Newcastle disease SCIENTIFIC & TECHNICO-ECONOMICAL BOOKLET





Together, beyond animal health

NEWCASTLE DISEASE: 100 years of threat in the poultry industry around the world.

2023 **EDITION**

FOREWORD

but some limitations have been encountered. Recent advances in control of this disease.

lifelong immunity with minimal additional field interventions that have been achieved.

in the market. That clearly proves that this concept is the best

We are proud that Vectormune[®] ND is the reference vaccine as the

there is now a very relevant data regarding the reproduction ratio That means, we can TAKE CONTROL OF TRANSMISSION.

understand ND control.

Click or Scan for more about



Click or Scan for more about ND disease in poultry





Booklet at a glance:

- From 5 continents and 27 countries
- More than 10 years of collection for
- Newcastle disease and its impacts
- Epidemiology
- Ideal approach for ND protection
- Field experiences and more...

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Newcastle disease: an old enemy

Newcastle disease (ND) is a highly contagious disease that varies widely in the type and severity of symptoms. It is one of the main barriers to international trade of poultry and poultry products and the economic impact of this disease is enormous.

In high challenge countries, when industrial chickens are experiencing a ND outbreak, they would display high mortality (up to 100%), high morbidity, listlessness, dyspnea, diarrhea, sometimes nervous signs (eq, torticollis, ataxia). At necropsy, internal organs are usually heavily haemorrhagic, especially the proventriculus, the cecal tonsils, the duodenum, the trachea, the brain.

In low challenge countries, industrial chickens are often facing the uncontrolled circulation of lentogenic (vaccine) strains, especially in high densely populated poultry areas. As a result, they may show subtle to overt respiratory signs, because of the inflammation of the trachea. It may worsen in case of suboptimal husbandry conditions and poor chick quality (too high stocking density, high ammonia level, wet litter, poor ventilation). As a result, flock uniformity will decrease, and secondary opportunistic respiratory infections (eq. E.coli) may arise with the need to apply antibiotic medication. Ultimately, slaughterhouse condemnations may increase due to excessive airsacculitis.



Almost 100 years old

Since it was first officially reported in 1926, Newcastle disease (ND) has established as a major disease threat for commercial poultry including chickens, turkeys, guails, pheasants, as well as for hobby and zoo birds.

The disease was discovered in Indonesia in 1926, but is named after Newcastle-onTyne, England, where it occurred in 1927. It is also called ranikhet, pseudo-fowl pest, and avian pneumo-encephalitis.

Newcastle disease is caused by a virus used to belong to the family of Paramyxoviridae; it is an avianan avianxovirus of serotype 1 (APMV-1). Now classification has been updated into: avian orthoavulavirus serotype 1.

It affects wild birds and domestic poultry and usually presents as a respiratory disease. Depression, nervous manifestations, or diarrhea may also be the predominant clinical symptoms and mortality. It is an officially regulated disease and, in its velogenic form, must be officially reported to the WOAH. (WOAH Terrestrial Animal Health Code). It also has a zoonotic dimension since initial exposure to infectious material can induce transient and benign conjunctivitis in humans in case of close contact.

1926	30's	40's	70′s
First description of the disease	First studies on attenuation of virulent NDV	Mesogenic strains, HB1 and LaSota strains	Therm stable strains

Today the situation is that despite being known for almost 100 years, ND still poses huge threats to poultry producers, in enzootic areas as well as in regions or countries considered as free. The result is that better solutions are required regarding both implementations of biosecurity procedures and the availability of more efficacious vaccine solutions if the poultry industry wants to have real control of this disease.

In 100 years, there has been a lot of research and development for vaccines. In order to have the best solution both for efficacy and safety, vector vaccines have been developed and well accepted by the producers. Since the late 2000s, recombinant HVT vector ND (rHVT-F) vaccines are playing a very important role, whatever the situation is.



Vectormune

NEWCASTLE DISEASE Click or Scan



ANIMAL HEALTH CODE Click or Scan



There are different genotypes but there is **only 1 serotype:**



Newcastle disease symptoms

Newcastle disease symptoms can be respiratory, nervous, intestinal symptoms for both clinical and subclinical infections.

ND can be classified into five different categories:

- Viscerotropic velogenic, a highly pathogenic form in which hemorrhagic intestinal lesions are frequently seen.
- Neurotropic velogenic,
- a form that presents with high mortality, usually following respiratory and nervous signs.
- Mesogenic,

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- a form that presents with respiratory signs, occasional nervous signs, but low mortality.
- Lentogenic or respiratory, a form that presents with a mild or subclinical respiratory infection.
- Asymptomatic,
- a form that usually consists of subclinical enteric infection.



SYMPTOMS - HOW TO SPOT & REPORT ND? Click or Scan









Velogenic ND pictures.



Newcastle disease (ND) is one of the most economically and clinically important poultry diseases. According to the World Bank, it is ranked as the 3rd most costly poultry disease, after avian influenza (high and low pathogenic) and after infectious bronchitis.



Despite many years of enforcement of international and national trading regulations, introduction of the biosecurity concept, harmonization and spreading of laboratory diagnostic and monitoring techniques, implementation of vaccination programs, ND is still listed among the most damaging poultry diseases considering both clinical and economical consequences.

Some regions or countries like Western Europe, the USA, As a consequence, NDV antibody testing conducted on Brazil, etc. have successfully reduced and even phased samples taken from broilers at the end of the growing out the incidence of the disease, so that ND is nowadays period or during the production phase in layers, has revealed considered only an epizootic risk. The vaccination the frequent presence of low antibody positive, or even programs, if applied, are always of the "light" type (hereafter fully antibody negative flocks in spite of (sometimes) very called "low challenge areas"). intensive vaccination programs including one or more inactivated and several live attenuated ND vaccines.

On the contrary, many countries from Latin America, Eastern Europe, Africa, the Middle East and Asia are still cohabiting with the enzootic form of the disease with continuous waves of unavoidable pressure regularly plaguing them. In these countries, vaccination is considered as a routine obligation guided by modest ambitions that are simply restricted to ensuring clinical and economical protection in case of challenge (hereafter called "high challenge areas").

Wild birds populations of backyard poultry, small scale farming operations and traditional live bird markets ensure the spreading of the ND virus and are important factors explaining from where the disease comes from and how it circulates throughout the world.

(1) World Livestock Disease Atlas - A Quantitative Analysis of Global Animal Health Data (2006-2009) The World Bank November 2011 | SU-Livestock Unit



But ND is also seen, even today, in poultry producing operations that are much better organized, following stringent biosecurity rules and often applying an intensive vaccination program. In fact, this has been a frustrating paradox that has really drawn the attention of veterinarians and production managers until the concept of flock monitoring and flock profiling have become popular.

There are many aspects for the importance of poultry industry in our life in terms of:

- NUTRITION as a good, affordable and healthy protein resource,
- SOCIO-ECONOMIC as employment and empowering the work force,
- ENVIRONMENT as minimizing the carbon footprint.

We can indeed add more to this list.

Therefore, ND control is very strategic in order:

- to secure the food safety and sustainability,
- for poverty alleviation,
- women empowering,
- to maximize the performances while minimizing the carbon footprint.

2 Newcastle disease global surveys

Malawi - South Africa - Poland - Turkiye Brazil - Colombia - Mexico - Germany - Spain

Conducting ND surveys is key to understand the presence and the extent of the disease challenge in poultry production.

In Ceva, we have been conducting epidemiological ND surveys in order to recognize and monitor the potential impact of the disease in the field. We believe that the field monitoring is the real tool to be aware and prepared for the best control program. We know that the disease pressure varies in the regions, countries and the continents.

Therefore we have 2 main pillars: PMV-1 (Lentogenic) Rolling infections and Velogenic Outbreaks.





ND survey results:

Ceva Santé Animale Veterinary Services Specialists, in cooperation with independant researchers, conducted a ND survey during 2019-2021 in order to update the epidemiology of the ND virus around the world.

In the next pages, you will access result of several studies from this survey, demonstrating the presence of Newcastle disease virus in Africa, Asia, Europe and Latin America despite vaccination.







BROILER PRODUCTION 4 FLOCKS, RESPIRATORY SIGNS

2 LIVE ND VACCINES

MATERIAL & METHODS

SAMPLES	AGE OF SAMPLING	TECHNIQUE
47 Serum samples	> 30 Days of Age (Serum)	ELISA conventional kit (BioChek)

RESULTS



CONCLUSION Waves of ND field infection can be observed.

South Africa ≽

MATERIAL & METHODS



Source: Ceva internal



COMMERCIAL BROILER PRODUCTION

Vectormune

2 LIVE ND VACCINES AT DAY 1 AND DAY 10 (COARSE SPRAY)





2 GROUPS OF BROILER FLOCKS

LIVE ND VACCINE (COARSE SPRAY)

187

44

17,412

22,529



MATERIAL & METHODS

SAMPLES	AGE OF SAMPLING	TECHNIQUE
46 Serum samples	39 Days of Age	ELISA conventional kit (Idexx)

3,741

5,377

Farm A =23 samples



959

812

2,084

2,864

Farm B = 23 samples

179.5

187.7



High seroconversion group shows the field infections on live ND vaccinated flocks.

CONCLUSION

One application of live vaccines in the field was unable to control the field infection.

MATERIAL & METHODS

SAMPLES AGE OF SAMPLING TECH	INIQUE
678 samples (23 for ND suspicion) > 27 Days of Age RT	-PCR



CONCLUSION

Live and inactivated vaccines do not provide consistent protection against NDV.



