Costs and benefits of foot and mouth disease vaccination in commercial dairy farms in Central Ethiopia

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Conclusions & Recommendation

- In previous FMD outbreak in Bishoftu, vaccination was not helpful because it did not reduce financial losses in commercial dairy farms.
- Preventive biannual vaccination with quadrivalent vaccine coupled with treatment during an outbreak is economically feasible.
- Biannual vaccination of dairy cattle with quadrivalent vaccine (O, A, SAT 1 & SAT 2) and medication during an outbreak is recommended.

Background (1)

- Ethiopia has large livestock population, majorly extensive production system

- Dairying is a booming industry, mainly exotic breeds and their crosses are kept

- However, highly susceptible to FMD infection

Background(2)

High seroprevalence of FMD in exotic dairy cattle reported

- Pastoral, 21% (Rufael et al., 2008)
- Mixed farms, 38.4% (Negussie et al., 2012)
- Intensive dairy, 80% (Negussie et al., 2012)

Substantial economic loss

- Andassa, 50% milk loss

Background (3)

- Severe economic losses in Ethiopia
- Trade ban of 2005/2006 > US$14 million (Leforban, 2005)
- Serotype O, A, C, SAT1 and SAT2 are isolated
- Prophylactive vaccination in some dairy farms
- No work on economics FMD vaccination in dairy sector in Ethiopia

Objective

- To estimate benefits and costs of different FMD vaccination practices in commercial dairy farms in Central Ethiopia

Materials & Method (1)

- Stochastic Monte Carlo simulation model was used

Three scenarios

No vaccination

Reactive vaccination

Preventive vaccination

Two sub-scenarios: with & without treatment

Inputs
Questionnaire survey
Expert opinion
Literature

Monte Carlo Simulation
cost and benefit model

@Risk software on Excel spread sheet

No vaccination (Baseline)

Losses
- Milk loss
- Mortality loss
- Loss due to premature culling
- Abortion loss

Expenditures
- Drugs and chemical costs
- Vet. Visit fee
- Other expenses

Reactive vaccination (Scenario 1)

Losses
- Milk loss
- Mortality loss
- Loss due to premature culling
- Abortion loss

Expenditures
- Drugs and chemical costs
- Vet. Visit fee
- Other expenses
- Vaccination and administration expenses

Preventive vaccination (Scenario 2)

Losses
- Milk loss
- Mortality loss
- Loss due to premature culling
- Abortion loss

Expenditures
- Drugs and chemical costs
- Vet. Visit fee
- Other expenses
- Vaccination and administration expenses

M & M (3)

