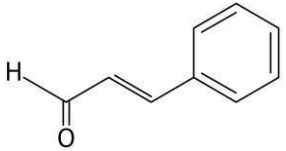
Terpene

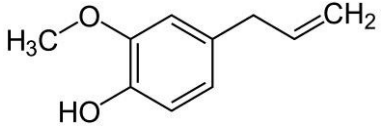




Thymol *Carvacrol*

Phenylpropene





Cinnamaldehyde *Eugenol*

Maceration : extracting the best of the plants

Dried plant

+

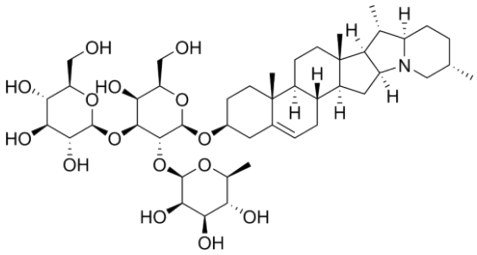
Solvent
(water, ethanol, methanol …)

Maceration

Plant extract

Maceration : extracting the best of the plants

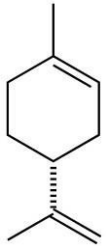
Saponins



Solanin

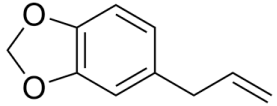
Molecules found in essenital oil

Terpene



Limonene

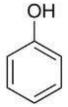
Phenylpropene



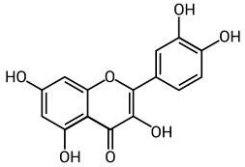
Safrole

Maceration : extracting the best of the plants

Polyphenols

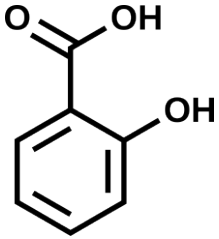


Flavonoids acid



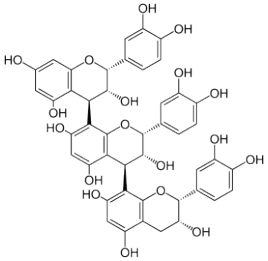
Quercetine

Phenolic



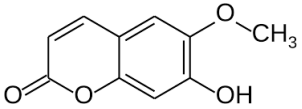
Salicylic acid

Tannins



Procyanidine

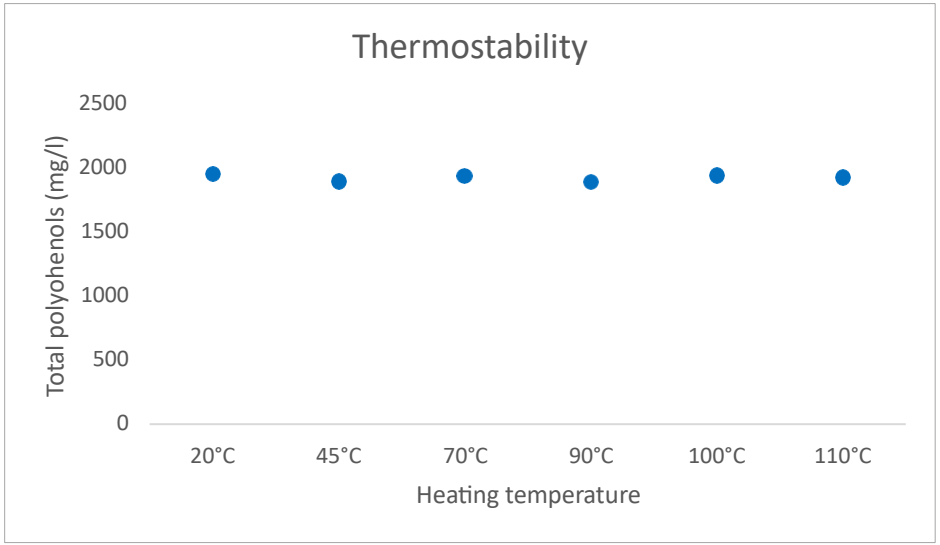
Coumarins



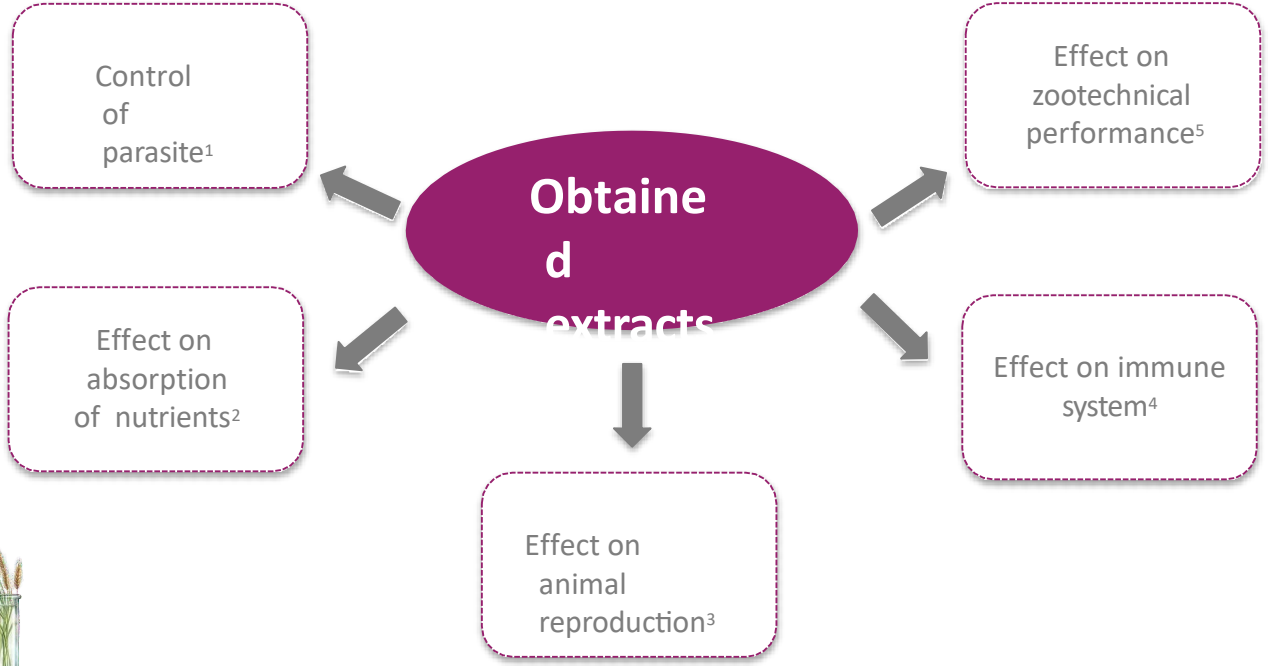
Scopoletine

Plant extract : thermostable bioactive compounds

Liquid plant extract have a very good thermostability at high temperature up to 110 °C



In vivo observed effect of plant extract from litterature