COMMERCIAL BROILER PRODUCTION 86 FLOCKS: 12 FLOCKS WITH ND SUSPICION, 1 FLOCK WITH NDV GENOTYPE VIIi

HATCHERY VACCINATION: LIVE ND VACCINE (VARIOUS) + INACTIVATED ND VACCINE AT 1 DAY OF AGE

FIELD VACCINATION: 2 LIVE ND VACCINES (LASOTA) AT 12-16 DAYS OF AGE



Latin America



COMMERCIAL BROILER PRODUCTION

GROUP 1 (35 FLOCKS) LIVE ND VACCINE AT HATCHERY

GROUP 2 (74 FLOCKS) LIVE ND VACCINE IN THE FARM



MATERIAL & METHODS



CONCLUSION Fluctuating titers of NDV and rolling infection from neighboring farms, due to field infection or farm vaccination, can be observed.

MATERIAL
& METHODS

	SAMPLES	TECHNIQUE
GROUP 1	335 samples	RT-PCR
GROUP 2	645 samples	RT-PCR

RESULTS



CONCLUSION

Vaccine take of the live vaccines in the field vaccination is **always** challenging.



COMMERCIAL LAYER PRODUCTION 2 COMPANIES, 7 FARMS

3 LIVE ND VACCINES

ING	TECHNIQUE
ge	ELISA conventional kit (Idexx)

Variable seroconversion between flocks



RESULTS

10,000

8,000 _

6,000

4,000

2,000

0

3,197

←12/08/2016

2.122

←01/06/2017

30/05/2017 → 01/11/2017 →

-01/11/2017

01/11/2018-

Latin America



1 FARM

HISTORICAL COMPARISON

VACCINATION PROGRAM BEFORE 2017: COMPETITOR rHVT-F ND

VACCINATION PROGRAM AFTER 2017: VECTORMUNE® ND (SAME VACCINATION PROGRAM)



MATERIAL & METHODS

SAMPLES	AGE OF SAMPLING	TECHNIQUE
71 Serum samples	> 28 Days of Age	HI test

RESULTS

Individual HI titers



CONCLUSION Vectormune[®] ND controls field virus circulation better than rHVT-F ND competitor.

<−−01/12/2018

GMT Newcastle Idexx

2016 to 2021

CONCLUSION Live and inactivated vaccines are not good enough to provide uniform and consistent immunity.





4 FARMS OF BROILERS WITH ND SUSPICION

1 LIVE ND VACCINE (COARSE SPRAY) + 1 INACTIVATED ND VACCINE

NO ND PREVIOUS SEROLOGY







11 BROILERS FARMS

1 LIVE ND VACCINE (COARSE SPRAY) AT 2 WEEKS OF AGE



MATERIAL & METHODS

AGE OF SAMPLING	TECHNIQUE
> 30 Days of Age	ELISA conventional kit (Idexx)

RESULTS



CONCLUSION

Live vaccines application causes rolling infection of the virus. One live vaccine in the field does not provide uniform and consistent immunity.

MATERIAL & METHODS

SAMPLES	AGE OF SAMPLING	TECHNIQUE
347 Serum samples	> 30 Days of Age	ELISA conventional kit (BioChek)

RESULTS

AMT ND BioChek at slaughter age

	10,000					
	9,000					
	9,000					
	8,000					
	7,000					
	.,					
	6,000					
	5,000					
-						
	4,000					
	3,000					
	2,000					
	1,000	Cut-off				
	0					
		2	22	47	87	152

CONCLUSION

Despite of no ND vaccination, there is still significant circulation of live ND virus



347 BROILERS FLOCKS

NO ND VACCINATION

71% NEGATIVE SEROLOGY, 29% POSITIVE SEROLOGY

SLAUGHTER AGE AT 39-43 DAYS OF LIFE



due to the live ND vaccinated neighboring flocks which cause rolling infections.

An ideal vaccination program

Further investigations have highlighted the facts that:

In endemic countries, day old chicks are carrying high levels of maternally derived antibodies that are interfering with live as well as inactivated ND vaccines applied at the hatchery, up to a point where neutralization is complete and prevents any vaccine take.

Vaccinating in the farm has many drawbacks and remains unreliable: lack of education of the workers, too much time required to apply the vaccine, drinking water quality and residues of sanitizer in the water makes farm vaccination a very unreliable process.

Live attenuated vaccines that are the backbone of a broiler ND vaccination program are responsible for lesions of the upper respiratory tract, post vaccination and rolling reactions that slow down the growth and leave the chickens susceptible to other pathogens.

These limitations explain why it is really common to discover unprotected flocks in endemic countries and why severe clinical outbreaks are often reported, despite "good vaccination" practices.

So far, the general opinion in the poultry industry was that ND would stay for long in most ND endemic countries and that is why vaccination was, at best, considered as an aid to maintain poultry production, but definitely far from being an effective tool of an eradication program.

On the other hand, in low challenge countries, the uncontrolled circulation of lentogenic (vaccine) strain was regarded as an issue, since it was frequently responsible for bacterial opportunistic secondary infections leading to extra antibiotic use and to higher condemnation rates due to airsacculitis.

This was the situation when Ceva launched Vectormune® ND in 2013.

Classification NDV

There are different genotypes and different geographical presence of NDV virus, however there is only one serotype.



1 SEROTYPE

Thus, the critical point is the concept and the technology of the vaccine choice.

Vectormune® ND has proven results against each genotype in different challenge conditions.





EWCASTLE DISEAS Click or Scan



PATHOTYPES

- 1. Viscerotropic velogenic
- 2. Neurotropic velogenic
- 3. Mesogenic
- 4. Lentogenic respiratory
- 5. Asymptomatic
- (https://oie.int)

CLASS I & II

(Czeglédi et al., 2006)

This is the main classification for the vaccine efficacy : as there is only one serotype, the genotype of the vaccine is not relevant.

An ideal vaccination program should provide:



Why a vector vaccine?



Vectormune[®] ND, as best-in-class rHVT-F ND vaccine, overcomes all these challenges.

Ceva





WHY VECTOR (rHVT-ND) VACCINE FOR ND DISEASE ? Click or Scan

4 Vectormune® ND: a reference rHVT-ND vector vaccine

There was certainly hope but there were also many questions, uncertainties and doubts, and because of that, a very significant extra investment was made to know and understand the potentialities of this new product. Scientific work inside as well as outside the company, in collaboration with independent research centers, was designed, organized and conducted. The information obtained regarding the vaccine induced immunity and tangible protection results far exceeded our expectations.

We now know that Vectormune[®] ND is much more than just a ND vaccine, and the objective of this booklet is to present some field studies that helped us to realize how cost-effective this product is, regardless the challenge conditions.

Vectormune® ND is a recombinant HVT vector vaccine, in which genome the "F" gene of a genotype 1 NDV has been inserted. The HVT strain used (FC 126), its origin, the low number of passages applied, the "F" insert, the insertion site, the promoter selected to ensure the expression of the F gene, the terminal sequence, etc... are all key elements explaining the uniqueness and outstanding features of this vaccine. Most of these features have been patented and belong to Ceva Animal Health. Vectormune® ND is actually unique and cannot be confused with other rHVT-ND vaccines.



The "F" (for "fusion") protein is the epitope present on the surface of NDV, allowing it to attach and penetrate target cells. It is, at the same time, **a key factor of virulence of the virus, as well as a key protective antigen**. One can easily understand that if immunity is built up against "F", then NDV would have much more difficulties to infect cells and create damage, which is probably explaining the incredibly high efficacy of Vectormune[®] ND. Vaccinated chickens are not only protected against clinical and economical consequences of infection: the replication of NDV inside the chicken's body is also hampered as indicated by a reduction of the shedding of the challenge virus as well as a more limited increase in antibody titers following infection.

The HVT strain used to carry and express the "F" gene is known for decades as a very safe and very stable virus, used worldwide to vaccinate chickens against Marek's disease. The particular strain and passage level used for the construction of Vectormune® ND replicates actively in the chicken and this may explain why protection against ND appears so quickly.

Onset of immunity

An antibody response to Vectormune[®] ND (of the type IgG, IgM and IgA) can be detected in SPF chickens as soon as 9-12 days post vaccination (Rauw *et al.*, 2012).

The immune response to Vectormune[®] ND is not only composed of circulating antibodies but also of a local immune response. It is not only humoral but also cellular (Rauw et al., 2010).

Antibody response to Vectormune® ND can be detected using the Haemagglutination Inhibition (HI) test, or ND "F" ELISA tests. Following vaccination at day one, in the presence of passive immunity, antibody response can be clearly differentiated from the controls at around 21-28 days of age. On the reverse, this detection is not possible with commercial ND ELISA kits (E.g.: Idexx, Biochek). If no live vaccine is used, this can be a simple serological method to differentiate vaccinated only from vaccinated and infected or simply infected animals (commonly known as "DIVA procedure").

Duration of immunity

Duration of immunity is probably the most impressive feature of this vaccine.

Following a single injection of Vectormune® ND at day of hatch, layers are totally protected against clinical signs, mortality and drop in egg production until, at least, 72 weeks of age (Palya *et al.*, 2012c). This cannot be compared to any existing ND vaccination conventional program where a minimum of 2 to 4 inactivated and 5 to 8 live vaccinations would be necessary to achieve acceptable (but not comparable) level of protection.



Spectrum of protection

Vectormune[®] ND is provided with a broad spectrum of efficacy.

Perfect protection has been demonstrated against challenges conducted with high doses of various NDV strains, belonging to diverse genotypes, including genotype II (Texas GB strain, B1B1 strain), genotype IV (Herts 33 strain), genotype V (Mexican Chimalhuacan strain), and genotype VII (several isolates).