Input data

Questionnaire survey

Expert opinions

Literature

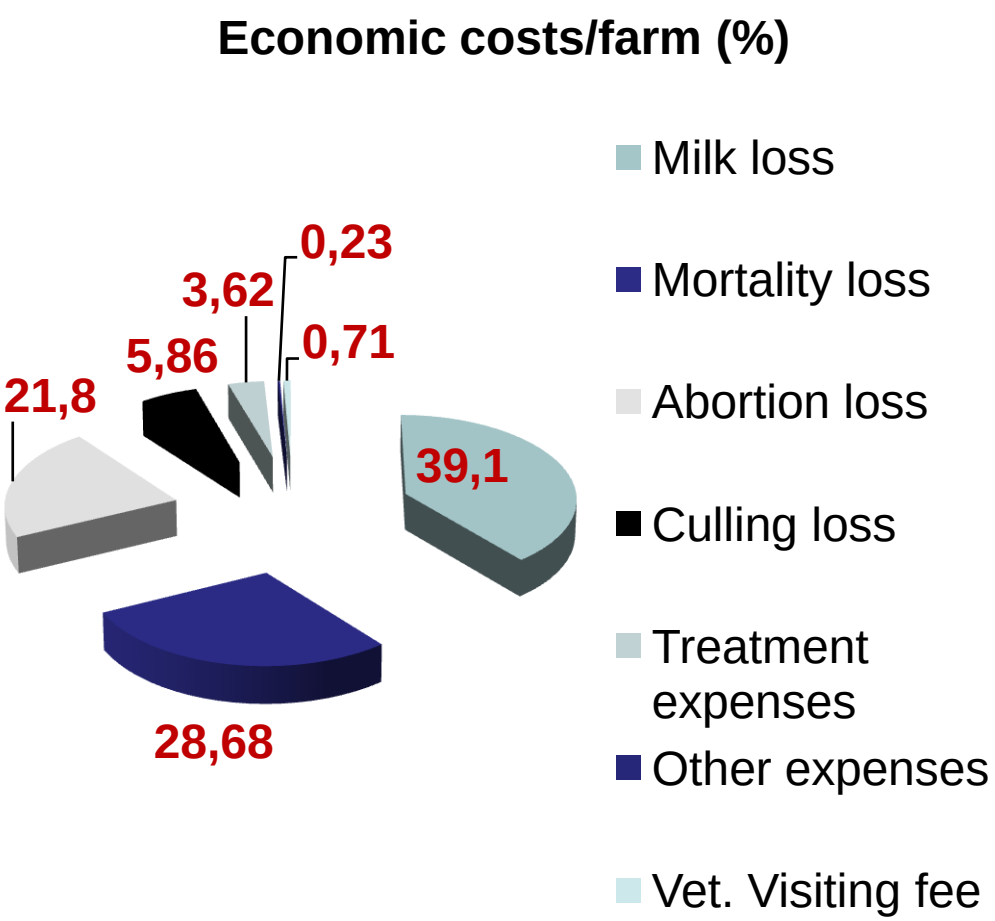
Scenarios	1.1	1.2	2.1	2.2	3.1	3.2	Sources
Reduced Morbidity	0	0%	50%	50%	80%	80%	Expert and assumption
SD	0	0%	10%	10%	15%	15%	
Reduced Mortality	0	40%	34%	60%	55%	90%	Expert and assumption
SD	0	9%	7%	14%	12%	18%	
Reduced Abortion rate	0	50%	33%	45%	59%	75%	Expert and assumption
SD	0	10%	10%	15%	16%	5%	
Reduced culling rate	0	50%	32%	60%	60%	90%	Expert and assumption
SD	0	10%	6%	14%	14%	20%	
Reduced milk loss	0	20%	20%	40%	80%	90%	Expert and assumption
SD	0	5%	5%	8%	18%	19%	
Reduced duration of milk loss	0	25%	25%	38%	40%	50%	Expert and assumption
SD	0	0%	4%	7%	7%	8%	
Reduced treatment expenses	0	0%	20%	20%	30%	30%	Expert and assumption
SD	0	0%	6%	8%	11%	12%	
Reduced other expenses	0	0%	20%	20%	30%	30%	Expert and assumption
SD	0	0%	6%	7%	10%	12%	
Reduced veterinarian visiting fee	0	0%	20%	20%	50%	50%	Expert and assumption
SD	0	0%	5%	6%	12%	12%	
ccination frequency	0	0	1	1	2	2	

Some considerations:

- Imported quadrivalent vaccine
- Preventive vaccination, biannual
- Treatment with antibiotics, multivitamin/Vit. B complex and antiseptics

Result(1)-economic costs of outbreak

Variables	€/herd	€/lac.cow
Milk loss	850.31	53.82
Mortality loss	623.73	39.48
Abortion loss	474.1	30.01
Loss due to premature culling	127.34	8.06
Total losses	2075.49	131.36
Treatment expenses	78.64	4.98
Other expenses	**4.92**	**0.31**
Veterinarian visiting fee	15.52	0.98
Total expenses	**99.08**	**6.27**
Total costs	**2174.57**	**137.63**