[1]A Jayanegara et al 2022 IOP Conf. Ser.: Earth Environ. Sci. 1041 012064 ; [2]Franz C, Baser K, Windisch W. Essential oils and aromatic plants in animal feeding – a European perspective. A review. Flavour Fragr J. 2010;25(5):327-40 ; [3]Sarswat, Chandra & Purohit, Govind Narayan. (2020). Use of ethno-veterinary medicine for therapy of reproductive disorders in cattle ; [4]Liu Y et al. Dietary plant extracts alleviate diarrhea and alter immune responses of weaned pigs experimentally infected with a pathogenic Escherichia coli. J Anim Sci. 2013 Nov;91(11):5294-306.[5]Grela ER, Krusiński R, Matras J. Efficacy of diets with antibioticand herb mixture additives in feeding of growing-finishing pigs. J Anim Feed Sci. 22 août 1998;7(Suppl. 1):171-5.

How plant can help managing bacterial issues in breeding ?

Pathogenic microbe (Gram)	Minimum inhibition concentration			
	Thymol	Eugenol	Carvacrol	Cinnamaldehyde
Brachyspira hyodysenteriae (-)	1,25 mmol/L	2,5 mmol/L	1,25 mmol/L	0,31 mmol/L
Escherichia Coli 0157:H7 (-)	166 µg/mL	466 µg/mL	283 µg/mL	133 µg/mL
Escherichia Coli k88 (-)	100 µg/mL	300 µg/mL	100 µg/mL	133 µg/mL
Lactobacillus Acidophilus, reuteri, salivarius	1500 µg/mL	1500 µg/mL	-	-

Omonijo FA, Ni L, Gong J, Wang Q, Lahaye L, Yang C. Essential oils as alternatives to antibiotics in swine production. Anim Nutr Zhongguo Xu Mu Shou Yi Xue Hui. juin 2018;4(2):126-36.
Du E, Gan L, Li Z, Wang W, Liu D, Guo Y. In vitro antibacterial activity of thymol and carvacrol and their effects on broiler chickens challenged with Clostridium perfringens. J Anim Sci Biotechnol. 24 déc 2015;6:58.