Vaccination strategy

Since protection with Vectormune[®] ND requires replication of the HVT vector and this generally takes some days, the first 3 weeks of life are not covered by Vectormune[®] ND. For this reason, in ND endemic countries, the vaccination strategy with Vectormune® ND requires ensuring early protection by application of a live attenuated ND vaccine by spray on the first day of age in the hatchery. In order to avoid damages to the trachea, which are detrimental to both growth and the integrity of the respiratory tract, it is strongly recommended to use a vaccine based on an apathogenic enterotropic NDV strain, like the Phy.LMV.42 NDV strain present in Cevac[®] Vitapest L (ND only) or Cevac[®] Vitabron L (combination of ND + IB).

AGE	ROUTE	LOW NDV RISK COUNTRY	MEDIUM NDV RISK COUNTRY	HIGH NDV RISK COUNTRY
Day 1 or 18-19 days	SC or in ovo	Vectormune"	Vectormune"	Vectormune*
of incubation	Coarse spray			
Week 2	Coarse spray			

In countries where ND is only an epizootic risk, it is advisable to remove any live ND vaccine from the program. The combination of a reliable ND passive immunity together with Vectormune® ND induced active immunity will ensure a very significant level of protection. By removing the use of any live ND vaccine in chicken flocks, this innovative approach helps to improve the overall respiratory health, which could in turn result in less antibiotic medication and lower rates of airsacculitis at the processing plant.

Following several years of investigation with Vectormune® ND, we believe that this vaccine is more a revolution than a simple evolution.

Vectormune[®] ND has been changing the approach of Newcastle disease prevention in the field and is being considered as a strong tool towards the long term control of this important poultry disease.



Vectormune[®] ND is compatible with Egginject[®], a reference In Ovo injector

Field Study: Successful immunization following 18.5 ED In Ovo application of rHVT-F vaccine using Egginject[®] In Ovo injector Cazaban C. et al. (2018)

Material and Methods

A field investigation was carried out in a leading European poultry supplier located in Hungary.

The trial was done in two commercial farms of 10 houses each. Each house contains about 26,000 broilers (Ross 308). More than one million broilers were included. They were provided with maternal immunity against ND at hatch (8 to 10 log, by HI test, 15,000 to 26,000 by BioChek ELISA).

Half of them were vaccinated with Vectormune® ND by in ovo route using Egginject® injector; through breakout sessions, injection was precisely set at 18.5 days of embryonic development.

Table 1: vaccination programs	Vectormune [®] ND pr
In ovo (Egginject®, 18.5 days)	Vectormune® ND + IBD imm
D1	Live IB Mass + IB varian
Results	8,000
The rates of vector vaccine detecti	on at 6 wooks

The rates of vector vaccine detection at 6 weeks of age in the two replicates were 90-93%.

Serology response was detected in vaccinated groups in a similar way in the two replicates; antibody detection was clearer using HI test or ID Vet ELISA than using BioChek ELISA.

The following figure displays the antibody results collected from the 1st replicate (serology results from 2nd replicate are not shown).

The production performances and return on investment of the vector program versus the control program are summarized in the following table. The results of the two replicates are combined:

Ξ			
	2,000	_	
	0	-	

6 0 0 0

4,000

Technical parameter	Vector program	Contro prograi
Final body weight (kg)	2.64	2.61
Feed Conversion Rate	1.63	1.65
Perfomance index	407	395

Note: Economical return on investment was based on the following assumptions: ● feed price: 0.30 €/kg; ● live bird price: 0.80 €/kg.

Conclusion

Using a comprehensive approach, this trial confirmed the reliability of the Egginject[®] in ovo injector in eliciting a clearly detectable immune response to Vectormune® ND, thus correlating these observations with better performances, which can be translated in extra value for the customer.



- The other half received the conventional vaccination program which included one live apathogenic ND vaccine applied by spray route at hatch.
- The table below depicts the tested Ceva program, versus the traditional control program. Day-old chicks were of the same origin, and they were fed the same feeding program.
- Two replicates of the same trial protocol were done by rotating the "Vectormune" ND" group and the Control Group.
- Assessment criteria included vector vaccine detection in spleen (50/group, 6 weeks of age), antibody response in vectorvaccinated chickens (HI test, and ID Vet or BioChek ELISA, weekly from 3 to 6 weeks of age) and production performances. The ROI (Return On Investment) was calculated.



5/A - MAXIMUM PROTECTION

The benefits of Vectormune[®] ND prevention program

Ceva support services

By providing a maximum protection with no side effects, the use of Vectormune[®] ND teams up with the Ceva outstanding services in a perfect combination, which offers a complete solution to control the Newcastle disease, and brings better profit and peace of mind to the poultry industry. Thanks to its long experience in collaborating with its customers, Ceva is proud to effer now an outstanding range of services from the warehouse to the hatchery, and to the further processing, namely:

- LINILOG (Liquid Nitrogen Logistic)
- C.H.I.C.K Program (Ceva Hatchery Immunisation Control Keys)
- GPS (Ceva Global Protection Services)

In order to monitor the correct application of the vaccine, Ceva developed and implemented several years ago the C.H.I.C.K program. More recently, Ceva has introduced the Global Protection Services (GPS) to screen ND pressure on farm and to monitor vaccine take and the serological response to ND. These service programs are monitored by local and fully dedicated vaccination services managers and veterinary services experts. Several scientific papers and publications are available, which demonstrate the efficacy, safety and compatibility of the vaccine. A good example is the compatibility between Vectormune® ND and Transmune® providing protection against ND, IBD and MD in one application.⁽¹⁾



confirming the superiority of the Ceva vector vaccines. These results can be described and organized, depending on the production phase where the improvements were observed

Improvements in vaccination control and immunization

Improvements in performance

Improvements in processing

Maximum protection

There are **different genotypes** but there is only 1 serotype.

Therefore, the origin of the vaccine strain is not relevant for our prevention strategy. The critical point is the concept and the technology of the vaccine choice. Vectormune® ND has proven results against each genotype in different challenge conditions.

		TVDE	CHALLENGE		PROTECTIO	N RATE (%)	
TRIAL	GENOTYPE	TYPE OF BIRD	Age (weeks)	Dose (log ₁₀ ELD ₅₀ /bird)	Route	Vaccinated	Controls
1		SPF	4	4.0	IM	100	0
2	II	Layers	19	4.0	IM	100	0
3	Ш	Broilers	1/2/3/4/5	3.5	Oc	0/10/60/90/100	0/0/0/0/0
4	П	Turkeys	1/2/3/4/5	3.5	IN	100 / 67 / 33 / 80 / 100	44/0/0/0/0
5	IV	SPF	4	5.0	IN	100	0
6	IV	Broilers	3	5.0	IM	95	0
7	IV	SPF	6	5.0	Oc	100	0
8	V	SPF	4	5.0	IN	100	0
9	V	Broilers	3/4/6	5.0	ON	81 / 95 / 100	0/0/0
10	V	Broilers	2/3/4/5	5.0	ON	0/84/100/100	0/0/0/0
11	V	Layers	5	5.0	ON	70	0
12	VII	Layers	2/3/4	5.0	IM	90/100/100	90/70/10
13	VII	SPF	3	5.0	IM	100	0
14	Vlla	SPF	4	5.0	IN	100	0
15	Vlla	Layers	3/5/8/10	5.0	IN	48/90/100/100	0/0/0/0
16	VIIb	SPF	4	5.0	IN	100	0
17	VIId	SPF	4	5.0	IN	100	0
18	VIId	SPF	4	5.0	IN	100	0
19	VIId	Broilers	3/4/5	5.0	Ch	100/100/100	0/0/0
20	VIId	Layers	72	5.0	IN	100	0
21	VIIh	SPF	2/3/4/6/8	5.0	IN	95/90/100/100/100	0/0/0/0/0
22	VIIh	Broilers	2/3/4/6	5.0	IN	25/68/95/100	5/0/0/0
23	VIIh	Layers	3/4/6/10/15/25/34/ 40/55/72	5.0	IN	74/95/100/100/100/ 100/100/100/100/100	20/0/0/0/0/0/0/0 /0/0
24	VIII	SPF	4	5.0	IN	100	0

Adapted from: Paniago et al. Assessment of the protection induced by a vector rHVT-F vaccine against different genotypes of ND virus. In Proceedings of the 65th WPDC, p. 197-199. Vancouver, Canada, April 24th - 27th 2016

	CHALLENGE	PROTECTION	RATE (%)
GENOTYPE	Age (weeks)	Vaccinated	Controls
VII	2/3/4	90/100/100	90/70/10
VII	3	100	0
VIIa	4	100	0
VIIa	3/5/8/10	48/90/100/100	0/0/0/0
VIIb	4	100	0
VIId	4	100	0
VIId	4	100	0
VIId	3/4/5	100/100/100	0/0/0
VIId	72	100	0
VIIh	2/3/4/6/8	95/90/100/100/100	0/0/0/0/0
VIIh	2/3/4/6	25/68/95/100	5/0/0/0
VIIh	3/4/6/10/15/25/34/40/55/72	74/95/100/100/100/100/100/100/100/100	20/0/0/0/0/0/0/0/0/0





5 / The benefits of Vectormune® ND prevention program

5/B - REDUCTION OF THE SHEDDING

B Reduction of the shedding





Spreading pattern of an infectious disease

A farm is not a perfectly closed and hermetic space. Exchanges inevitably take place with the external environment - and this is where the virus can enter the place. Once in the farm, the course of infection becomes difficult to control and contamination is rapid inside and then outside the building. For the modern poultry industry, the challenge is to stop the spread of the disease as guickly as possible.

A simple diagram shows how limiting contacts early might prevent many infections by cutting a link in the chain of transmission.





At flock level, a proper vaccination program can strongly help to reduce the transmission of the virus.