Result(2) – ANOVA output

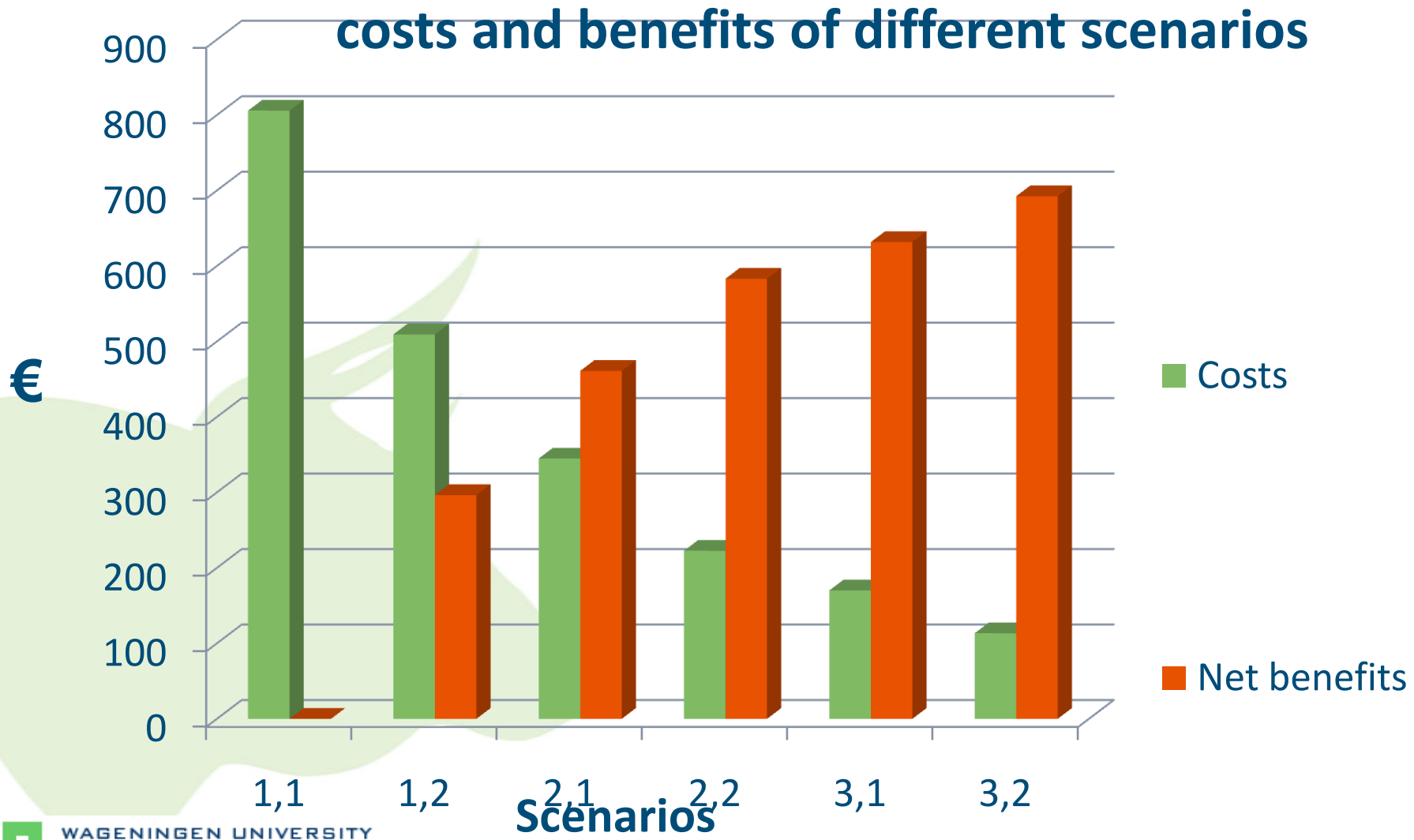
Variables	Comparison among vaccination status (p-value)
Milk loss/cow(litre	0.368
Duration of milk loss(days)	0.287
Morbidity	0.655
Mortality among calves	0.466
mortality among adult	0.513
Abortion rate	0.98
Premature culling rate	0.095
Number of treated animals	0.372
Treatment costs	0.44
Vet visit fee	0.302
Other expenses	0.379

Economic costs among farms of different vaccination status is not significant.

Result (3) – Simulation output

	No Vaccination		Reactive vaccination		Preventive vaccination	
Treatment	No	Yes	No	Yes	No	Yes
	Sc. 1.1	Sc. 1.2	Sc2.1	Sc. 2.2	Sc. 3.1	Sc. 3.2
Milk loss (Euro)	140.55	112.15	61.16	46.28	6.82	4.66
Mortality loss	91.16	61.72	49.18	13.49	18.24	1.16
Abortion loss	99.63	72.04	61.2	45.46	26.54	4.66
Premature culling loss	467.24	228.62	159.09		34.13	10.32
Treatment expenses	0	27.54	0	12.12	0	4.31
Other expenses	0	0	0.57	0.57	0.21	0.21
Veterinarian visiting fee	5.92	5.92	4.74	4.73	2.96	2.94
Vaccine and adm. expenses	0	0	8.92	8.92	85.19	85.19
Costs (losses + expenditures)	**805.82**	**509.3**	**344.86**	**222.66**	**170.09**	**113.36**
Net benefits	**0**	**296.51**	**460.96**	**583.16**	**631.73**	**692.46**
Benefits/cost ratio	0	0.6	1.3	2.6	3.7	6.1

Result(3) - Summary of simulation output



Conclusions & Recommendation

- In previous FMD outbreak in Bishoftu, vaccination was not helpful from economic point of view because it did not reduce financial losses in commercial dairy farms.
- The third Scenario, preventive biannual vaccination with quadrivalent vaccine coupled with treatment during an outbreak is economically feasible.
- Biannual vaccination of dairy cattle with polyvalent vaccine (O, A, SAT 1 & SAT 2) and medication during an outbreak is recommended.

Thank you for your attention!

Questions?