A combination of maceration and essential oil for a synergic effect and a better efficiency

Trials on monogastric

Cinnamon

Oregano

Thyme

University trial / Europe

Clostridium Perfringens challenge

Experimental setup :

- **Negative Control : No inoculation**
- **Positive Control : Inoculation with clostridium perfringens**
- **Antibiotic lot : Inoculation + treated with Antibiotic 15mg/kg/day for 3 days**
- **Plant extract: Inoculation + 100 grams of Plant extract per ton of feed**

Inoculation program :

Day 14 : Fed with a C. perfringens inoculum (density of 10^7 UFC/mL)

Day 28 : Direct oral administration of C. perfringens at a density of 10^8 - 10^{10} CFU/mL

Monitoring of zootechnical performances, D0 – D35 :

- **Finishing Body Weight**
- **Feed conversion ration (FCR)**
- **Lesions of necrotic enteritis**
- **Microbiological Evaluation D21 and D35**

University trial / Europe

Clostridium Perfringens challenge

Microbiological Evaluation at Day 21

Groups	CFU / mL
Negative Control (a)	10^2
Positive Control (b)	10^7
Antibiotic Group (c)	10^5
Plant extract 100 ppm (c)	10^4

Statistical Significance : $p<0.05$

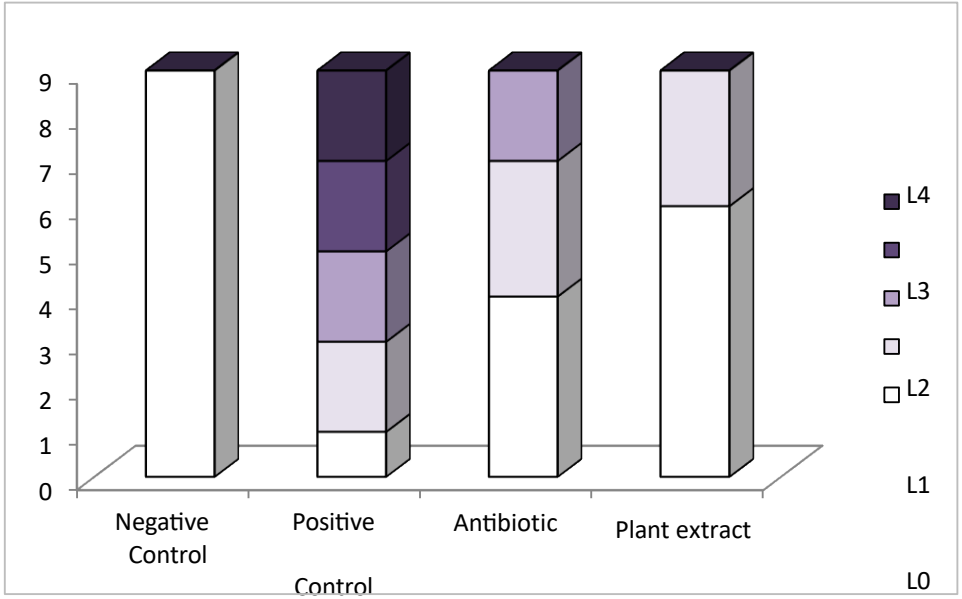
Microbiological Evaluation at Day 35

Groups	CFU / mL
Negative Control (a)	10^3
Positive Control (b)	10^9
Antibiotic Group (c)	10^6
Plant extract 100 ppm (c)	10^5