The reproduction ratio (R) is an average number of infectious individuals caused by one infectious individual in its entire infectious period in a totally susceptible population. (Diekmann, Heesterbeek & Britton, 2013)

Vectormune[®] ND successfully brought the R value below 1. (Tatar-Kis T., et al., 2020)



A proven reference for the reduction of Newcastle disease

Lab study: Quantify the transmission of velogenic ND virus among 42-day old vaccinated broilers

Tatár-Kis T, Fischer EAJ, Cazaban C, Walkó-Kovács E, Homonnay ZG, Velkers FC, Palya V, Stegeman JA. A Herpesvirus of Turkey-Based Vector Vaccine Reduces Transmission of Newcastle disease Virus in Commercial Broiler Chickens with Maternally Derived Antibodies. Vaccines (Basel). 2020 Oct 16;8(4):614. doi: 10.3390/vaccines8040614. PMID: 33081359; PMCID: PMC7720113.

A recent publication about Vectormune® ND provided the additional asset of significantly reducing the likelihood of virus transmission among birds. Indeed, a velogenic ND virus was provided with a reproduction ratio (R0) figure of 3.20; it basically means that 10 infected chickens are able to transmit the disease to 32 new birds, hence explaining the spreading capacity of this disease to neighboring houses; the outcome will be increased losses, including high mortality rate in case of velogenic strains. On the contrary, in Vectormune® ND-vaccinated broilers, this R0 dropped to 0.82, which means that vaccinated flocks will significantly reduce and slow down the spreading of the virus. In addition, they will survive thanks to a strong protection.

Study design:

 2 groups of commercial broilers (Ross 308): Vaccinated (Vectormune ® ND) vs Control

	Vectormune [®] l	ND group	Control group		
	Directly-inoculated (Seeders) (n=20)	Contacts (n=20)	Directly-inoculated (Seeders) (n=16)	Contacts (n=21)	
Day-old	rHVT-ND (Vectormune® ND) Subcutaneous route, 0.2 ml		-		
Day 42	vNDV, 5 log ₁₀ ELD50/bird intra-nasally	Brought together 8 hours later	vNDV, 5 log ₁₀ ELD50/bird intra-nasally	Brought together 8 hours later	

Results:









ROILER CHICKENS WIT MATERNALLY DERIVED ANTIBODIES

Click or Scan

Challenge at D42

- Random allocation per groups
- 2 sub-groups in each group: Seeders vs contacts

The challenge model was validated.

No mortality attributable to velogenic NDV infection was seen in the vaccinated group during the 14-day post-challenge

No mortality in the vaccinated group, 100% mortality in non vaccinated group

observation period, regardless of the subgroup. In contrast, all non-vaccinated chickens succumbed to the challenge. Mortality appeared between 6 and 9 dpch in the seeder subgroup and between 8 and 13

dpch. In contact group.

33

Reduction of the shedding in directly inoculated (seeder) subgroups



The shedding after challenge was significantly reduced in the vaccinated birds.



Reduction of the shedding in contact subgroups

The shedding in contact birds was significantly reduced in the vaccinated group.

 The horizontal spread of the infection among vaccinated broilers (β) was close to 3x slower than in unvaccinated birds. It allows more time to intervene.

	VACCINATES	UNVACCINATES	P-value
T inf (infectious period in contacts)	3.4 days (-> survival)	4.8 days (-> death)	P<0.05
β (transmission coefficient)	0.24	0.67	P<0.05

Most virus introductions would not result in an outbreak in vaccinated chickens.

	VACCINATES	UNVACCINATES
P:1-1/R	<0	69%

Conclusion:

Vectormune[®] ND is a strong tool to break the uncontrolled transmission of NDV among chickens in a house, in between houses in a farm, and ultimately among farms in a high densely populated poultry area.



Hence, Vectormune[®] ND helps to prevent and control Newcastle disease outbreaks in poultry industry and protects the performance. By this way, Ceva Animal Health provides one more evidence towards supporting its customers to achieve their targets all around the world.

Figure 2. Kinetics of velogenic NDV shedding in vaccinated and unvaccinated birds after direct infection (seeder subgroups) or contact infection (contact subgroups). Oro-nasal swabs and cloacal swabs were collected daily for 14 days post-challenge; vNDV amount was quantified by RT-qPCR. Individual results and mean & STD of Ct values are shown.





A PROVEN REFERENCE FOR THE REDUCTION OF NEWCASTLE DISEASE Click or Scan

5 / The benefits of Vectormune® ND prevention program Cevo

5/B - REDUCTION OF THE SHEDDING

Reduction of the shedding: better performance and serological values

A Novel recombinant Herpes virus of turkey expressing F gene of Newcastle disease (rHVT-F) reduces velogenic genotype VII Newcastle disease virus shedding following challenge in commercial broilers.

Mahmoud Sedeik¹, Nahed Elshall¹, Ashraf Awad¹, Jaime Sarabia³ and Ahmed Setta^{2,3} 1Department of Poultry and Fish diseases, Faculty of Veterinary Medicine, Alexandria University, 2Department of Poultry Diseases, Faculty of Veterinary Medicine, Cairo University, 3Ceva Sante Animale.

VII Mediterranean poultry summit.(ID: 130136, 2022)

In the present study a total of 140 day-old commercial chickens were divided into 14 groups and received different ND vaccination programs (ND vector and homologous and heterologous live and inactivated ND vaccines) while 2 groups were served as positive and negative controls. Challenge with velogenic ND genotype VIId was done at 28 days of age using 106 EID50 at 100 µl per bird and chickens were monitored for 10 days later.

Monitoring serological responses and tracheal shedding of the challenge virus at 3, 6 and 9 days post-infection were done in triplicates. The obtained results have shown that rHVT-F vector vaccine-vaccinated group has shown better clinical protection, HI humoral immune responses and significantly reduced the challenge virus shedding as compared to other groups vaccinated with live, inactivated and other competitor ND vector vaccines.

G2	rHVT-ND + 1xLive ND GII			
G3	rHVT-ND + Inactivated ND GII			
G 4	Vectormune [®] ND			
G5	Vectormune® ND + 1xLive ND GII			
G6	Vectormune® ND + 1x Inactivated ND GII			
G7	Inactivated ND GII + 1x live ND GII			
G8	2x Inactivated ND GII + 1x live ND GII			
G9	2x Inactivated ND GII			
G10	Inactivated ND GII + Inactivated ND GVII			
G11	Inactivated ND GII + Inactivated ND GVII + 1x live ND GII			
G12	Inactivated ND GVII + 1x live ND GII			
G13	Non vaccinated challenged			
G14	Non vaccinated non challenged			

Table 1. Different study groups. Challenge was done at 28 days of age with velogenic NDV genotype VII (MK977858), 0.1 ml with infective dose 10⁶ EID50.



Figure 1. Viral shedding from tracheal swabs of different groups examined at 3, 6 and 9 days PC (n=3).



G1 rHVT-ND







Conclusion:

•Testing different vaccination programs against NDV challenge, Vectormune ND has provided good serological responses with an improved performance compared with other groups vaccinated with different vector and conventional NDV vaccines.

• Vectormune ND vaccinated group of chickens has shown significant reduction in the NDV challenge virus shedding in comparison with other rHVT-ND vector vaccine and conventional NDV vaccines, including homologous NDV genotype VII vaccines.







Click or Scan

Ceva 5 / The benefits of Vectormune® ND prevention program

No side effect

Live attenuated vaccines that are the backbone of a broiler ND vaccination program may be responsible for the lesions of the upper respiratory tract, post vaccination and rolling reactions that slow down the growth, worsen flock's uniformity and leave the chickens susceptible to other pathogens.

Furthermore, conventional live vaccines, even if lentogenic strains, always carry a certain safety risk in terms of some mild symptoms and shedding after vaccination and need for booster vaccination.

Field study: Post vaccination reactions in commercial broilers, Vectormune[®]ND group vs no vaccination

Sesti 2016, 65th WPDC

VACCINATION PROGRAM	MATERIAL & METHODS	FIELD VACCINATION
Vectormune [®] ND group	ELISA conventional kit (Idexx)	Vectormune® ND
Control group	ELISA conventional kit (Idexx)	No ND vaccination





Conclusion

In low challenge countries, we expect to see low titers. Vectormune® ND allows better protection with lower titers. High serological titers show viral challenges which reduces the export possibilities.

Field study: Post vaccination reactions Vectormune[®]ND group vs live ND vaccinations

VACCINATION PROGRAM	HATCHERY VACCINATION	FIELD VACCINATION
Vectormune [®] ND group	Vectormune® ND + Live ND (LaSota)	3x Live ND (LaSota)
Live ND group	Live NDV (LaSota)	3x Live ND (LaSota)

Respiratory PVR makes trachea sensitive to bacterial respiratory infections (Van Eck and Goren, 1991)











IN HIGH ND CHALLENGE COUNTRIES?

Click or Scan

Conclusion

Vectormune[®] ND vaccination program group clearly showed a lower level of inflammatory lesions both in the upper and lower PART of the trachea.

WITH DIFFERENT DISEASE PRESSURE **& VACCINATION PROGRAMS**

Importance of a proper analysis

Over the past 10 years, digitalization – along with the new technologies – has emerged and developed itself in all industries a llowing to get more and new relevant information. Valuable data helps in our constant decision-making process. The poultry industry – globally integrated from the breeders to the slaughterhouses, passing by the hatcheries and farm – has therefore guickly adapted to this new environment, seeing the hidden value of the data.

In Ceva, we are collecting huge amounts of health data (serology data, broiler age, vaccination program...) thanks to our services, the GPS, and the hatchery C.H.I.C.K. program. Our customers are also collecting a lot of production parameters in order to follow the health and growth of their birds. Due the importance of combination of health and production parameters, in 2021, has been launched a Real World Evidence (RWE) project on top of the data activity already in place.

RWE is a recent wording commonly used in human medicine in order to demonstrate the benefits of a product through the analysis of real world data (RWD). Data in real life conditions, without control of the environment or some parameters, on chosen subjects. For us, it means analyses of field poultry data (involving vaccine - related data or not). Even though, Ceva being an animal health company, the majority of our RWE analysis are focusing on the birds health.

The objective of the RWE project is simple: enlarge the capability to work on poultry data, to do professional statistics for the Poultry Industry -using a statistical software called Python- thanks to key veterinarians located around the world. The data analyse, associated with the veterinarian knowledge, is making a true difference for the interpretation of the results, as well as for the solution to put in place.

A methodology in 3 main steps has been established internally :

1 - Challenge

Analysis of the individual serology titers to answer to the following question: « Is there an IB / IBD / ND challenge in my farms? if yes, how many farms were involved? ». According to the lab history, the country, the vaccination program and the kit used, a threshold is defined by our experts. Then, if at least 20% of the birds are above that threshold, we consider the flock as being « challenged ».

2 - Performances

Analysis of the production parameters (slaughter age and weight, mortality percentage, feed conversion rate...). This analysis is done either per vaccination program, or following the previous classification « challenged vs non challenged ».

3 - Economics

Analysis of a disease impact. The statistical differences observed at the previous step are converted into economics, in order to evaluate the cost of an IB / IBD / ND challenge. In a few years, already 200 RWE studies have been done worldwide, demonstrating the strong enthusiasm and willingness of the Poultry Industry to learn from its data, to improve the production and raise healthy well protected birds.

Our RWE experiences⁽¹⁾ show that 80% OF THE VECTORMUNE® ND STUDIES DEMONSTRATED A SIGNIFICANT ADDED VALUE with the average of 61 €/1,000 birds.



Recent trials have been performed worldwide, which compare Vectormune® ND versus live or inactivated ND vaccines, or absence of ND vaccination, or use of competitors' rHVT-F vaccines.

The return on investment has been assessed by taking the following market prices assumptions into account: Final body weight of $2kg \bullet FCR 1.6 \bullet Feed price: 0.30 \in /kg \bullet Live bird price: 0.80 \in /kg$

By doing so, it was possible to calculate an additional profit related to improvements in the major production performance parameters.

Technical Parameters	Value/1,000 Birds	Value/100 M. Birds
0.01 FCR	6€/1,000 birds*	600 K€*
10 g. BW	3.2€/1,000 birds*	320 K€*
1% Mortality	11€/1,000 birds*	1,100 K€*

The table below summarizes the range of improvement points that were provided by Vectormune® ND in field trials that are displayed hereafter.

	Mortality (%)	Body weight (g)	FCR	Income (€/1,000 birds)
High risk areas	-0.41 to -8.25	-52 to +210	-0.003 to -0.23	+21 to +190
Low risk areas	+0.25 to -1.52	-65 to +272	+0.05 to -0.06	+4 to +185

(1) Studies with more than 30 million birds with Vectormune® ND alone. * This value has been calculated from Ceva field data and might vary depending on NB pressure and region. Disclaimer: Study results disclosed through the present document are intended to report the results that have been obtained in the specific conditions of performance of the Study and were known at the time of the Study's completion. Ceva does not make any warranty, expressed or implied, with respect to results herein disclosed and assume no liability for any party's use, or the results of such use, of any information contained in this document





Vectormune® ND vs. rHVT-ND + inactivated ND vaccines



VACCINATION PROGRAMS

GROUP 1 - CEVA PROGRA
Vectormune [®] ND (SC) Live ND + IB (spray)
Live ND vaccine
Live ND vaccine

Real World Evidence (RWE): WHATEVER THE SITUATION

Ceva Sante Animale, in cooperation with independent researchers have conducted field and lab studies with different realities at 5 continents. These studies have been reviewed and analyzed by our RWE team.

In the next pages, you will access these studies and the conclusions with different realities, vaccination programs and demonstrating the superiority of Vectormune® ND whatever the situation is...







ECONOMIC EVALUATION Based on cost-benefit calculations (mortality, body weight and FCR), the extra revenues per 1,000 birds would be $+43 \in$





2 GROUPS OF BROILERS

GROUP 1 (CEVA): VECTORMUNE® ND AT DAY 1

GROUP 2: COMPETITOR rHVT-F ND VACCINE AT DAY 1 + INACTIVATED ND VACCINE AT DAY 12

SLAUGHTER AT 35 DAYS







2 GROUPS OF BROILERS VACCINATED WITH VECTORMUNE® ND

GROUP 1 (IN OVO):

VECTORMUNE® ND + TRANSMUNE® IN OVO

GROUP 2 (HATCHERY):

VECTORMUNE® ND + TRANSMUNE® + INACTIVATED ND VACCINE AT DAY 1

VACCINATION PROGRAMS

0

21 days

28 days

	In ovo vaccination (-18 days of life)	Day old chick	7 days old	PARAMETERS
ln ovo Group	Vectormune® ND + Transmune® (Egg Inject)	NB+IB (Spray)	NB + IB (Spray)	Serology - ND-HI and ND-F Protein ELISA Performance data - % mortality and 7 days mortality - Body weight and FCR
D1 Group	-	Vectormune® ND (SC) + Transmune® (SC) + ND inactivated (SC) + ND+IB (Spray)	NB + IB (Spray)	 Cost benefit calculation Efficacy by challenge test % clinical protection Virus shedding Body weight



21 days

Protection with the vaccination program (%)

28 days

21 days

28 days



CHALLENGE AT 21 DAYS





Vaccination with Vectormune® ND and Transmune® allows removing inactivated vaccines and working 100 % in ovo.



Source: Ceva internal



Vectormune® ND + Transmune®

Vectormune® ND + Transmune® + Inactivated vaccine

Control positive

CHALLENGE AT 28 DAYS

There is not any extra value of adding inactivated ND vaccine on Vectormune ND vaccination group. But, on the contrary, with Vectormune ND without inactivated ND vaccine,



Vectormune® ND vs. rHVT-ND vaccines



476,500 BROILERS 2 CONTEMPORANEOUS GROUPS SAME MANAGEMENT PROCEDURES

GROUP 1 (CEVA):

271,500 BIRDS VECTORMUNE® ND IN OVO

GROUP 2:

Vectormune® ND

205,000 BIRDS rHVT-F VACCINE IN OVO

SLAUGHTER AT 44-45 DAYS

VACCINATION PROGRAMS

	GROUP 1 - CEVA PROGRAM	GROUP 2 - COMPETITOR
ED 18 (in ovo)	Vectormune [®] ND (in ovo)	Competitor rHVT-F (in ovo)







FCR



Competitor rHVT-ND-F vaccine



ECONOMIC EVALUATION

Based on cost-benefit calculations (mortality, body weight and FCR),

the extra revenues per 1,000 birds would be +18.93€

Source: Bianchet L. et al., 2017. Comparative field evaluation of two vector marek's/newcastle (rHVT-F) vaccines in commercial broiler flocks. XXth World Veterinary Poultry Association (WVPA) congress, Edinburgh, Scotland, September 4-8. Bianchet L. et al., 2017. Evaluación de campo comparativa de dos vacunas vectorizadas Marek/Newcastle (rHVT-F) en lotes de pollos comerciales. XXV Congreso Latinoamericano de Avicultura (CLA), Guadalajara, Mexico, September 26-29.







ENDEMIC NEWCASTLE DISEASE COUNTRY

1 FARM HISTORICAL COMPARISON

VACCINATION PROGRAM **BEFORE 2017:** COMPETITOR rHVT-F ND VACCINE

VACCINATION PROGRAM AFTER 2017: **VECTORMUNE® ND** (SAME VACCINATION PROGRAM)

vs. rHVT-ND vaccines

Vectormune[®] ND controls field virus circulation better than rHVT-F ND competitor.

47



Vectormune® ND vs. rHVT-ND vaccines



2 GROUPS OF BROILERS

GROUP 1 (CEVA):

VECTORMUNE[®] ND AT DAY 1 (3 FARMS)

GROUP 2:

COMPETITOR rHVT-ND VACCINE AT DAY 1 (3 FARMS)



VACCINATION PROGRAMS

	GROUP 1 - CEVA PROGRAM	GROUP 2 - COMPETITOR
DAY 1	Vectormune [®] ND Live ND vaccine	Competitor rHVT-ND vaccine Live ND vaccine
DAY 12	Live ND vaccine	Live ND vaccine

RESULTS & CONCLUSIONS



Vectormune® ND Competitor r-HVT-ND vaccine ND ELISA-F at day 28 BioChek (titer groups) 2 3 4 5 6

> 5 6 7

4

8 9

Customer testimonial

0 1

«We noted a worsening of the ND situation with the rHVT-ND competitor. There were signs of clinical and pathological changes related ND with the rHVT-ND competitor compared to the situation under control with Vectormune® ND.»

> Vectormune[®] ND provides better protection with faster, uniform and better immunity than any other recombinant product.

2

VACCINATION PROGRAMS

	GROUP 1 - CEVA PROGRAM
ED18 (in ovo)	Vectormune® ND (in ovo)
D1 (hatchery)	ND + IB live vaccines (spray)
D16	-







ECONOMIC EVALUATION Based on cost-benefit calculations (mortality, body weight and FCR), the extra revenues per 1,000 birds would be +75.55€





2 GROUPS OF BROILERS 204,000 BIRDS SAME ORIGIN. SAME FEEDING PROGRAM

GROUP 1 (CEVA): 146,000 BIRDS VECTORMUNE® ND IN OVO

GROUP 2: 58,200 BIRDS COMPETITOR rHVT-ND VACCINE IN OVO

SLAUGHTER AT 36 DAYS



vs. rHVT-ND vaccines







2 GROUPS OF BROILERS 100,000 BIRDS

GROUP 1 (CEVA):

VECTORMUNE® ND AT DAY 1

GROUP 2:

COMPETITOR rHVT-ND VACCINE AT DAY 1

VACCINATION PROGRAMS

	GROUP 1 - CEVA PROGRAM	GROUP 2 - COMPETITOR
DAY OLD	Vectormune® ND (SC) • ND inactivated vaccine (SC) • ND + IB vaccine (spray)	Competitor rHVT-ND vaccine (SC) • ND inactivated vacccine (SC) • ND + IB vaccine (spray)
7 DAYS	ND+IB live vaccine (spray)	ND+IB live vaccine (spray)



Statistically faster and higher seroconversion of ELISA ND-F titre vs rHVT-ND group from D21 until harvesting age (D35).