Statistical Significance : $p<0.05$

University trial / Europe

Clostridium Perfringens challenge

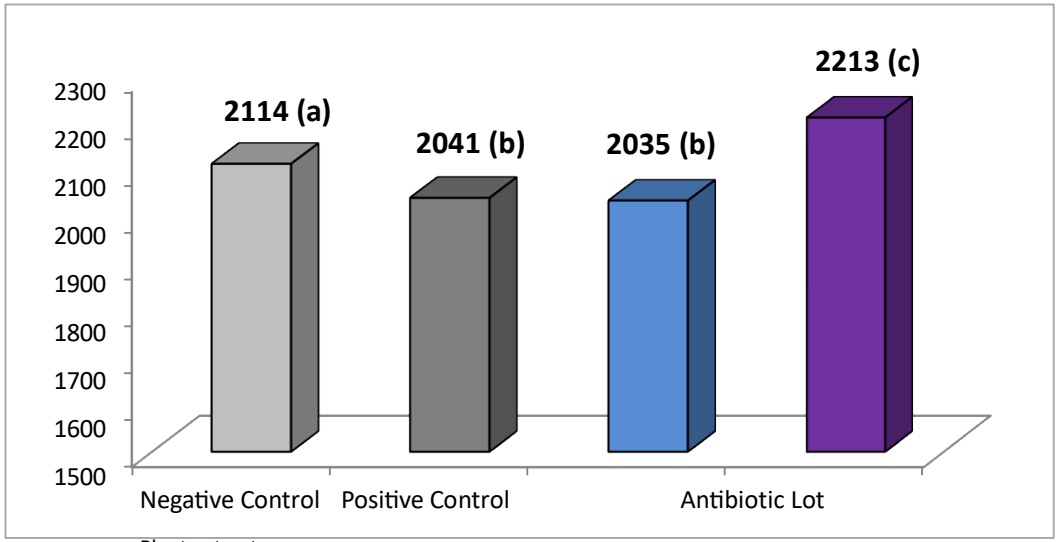


Reduced necrotic enteridis lesions with plant extract

University trial / Europe

Clostridium Perfringens challenge

Finishing Body Weight at Day 35



(a,b,c) Statistical Significance : $p<0.05$

University trial / Europe

Clostridium Perfringens challenge

Obtained results on final body weight with plant extract compared to other group :

4,7 % higher compared negative control group

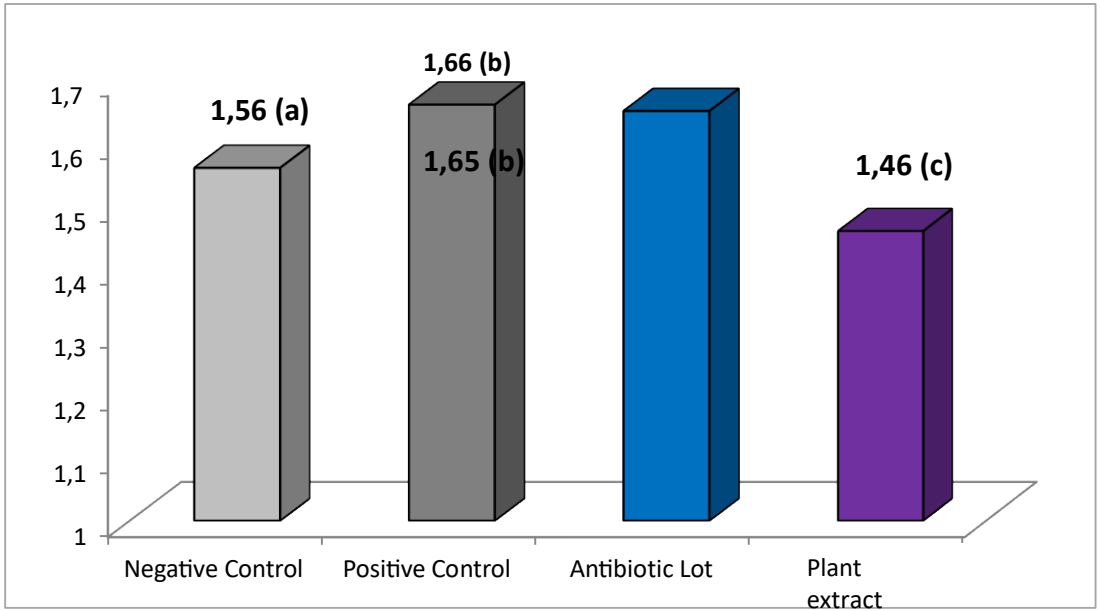
8,4 % higher compared positive control group

8,7 % higher compared to antibiotic

University trial / Europe

Clostridium Perfringens challenge

Feed Conversion Ratio at Day 35



(a,b,c) Statistical Significance : $p<0.05$

University trial / Europe

Clostridium Perfringens challenge

Obtained results on feed conversion ratio with plant extract compared to other group :

- 6,4 % decreased compared negative control group
- 12 % decreased compared positive control group
- 11,5 % decreased compared to antibiotic

University trial / Europe

Salmonella Enteritidis challenge

Experimental setup :

5 treatments - 20 broilers per replicate

Negative Control : No inoculation

Positive Control : Inoculation with *Salmonella Enteritidis*

Antibiotic lot : Inoculation + treated with Antibiotic 50mg/L/day for 3 days

Plant extract 50: Inoculation + 50 grams of Plant extract per ton of feed

Plant extract 100: Inoculation + 100 grams of Plant extract per ton of feed

Inoculation program :

On Day 3 of the experiment, the trial groups were orally challenged with 0.1 mL of a Salmonella enteritidis ATCC 13076 strain at the density of 106 CFU.