Vectormune[®] ND provides higher immunity than rHVT-ND competitor.

Thailand⁽³⁾

VACCINATION PROGRAMS

Hatchery Program (DOC)FarmVectormune® ND + Transmune® (SC)NB+IB+IBD vaccines (DW)• ND inactivated vaccine (SC) • Live ND vaccine (spray)NB+IB+IBD vaccines (DW)	GROUP 1 - CEVA PROGRAM		
+ Transmune® (SC) NB+IB+IBD • ND inactivated vaccine (SC) vaccines (DW)	Hatchery Program (DOC)	Farm	
	+ Transmune [®] (SC) • ND inactivated vaccine (SC)		

RESULTS & CONCLUSIONS

Serology comparison Biochek ELISA NDV-F (titers)



ECONOMIC EVALUATION

Based on cost-benefit calculations (mortality, body weight and FCR), the extra revenues per 1,000 birds would be +22.61€





2 GROUPS OF BROILERS

GROUP 1 (CEVA): VECTORMUNE® ND AT DAY 1

GROUP 2: COMPETITOR rHVT-ND VACCINE AT DAY 1



vs. rHVT-ND vaccines



Vectormune® ND vs. rHVT-ND-IBD vaccines



2 GROUPS OF BROILERS

GROUP 1 (CEVA): VECTORMUNE® ND + TRANSMUNE®

GROUP 2: COMPETITOR rHVT-ND-IBD VACCINE

GROUP 3 (CONTROL):

NO VACCINATION

SEROLOGY COMPARISON AT D14, D20, D27, D38



Vectormune® ND + Transmune® Competitor rHVT-ND-IBD vaccine Control



Science and Investigation Department

RESULTS & CONCLUSIONS

Clinical protection from virulent NDV challenge (W3 and 4)



Clear difference between 2 groups both at day 21 and day 28.

Vectormune[®] ND together with Transmune® allows faster and higher onset of immunity.

Vectormune[®] ND together with Transmune® developed much higher clinical protection than competitor rHVT-ND-IBD group.

Source: SID/SSIU/ Ceva Phylaxia



2 GROUPS OF BROILERS

GROUP 1 (CEVA): VECTORMUNE® ND + TRANSMUNE®

GROUP 2: COMPETITOR rHVT-ND-IBD VACCINE

GROUP 3 (CONTROL):

NO VACCINATION

VIRULENT NDV CHALLENGE AT D21 AND D28 IN BOTH GROUPS

> Vectormune® ND + Transmune® Competitor rHVT-ND-IBD vaccine Control



vs. rHVT-ND-IBD vaccines



Vectormune® ND vs. rHVT-ND-IBD vaccines



COMMERCIAL BROILER PRODUCTION 2 GROUPS

GROUP 1 (CEVA):

VECTORMUNE® ND

GROUP 2:

COMPETITOR rHVT-ND-IBD VACCINE

SEROLOGY IDDEX TESTING AT SLAUGHTER AGE

RESULTS



Competitor rHVT-ND-IBD vaccine



Serology Idexx at slaughter age

In low challenge countries, we expect to see low titers. Vectormune[®] ND provides better protection with lower titers. High serological titers show lentogenic viral circulation which creates issues in the export possibilities.

Thailand⁽⁴⁾ =

MATERIAL & METHODS

CHALLENGE STRAIN	• 1/2/1/12/MY recent g
CHALLENGE INFECTION	• Dose of 105,0 EID50/d
SAMPLING PRE CHALLENGE	Sera at 0 DPC (all chie
SAMPLING POST CHALLENGE	• At 4 DPC: oronasal an





Vectormune ND provides better onset of immunity and lower shedding of ND virus.





COMMERCIAL BROILER PRODUCTION 2 GROUPS

NDV CHALLENGE AT 3, 4 AND 6 WEEKS OF AGE 20 CHICKENS/GROUP

GROUP 1 (CEVA): **VECTORMUNE® ND**

GROUP 2: COMPETITOR rHVT-ND-IBD VACCINE







Indonesia

11 400 000 BIRDS

ENDEMIC NEWCASTLE DISEASE COUNTRY

HISTORICAL COMPARISON

VACCINATION PROGRAM **BEFORE 2019:** INACTIVATED ND VACCINE + 2 LIVE ND VACCINES

VACCINATION PROGRAM SINCE NOVEMBER 2019: VECTORMUNE® ND + 2 LIVE ND VACCINES

SLAUGHTER AT AROUND 27 DAYS OF AGE









P value of ND titers<0.05: the difference between ND inactivated and Vectormune® ND groups is statistically significant. Vectormune[®] ND controls field virus circulation better then ND inactivated vaccine.







ECONOMIC EVALUATION Based on cost-benefit calculations (mortality, body weight and FCR), the extra revenues per 1,000 birds would be +196.00€

Vectormune"

Vectormune® ND vs. inactivated vaccines



2 GROUPS OF BROILERS, 36 FLOCKS

GROUP 1 (CEVA): 22 FLOCKS VECTORMUNE® ND + 2 LIVE ND VACCINES

GROUP 2: 14 FLOCKS INACTIVATED VACCINE + 2 LIVE ND VACCINES

2

Inactivated vaccine + 2 live ND vaccines (n=14)

Only 14% of the farms

showed marginally protective

titers after 4 weeks

4

Malaysia⁽¹⁾







Vectormune[®] ND performs better than inactivated vaccines due to the interference between inactivated vaccines and MDA especially with the presence of high MDA level. The protection is lower and the transmission risk is higher.



ECONOMIC EVALUATION

Based on cost-benefit calculations (mortality, body weight and FCR),

the extra revenues per 1,000 birds would be +108.00€

VACCINATION PROGRAMS

	CEVA PROGRAM (2014)	GROUP 2 (2013)
D1 (hatchery)	Vectormune [®] ND (SC) Live LaSota vaccine (spray)	Inactivated gen. VII (SC) Live gen.VII vaccine (spray)
D7	Live LaSota vaccine (spray)	Live gen.VII vaccine (spray)
D14	Live LaSota vaccine (spray)	Live gen.VII vaccine (spray)







COMMERCIAL BROILER PRODUCTION 1 FARM, 25,000,000 DAY-OLD CHICKS

HISTORICAL COMPARISON

GROUP 1 (CEVA): 14,104,600 BIRDS, 65 FLOCKS VECTORMUNE® ND AT DAY 1

GROUP 2:

11,131,500 BIRDS, 75 FLOCKS INACTIVATED GEN. VII VACCINE AT DAY 1

SLAUGHTER AT 36.22 DAYS

would be +108€

vs. inactivated vaccines



Vectormune® ND vs. inactivated vaccines



COMMERCIAL BROILER PRODUCTION 2.700.000 DAY-OLD CHICKS

GROUP 1 (CEVA): **VECTORMUNE® ND**

GROUP 2:

INACTIVATED ND VACCINE

Vectormune® ND Inactivated ND vaccine

Production performance comparison over 12 months (n=2.7M)



RESULTS & CONCLUSIONS

450

400

350

300

250

200



Performance Index





Mexico⁽²⁾

VACCINATION PROGRAMS

GROUP 1 - CEVA PROGRAM
Vectormune® ND vaccine (S Live ND + IB vaccines (spray
Live ND vaccine
Live ND vaccine

RESULTS & CONCLUSIONS

TRIAL 1

10

6 -

4 —

2 —

0







ECONOMIC EVALUATION

Based on cost-benefit calculations (mortality, body weight and FCR),

the extra revenues per 1,000 birds would be +38.46€

ECONOMIC EVALUATION

Based on cost-benefit calculations (mortality, body weight and FCR),

the extra revenues per 1,000 birds would be +59.10€





COMMERCIAL BROILER PRODUCTION 2 CONTEMPORANEOUS GROUPS

GROUP 1 (CEVA): VECTORMUNE® ND AT DAY 1

GROUP 2:

INACTIVATED ND VACCINE AT DAY 1 AND DAY 12

SLAUGHTER AT 35 DAYS

vs. inactivated vaccines



Morocco

COMMERCIAL BROILER PRODUCTION 347,000 DAY OLD CHICKS 4 FARMS, 2 GROUPS IN EACH FARM

GROUP 1 (CEVA):

173.500 BIRDS VECTORMUNE® ND AT DAY 1

GROUP 2:

173,500 BIRDS INACTIVATED ND VACCINE AT DAY 1

Trial 2

Following these results, the owner decided to vaccinate his entire production with Vectormune® ND and to reduce the amount of live ND vaccines (see table). Control group includes historical data from three farms.

ACCINATION PROGRAMS

	GROUP 1 - CEVA PROGRAM	GROUP 2
D1 (hatchery)	Vectormune [®] ND (SC) Live ND vaccine (Phy. LMV 42)	Inactivated ND vaccine (SC) Live ND vaccine (VG/GA)
D12	Live ND vaccine (LaSota)	Live ND vaccine (cloned LaSota)
W3	-	Live ND vaccine (cloned LaSota)

Trial 1 VACCINATION PROGRAMS

	GROUP 1 - CEVA PROGRAM	GROUP 2
D1 (hatchery)	Vectormune [®] ND (SC) Live ND vaccine (VG/GA)	Inactivated ND vaccine (SC) Live ND vaccine (VG/GA)
D12	Live ND vaccine (LaSota)	Live ND vaccine (cloned LaSota)
W3	Live ND vaccine (LaSota)	Live ND vaccine (cloned LaSota)











Inactivated ND vaccine

On the four farms, production performances were improved in the groups that received Vectormune® ND compared to control.