Monitoring points D0 –

D35 : ELISA trial

Microbiological Evaluation D10

Finishing Body Weight

Feed conversion ratio (FCR)

University trial / Europe

Salmonella Enteritidis challenge

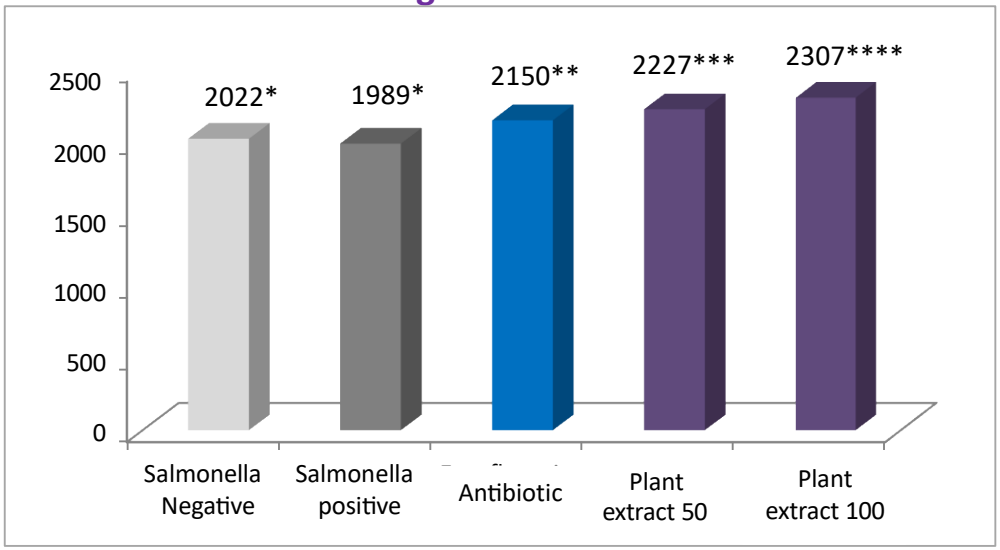
Microbiological evaluation (Day 10 - One week after the challenge)

	Salmonella negative	Salmonella positive	Antibiotic	Plant extract 50	Plant extract 100
CFU/mL	-	10^6	10^2	10^4	10^3

University trial / Europe

Salmonella Enteritidis challenge

Final Body Weight



University trial / Europe

Salmonella Enteritidis challenge

Obtained results on final body weightwith plant extract compared to other group :

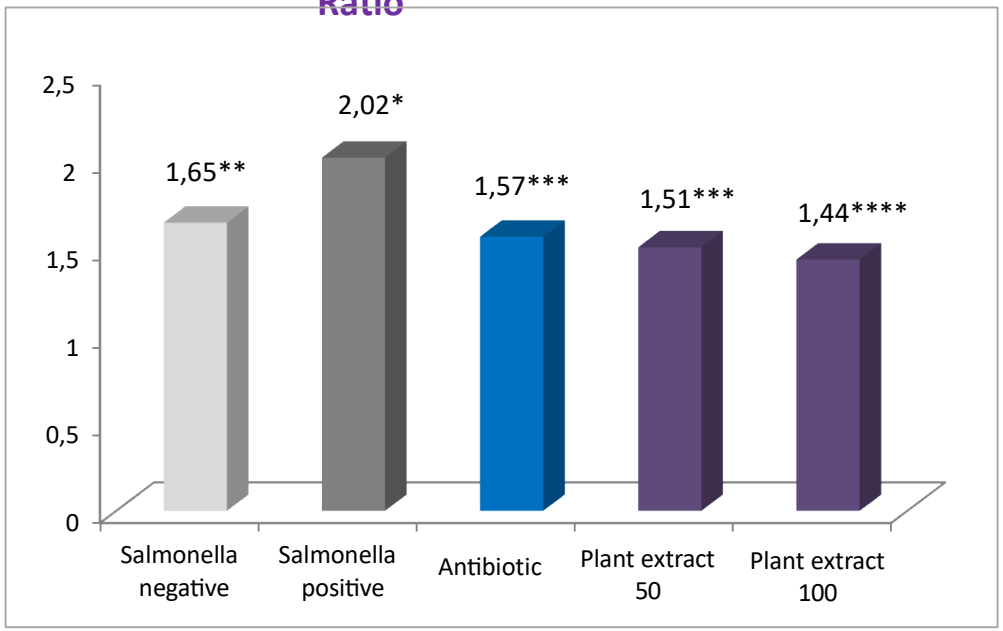
10,1 % - 14,1 % higher compared negative control group

12 % - 16 % higher compared positive control group

3,6 % - 7,3 % higher compared to antibiotic

University trial / Europe

Salmonella Enteritidis challenge



University trial / Europe

Salmonella Enteritidis challenge

Obtained results on feed conversion ratio with plant extract compared to other group :

8,5 % - 12,7 % decreased compared negative control group

25,2 % - 28,7 % decreased compared positive control group

3,8 % - 8,3 % decreased compared to antibiotic

University trial / Europe

Salmonella Enteritidis challenge

Plant extract Vs Antibiotic

- Reduce *S. Enteritidis* intestinal population with plant extract
- Better zootechnical performances with plant extract