RESULTS & CONCLUSIONS





ECONOMIC EVALUATION Based on cost-benefit calculations (mortality, body weight and FCR),

Source: Erraji A. et al., 2015. Opportunity of using rHVT-F vaccine (Vectormune® ND) for controlling Newcastle disease and improving broiler chicken performances in Morocco. XIXth World Veterinary Poultry Association (WVPA) Congress, Cape Town, South Africa, September 7-11.





Again, production performance were improved : mortality was reduced in the 3 farms, FCR and production index were improved.

the extra revenues per 1,000 birds would be +42.85€





Vectormune® ND vs. inactivated vaccines

Venezuela 🚧

2 GROUPS OF BROILERS, 148,000 CHICKS, CONTEMPORANEOUS

GROUP 1 (CEVA):

74,300 BIRDS VECTORMUNE® ND IN OVO

GROUP 2:

73,300 BIRDS INACTIVATED ND VACCINE AT DAY 1

SLAUGHTER BETWEEN 40 AND 45 DAYS

40 DAYS OF LIFE





VACCINATION PROGRAMS

	GROUP 1 - CEVA PROGRAM	GROUP 2	
ED19 (in ovo)	Vectormune [®] ND (in ovo) SB1 IBD immune complex vaccines	HVT + SB1 IBD immune-complex vaccines	
D1 (hatchery)	Live ND + IB vaccines (spray)	Inactivated ND vaccine (SC) Live ND + IB vaccines (spray)	
D12	Live ND + IB vaccines (spray)	Live ND + IB vaccines (spray)	
D13	Live ND + IB vaccines (spray)	Live ND + IB vaccines (spray)	

RESULTS & CONCLUSIONS



1st WEEK OF LIFE





45 DAYS OF LIFE













ECONOMIC EVALUATION

Based on cost-benefit calculations (mortality, body weight and FCR),

the extra revenues per 1,000 birds would be +49.31€





Vectormune® ND vs. inactivated vaccines

Vectormune® ND vs. live ND vaccines (in high ND challenge)



AKES THE DIFFERENCE VS. INACTIVATED ND VACCINES IN ND CONTROL

Click or Scan

Turkiye⁽²⁾

COMMERCIAL BROILER PRODUCTION 52 FLOCKS

GROUP 1 (CEVA):

13 FLOCKS **VECTORMUNE® ND**

GROUP 2:

39 FLOCKS INACTIVATED ND VACCINE



/ACCINATION PROGRAMS

ED18 (in ovo)

D1 (hatchery)

D10

D18

3 —

2 –

1 —

	Inactivated ND vaccine	Vectormune® ND	p value	Potential economic impact (€/000 birds)	Comments
Number of flocks	39	13			
Chick quantity (m ²)	14.89	14.82	> 0.05		Non significant difference
Slaughter age (d)	41.39	41.71	> 0.05		Non significant difference
Slaughter weight (kg)	2.50	2.60	< 0.05	40	Significant difference (100g)
FCR	1.73	1.70	< 0.05	18	Significant difference (3 pts)
7D mortality (%)	0.88	1.44	< 0.05	3.36	Significant difference (0.56%)
Total mortality (%)	5.33	4.88	> 0.05		Non significant difference
Condemnation rate	0.24	0.29	< 0.05		Significant difference
EPEF	332.03	348.36	< 0.05		Significant difference



RESULTS & CONCLUSIONS



ECONOMIC EVALUATION

Based on cost-benefit calculations (mortality, body weight and FCR),

the extra revenues per 1,000 birds would be +58.00€

RESULTS & CONCLUSIONS



ECONOMIC EVALUATION

Based on cost-benefit calculations (mortality, body weight and FCR),

the extra revenues per 1,000 birds would be +190.42€

Source: Sesti L. et al., 2013. Assessment of a vector Marek's/Newcastle vaccine through clinical and productive performance of commercial broilers in two different epidemiological situations of Newcastle disease challenge. XVIIIth World Veterinary Poultry Association (WVPA) Congress, Nantes, France, August 19-23.

Source: Ceva Internal data



2,000,000 BROILERS 2 CONTEMPORANEOUS GROUPS

GROUP 1 (CEVA):

995,250 BIRDS **VECTORMUNE® ND IN OVO**

GROUP 2:

950,275 BIRDS 2 LIVE ND VACCINES AT DAY 10 AND DAY 18

SLAUGHTER AT 41.2 DAYS





vs. live ND vaccines (in high ND challenge)

67



Vectormune® ND vs. live ND vaccines (in high ND challenge)



COMMERCIAL BROILER PRODUCTION 190,000 DAY OLD CHICKS 2 GROUPS, 4 FLOCKS EACH CONTEMPORANEOUS SAME ORIGIN, SAME FEEDING PROGRAM

GROUP 1 (CEVA):

95,336 BIRDS, 4 FLOCKS VECTORMUNE® ND AT DAY 1

GROUP 2:

94,997 BIRDS, 4 FLOCKS LIVE ND VACCINE AT DAY 18

SLAUGHTER AT 34 DAYS

Vectormune® ND



RESULTS & CONCLUSIONS

	GROUP 1 - CEVA PROGRAM	GROUP 2	p value
SLAUGHTER AGE (d)	33.1	32.9	> 0.05
ADG (G/D)	55.8	54.2	< 0.05
SLAUGHTER WEIGHT (kg)	1.946	1.859	< 0.05
FCR	1.53	1.55	> 0.05
TOTAL MORTALITY (%)	3.23	3.51	> 0.05
EPEF	363.5	344.62	< 0.05



ECONOMIC EVALUATION

Based on cost-benefit calculations (mortality, body weight and FCR),

the extra revenues per 1,000 birds would be +34.80€

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VACCINATION
PROGRAMS
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	GROUP 1 - CEVA PROGRAM	GROUP 2
D1 (hatchery)	Vectormune [®] ND (SC) IBD immune-complex vaccine (SC) ND + IB live vaccine (spray)	ND + IB live vaccine (spray)
D7	-	IBD intermediate live vaccine (drinking water)
D14	-	IBD intermediate live vaccine (drinking water)
D18	-	Live ND vaccine (drinking water)

RESULTS & CONCLUSIONS







Live ND vaccine

ECONOMIC EVALUATION

Based on cost-benefit calculations (mortality, body weight and FCR),

the extra revenues per 1,000 birds would be +81.73€





COMMERCIAL BROILER PRODUCTION 351 FLOCKS



GROUP 2: LIVE ND VACCINE





Vectormune® ND vs. live ND vaccines (in high ND challenge)



COMMERCIAL BROILER PRODUCTION 2 GROUPS, 30 FLOCKS, 2,130,000 BIRDS

GROUP 1 (CEVA): 15 FLOCKS VECTORMUNE® ND + 4 LIVE ND VACCINES (LASOTA)

GROUP 2 : 15 FLOCKS 4 LIVE ND VACCINES (LASOTA)



core 0: no inflammation.



Score 2: moderate inflammatory lesions.



4 LaSota



RESULTS & CONCLUSIONS



Vectormune® ND + 4 LaSota





Vectormune® ND vaccination program group clearly showed a lower level of inflammatory lesions both in the upper and lower part of the trachea.

Growth performance





Vectormune ND provides better protection and performance results.









Performance index





24,500,000 DAY-OLD CHICKS, 3 COMPANIES, CONTEMPORANEOUS, SAME ORIGIN

GROUP 1 (CEVA):

13,500,000 BIRDS VECTORMUNE® ND AT DAY 1

GROUP 2:

11,000,000 BIRDS LIVE ND VACCINE

SLAUGHTER BETWEEN 48 AND 54 DAYS



ACCINATION PROGRAMS

	GROUP 1 - CEVA PROGRAM	GROUP 2
COMPANY 1	3,500,000 birds Vectormune® ND (SC) at D1	4,000,000 birds Live ND (C2) vaccine (spray) at D1
COMPANY 2	6,000,000 birds Vectormune® ND (SC) at D1	3,000,000 birds Live ND (VG/GA) vaccine (spray) at D1
COMPANY 3	4,000,000 birds Vectormune® ND (SC) at D1	4,000,000 birds Live ND (Hitchner B1) vaccine (spray) at D1

RESULTS & CONCLUSIONS









Source: Sara L. and L. Sesti, 2017. Experiencias de campo con la utilización de la vacuna vectorizada para el control de la enfermedad de Marek y la enfermedad de Newcastle (rHVT-NDV) en pollos de engorde en Argentina. XXV Congreso Latinoamericano de Avicultura (CLA), Guadalajara, Mexico, September 26-29.



the extra revenues per 1,000 birds would be +118.23€



Vectormune® ND vs. live ND vaccines (in low ND challenge)



360,000 BROILERS 2 CONTEMPORANEOUS GROUPS SAME ORIGIN SAME FEEDING PROGRAM

GROUP 1 (CEVA):

107,535 BIRDS **VECTORMUNE® ND IN OVO**

GROUP 2:

Vectormune® ND

252,683 BIRDS LIVE ND (VG/GA) VACCINE AT DAY 14



VACCINATION PROGRAMS

RESULTS & CONCLUSIONS

+114g BW

MONTH 1

Final weight (g)

FCR

-8pts FCR

2.500

2 4 5 0 -

2,400-

2,350-

2,300-

1.90

1.86

1.82

1.78

	GROUP 1 - CEVA PROGRAM
D1 (hatchery)	Vectormune® ND (SC) IBD Immune complex vaccine (S Live IB vaccine (spray)
D12	-

2.500-

2.450-

2,400-

2,350-

2.300-

1.90

1.86

1.82 -

1 78

2,494

/ACCINATION PROGRAMS

	GROUP 1 - CEVA PROGRAM	GROUP 2 - CONTROL
ED18 (in ovo)	Vectormune [®] ND	-
D14	-	Live ND (VG/GA) vaccine (spray)









Live ND vaccine

ECONOMIC EVALUATION

Based on cost-benefit calculations (mortality, body weight and FCR),

the extra revenues per 1,000 birds would be +63.16€

ECONOMIC EVALUATION Based on cost-benefit calculations (mortality, body weight and FCR), would be +54.21€

Source: Koutoulis K. 2017. Ceva Vaccinology Summit, Athens, Greece.