Commercial trial /
Europe

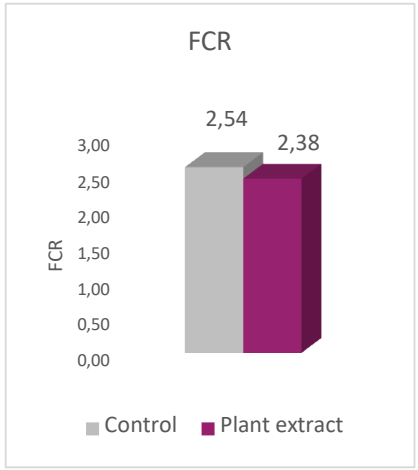
Pigs during fattening period

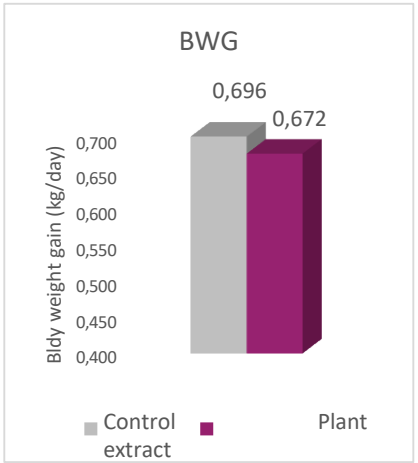
Trial was conducted on pigs during the fattening period :
Pig weight at the beginning of the trial : cca 20 KG
Pig weight at the end of the trial : cca 120 KG

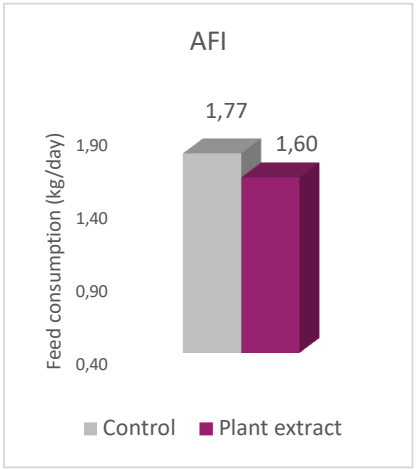
Control Group with 807 pigs : non-supplemented during the period
Plant extract Group with 702 pigs : supplemented with Plant extract at 100 grams/ton of feed
Zootechnical performances (BWG, FCR and Mortality) were monitored during the trial

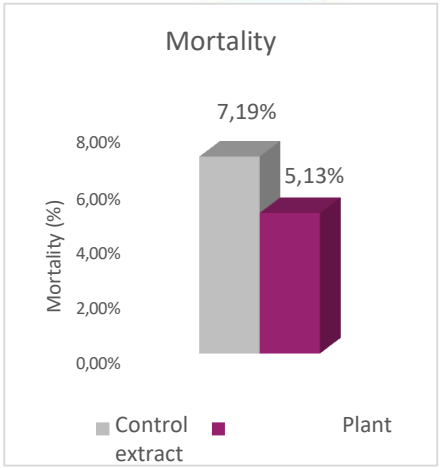
Commercial trial / Europe

Pigs during fattening period









Commercial trial / Europe

Pigs during fattening period

Obtained results with plant extract compared to control group :

Lower FCR by **6,3%**

Mortality decreased by **2,06 points**

Commercial trial / Europe

Pigs during fattening period

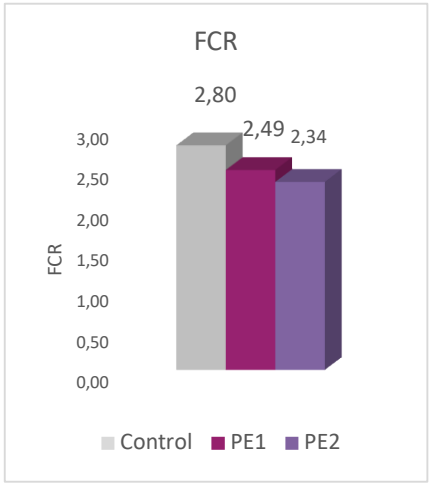
Trial was conducted on pigs during the fattening period :
Pig weight at the beginning of the trial : cca 20 KG
Pig weight at the end of the trial : cca 120 KG

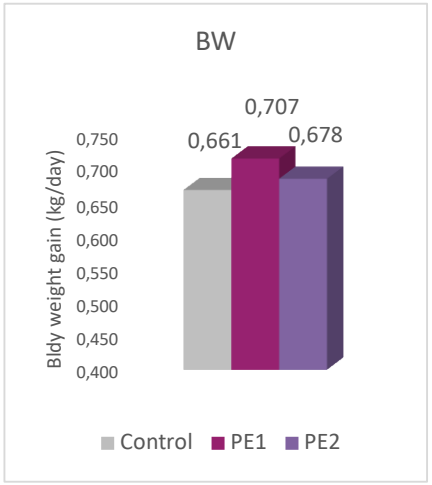
Control Group with 434 pigs : non-supplemented during the period
Plant extract1 Group with 432 pigs : supplemented with Plant extract at 100 grams/ton of feed
Plant extract2 Group with 360 pigs : supplemented with Plant extract at 100 grams/ton of feed

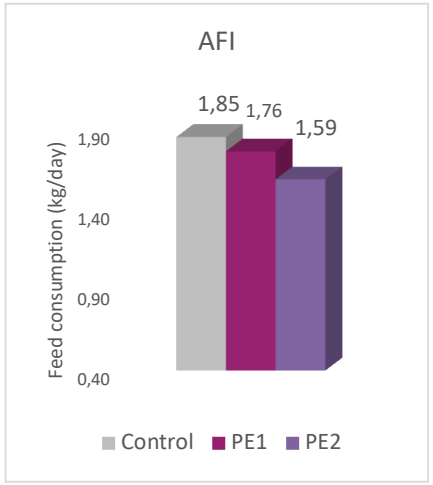
Zootechnical performances (BWG, FCR and Mortality) were monitored during the trial

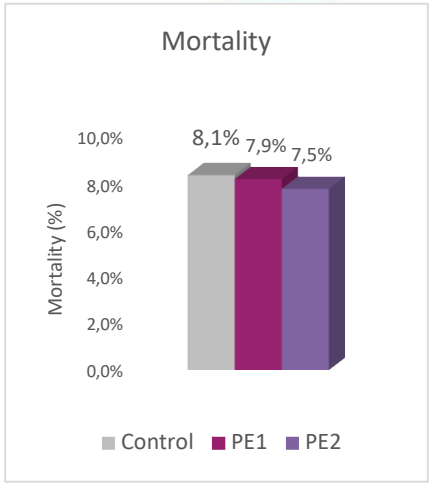
Commercial trial / Europe

Pigs during fattening period









Commercial trial / Europe

Pigs during fattening period

Obtained results with plant extract compared to control group :

11,1% - 16,4%
Lower FCR

2,3% - 7,0 %
Higher BWG

Commercial trial / Europe

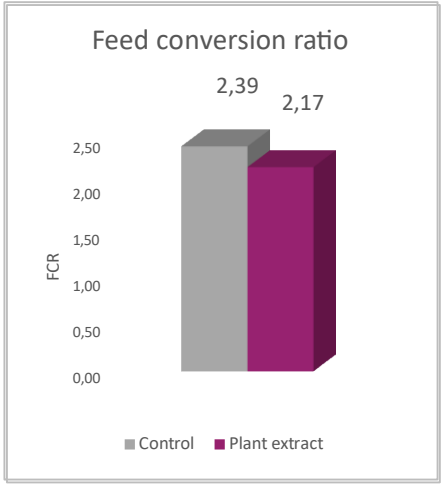
Pigs during fattening period

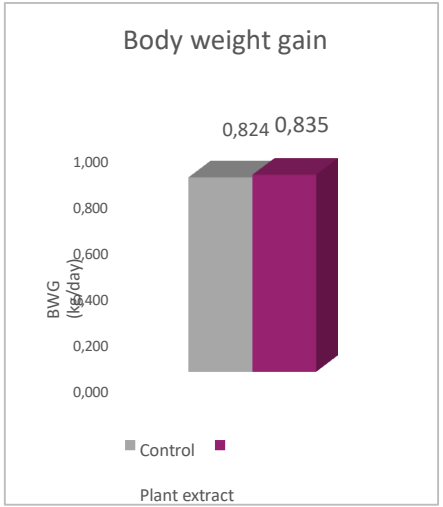
Trial was conducted on pigs during the fattening period :
Pig weight at the beginning of the trial : cca 20 KG
Pig weight at the end of the trial : cca 120 KG

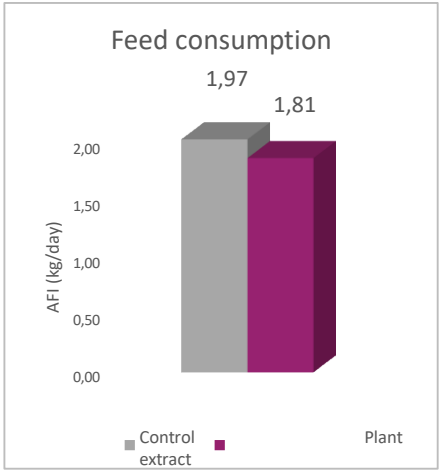
Control Group with 500 pigs : non-supplemented during the period
Plant extract Group with 500 pigs : supplemented with Plant extract at 100 grams/ton of feed
Zootechnical performances (BWG, FCR and Mortality) were monitored during the trial