1 FARM, 2 GROUPS 1,800,000 DAY OLD CHICKS 2 GROUPS HISTORICAL COMPARISON (3 MONTHS)

GROUP 1 (CEVA): 840,000 BIRDS

VECTORMUNE® ND AT DAY 1

GROUP 2:

891.000 BIRDS

LIVE ND VACCINES AT DAY 1 AND DAY 12



the extra revenues per 1,000 birds

vs. live ND vaccines (in low ND challenge)





4,800,000 DAY-OLD CHICKS, 3 COMPANIES, 2 GROUPS, 10 CONTEMPORANEOUS FLOCKS EACH

GROUP 1 (CEVA):

2,270,000 BIRDS VECTORMUNE® ND AT DAY 1

GROUP 2:

2,519,000 BIRDS LIVE ND VACCINE

SLAUGHTER BETWEEN 36 AND 54 DAYS

COMPANY 2 - Slaughter at 50.5 days



COMPANY 3 - FEMALES - Slaughter at 36.7 days



ACCINATION PROGRAMS

	GROUP 1 - CEVA PROGRAM	GROUP 2
COMPANY 1	437,000 birds Vectormune[®] ND (SC) at D1	555,000 birds Live ND vaccine (spray) at D1 + LaSota (drinking water) at D18
COMPANY 2	761,000 birds Vectormune® ND (SC) at D1	754,000 birds Live ND vaccine (spray) at D1
COMPANY 3	1,080,000 birds Vectormune® ND (SC) at D1	1,210,000 birds Live ND vaccine (spray) at D1

RESULTS & CONCLUSIONS





COMPANY 3 - MALES - Slaughter at 50.7 days



ECONOMIC EVALUATION

Based on cost-benefit calculations (mortality, body weight and FCR),

would be +40.53€

Source: Sesti L. et al., 2013. Assessment of a vector Marek's/Newcastle vaccine through clinical and productive performance of commercial broilers in two different epidemiological situations of Newcastle disease challenge. XVIIIth World Veterinary Poultry Association (WVPA) Congress, Nantes, France, August 19-23.



















the extra revenues per 1,000 birds



Vectormune® ND vs. live ND vaccines (in low ND challenge)



3,000,000 DAY-OLD TURKEYS 2 CONTEMPORANEOUS GROUPS

GROUP 1 (CEVA):

1,200,000 BIRDS VECTORMUNE® ND AT DAY 1

GROUP 2:

1,800,000 BIRDS LIVE ND VACCINE AT DAY 1 WITH 1 OR 2 BOOSTERS



RESULTS & CONCLUSIONS

	GROUP 1 VECTORMUNE® ND	GROUP 2 LIVE ND VACCINE	p value of means	Potential economic impact (€/000 birds)
Number of flocks	16	13		
Slaughter age (d)	46.19	46.77	> 0.05	
ADG g/d)	55.44	50.31	< 0.05	
Slaughter weight (kg)	2.56	2.35	< 0.05	168
Mortality rate (%)	3.18	4.45	> 0.05	7.5
FCR	1.66	1.75	< 0.05	54
Profit (cts/bird)	0.52	0.27	< 0.05	

ACCINATION PROGRAMS

	GROUP 1 - CEVA PROGRAM	GROUP 2
D1 (hatchery)	Vectormune® ND (SC)	1 to 3 Live ND vaccine (spray)

RESULTS & CONCLUSIONS

Results are displayed using a theorical value of 100 as reference.

101

100 -

99



103 102 +0.4%101 FCR 100 -99 -FCR

Vectormune® ND Live ND vaccine



Vectormune® ND is inducing persistant immunity in turkeys, which contributed to significant improvement in final body weights and daily gains.

Calculated income per 1,000 birds was **310€**

Source: Chataigner E. and S. Castagnos, 2018. Field study on production performances improvement in commercial meat turkeys by using a vector vaccine rHVT-ND compared with live vaccines program in France. XVth European Poultry Conference, Dubrovnik, Croatia, September 17-21.



ECONOMIC EVALUATION Based on cost-benefit calculations (mortality, body weight and FCR), the extra revenues per 1,000 birds would be +222.00€

COMMERCIAL BROILER PRODUCTION 29 FLOCKS

GROUP 1 (CEVA):

16 FLOCKS VECTORMUNE® ND AT D1 + LIVE ND VACCINE (LASOTA) AT D12 (DW)

GROUP 2:

13 FLOCKS LIVE ND VACCINE





WHY LIVE ND VACCINE ARE NOT GOOD ENOUG FOR LOW ND CHALLENGE COUNTRIES?

Click or Scan



vs. live ND vaccines (in low ND challenge)

79



Vectormune® ND vs. live ND vaccines (in low ND challenge)



2,500,000 DAY-OLD CHICKS 2 GROUPS, SAME ORIGIN, SAME FEEDING PROGRAM

GROUP 1 (CEVA):

1,113,600 BIRDS VECTORMUNE® ND AT DAY 1

GROUP 2:

1,402,600 BIRDS LIVE ND VACCINE AT DAY 1



/ACCINATION PROGRAMS

	GROUP 1 - CEVA PROGRAM	GROUP 2
D1 (Hatchery)	Vectormune [®] ND (SC)	Live ND (Phy. LMV) vaccine (spray)

D1 (Hatchery)

GROUP 1 - CEVA PROGRAM Vectormune® ND (SC)

RESULTS & CONCLUSIONS







RESULTS & CONCLUSIONS 7.0

VACCINATION PROGRAMS



ECONOMIC EVALUATION

Based on cost-benefit calculations (mortality, body weight and FCR),

the extra revenues per 1,000 birds would be +52.69€





10,000,000 DAY-OLD CHICKS 2 CONTEMPORANEOUS GROUPS

GROUP 1 (CEVA): 5,000,000 BIRDS VECTORMUNE® ND AT DAY 1

GROUP 2:

5,000,000 BIRDS LIVE ND VACCINE AT DAY 1

SLAUGHTER AT 58,9 DAYS (GROUP 1) AND 58,7 DAYS (GROUP 2)





Based on cost-benefit calculations (mortality, body weight and FCR),

the extra revenues per 1,000 birds would be +62.29€

vs. live ND vaccines (in low ND challenge)





ARE NOT GOOD ENOUGH FOR LOW ND CHALLENGE COUNTRIES?

Click or Scan

RESULTS & CONCLUSIONS



COMMERCIAL BROILER PRODUCTION 8 FLOCKS

Control

GROUP 1 (CEVA): **VECTORMUNE® ND**

VACCINATION PROGRAM

GROUP 2 (CONTROL): NO ND VACCINATION





no vaccination

vs.

In low challenge countries, we expect to see low titers. Vectormune[®] ND allows better protection with lower titers. High serological titers show viral challenges

which reduces the export possibilities.





7 Summary of profitability

	Mortality (%)	BW (extra g./bird)	FCR (points)	Results (€/1,000 birds)	Page
Mexico (1)	-0.52	+39	-0.04	+43	43
🚍 Thailand (1)	-2.1	+50	-0.06	+16.80	44
📀 Brazil (1)	-0.63	na	-0.02	+18.93	46
🚃 Russia (2)	-5.9	-52	-0.23	+75.55	49
📻 Thailand (3)	na	na	na	+22.61	51
💳 Indonesia	-6.18	+140	-0.207	+196	56
🗾 India	-1	+100	-0.04	+108	58
🕌 Malaysia (1)	-3.82	-20	-0.12	+108	59
🕌 Malaysia (2)	-2.7	+60	-0.17	+59.10	60
Mexico (2)	-0.58	+53	-0.025	+38.46	61
* Morocco	-3.35	na	-0.01	+42.85	62
👝 Venezuela	-0.89	+111	-0.06	+49.31	64
C• Turkiye (1)	-0.45	+10	-0.03	+58	66
Peru	-3.4	+210-	-0.08	+190.42	67
The Philippines	-4.63	+10	-0.05	+81.73	68
≽ South Africa	-028	+87	-0.02	+34.80	69
💶 Argentina	-1	+53	-0.05	+118.23	72
📕 Belgium	-0.76	+115	-0.03	+63.16	74
📀 Brazil (3)	na	+132	-0.06	+54.21	75
📀 Brazil (4)	-0.9	-10	-0.04	+40.53	76
France	na	na	na	+310*	78
Greece Greece	-1.3	+210	-0.09	+222	79
Poland	-0.23	+138	-0.01	+52.69	80
📕 USA (1)	-1.52	+20	-0.01	+62.29	81

na: not available * Data in turkeys



Ceva





<u>coo</u>		
	Notes	

Vectormune ND® is a reference ND vaccine worldwide



TAKE CONTROL OF TRANSMISSION



Click or Scan



Vectormune[®] ND is the proven reference for the reduction of Newcastle disease transmission.

Whatever your situation; Vectormune[®] ND protects your performance against lentogenic and velogenic strains, thanks to the best in class transmission control!