Commercial trial / Europe

Pigs during fattening period







Commercial trial / Europe

Pigs during fattening period

Obtained results with plant extract compared to control group :

9,2 %
Lower FCR

1,3 %
Higher BWG

Commercial trial /
Europe

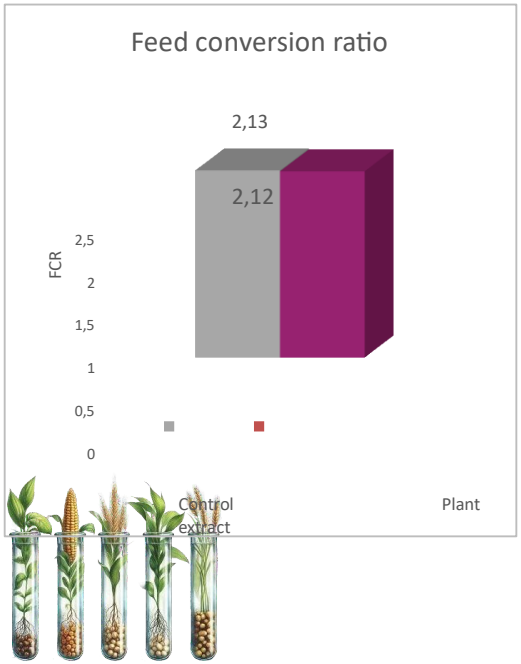
Pigs during fattening period

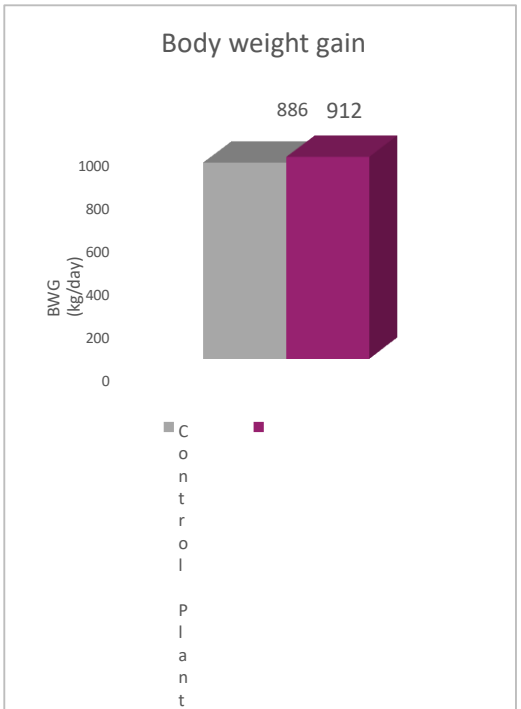
Trial was conducted on pigs during the fattening period :
Pig weight at the beginning of the trial : cca 20 KG
Pig weight at the end of the trial : cca 120 KG

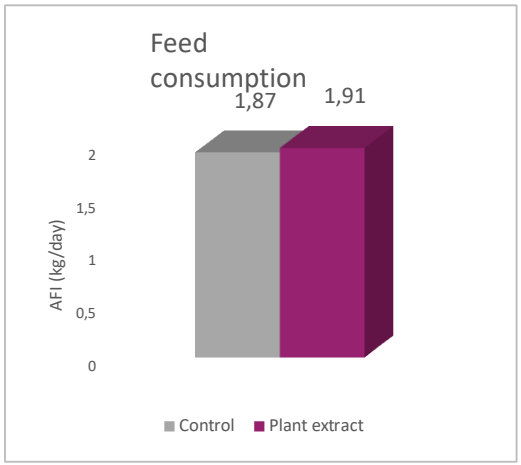
Control Group with 140 pigs : non-supplemented during the period
Plant extract Group with 140 pigs : supplemented with Plant extract at 100 grams/ton of feed
Zootechnical performances (BWG, FCR and Mortality) were monitored during the trial

Commercial trial / Europe

Pigs during fattening period







Commercial trial / Europe

Pigs during fattening period

Obtained results with plant extract compared to control group :

2,9 %
Higher BWG

8,4 %
Lower treatement

Commercial trial / Europe

Pigs during fattening period

Benefits of the plant extract supplementation :

- Increase Body weight gain
- Decrease of mortality
- Reduction of FCR from 6% to 16% depending on the group

Take home message

- ✓ Plant extract contains a wide range of phytobiotics that have numerous properties
- ✓ Plant extract have equal to better results than antibiotics
- ✓ Plant extract as an environmental and public healt-friendly alternative to AGP and zinc oxide

NutriForum 24

SANIPHYT

Rendimiento Natural

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