

PZP Vaccine Facts

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Importance of Background Knowledge before PZP Contraceptive Use

- ~ **Trustworthy Information Sources about the Vaccine**
- ~ **What it is made of**
- ~ **Proper and Reliable Storage, Prep and Delivery**
- ~ **Time of Year for Treatment**
- ~ **Horse Accessibility**
- ~ **Knowledge of Horse Population**
- ~ **Identity of Individual Mares and their Foals**
- ~ **Management Potential and Costs**

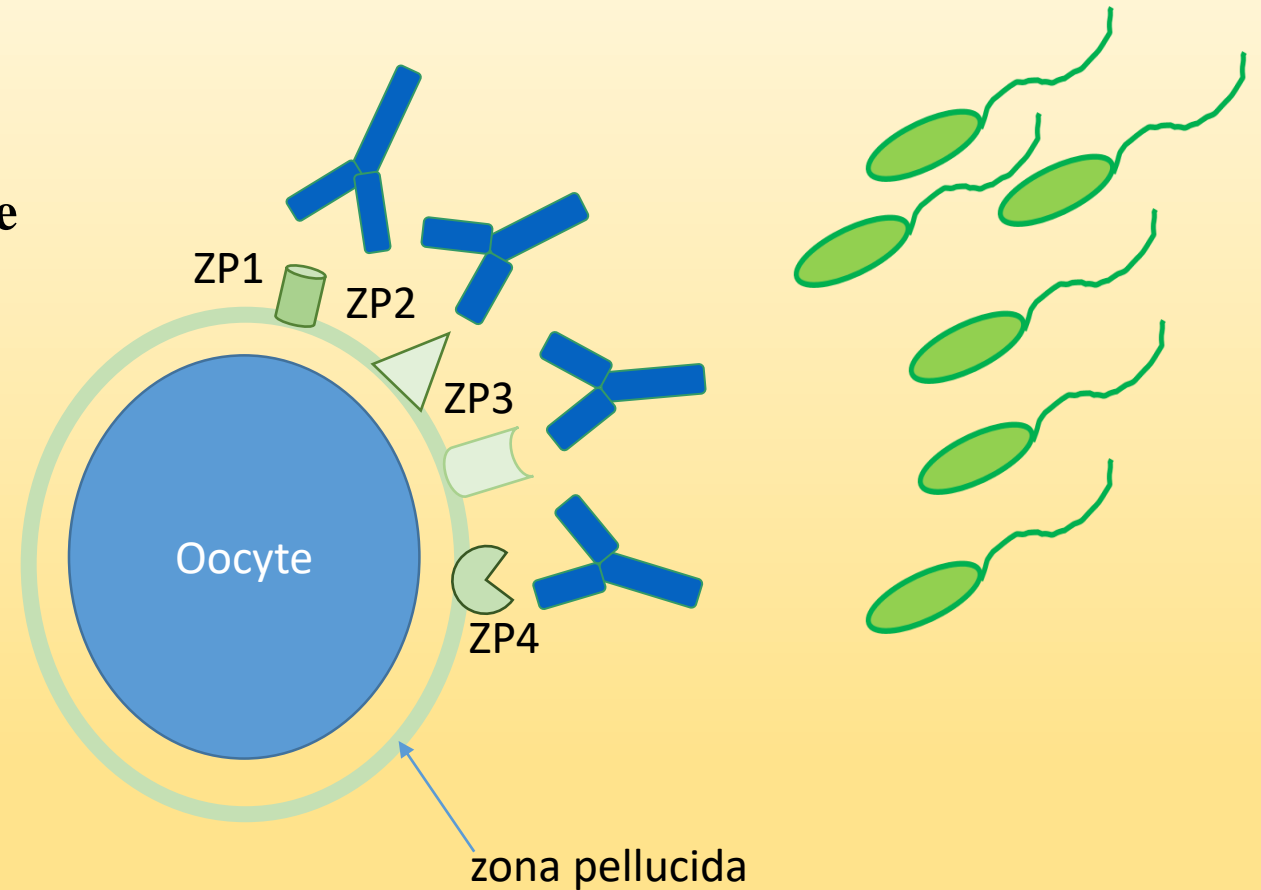


PZP Vaccine

~ PZP (Porcine Zona Pellucida) is derived from the protein coating around pig eggs.

~ Once isolated, mixed with an appropriate adjuvant (an enhancer of immune response) and injected, it raises antibodies that attach to the surface of ovulated eggs of various species and prevent sperm from attaching to the egg.

~ Result >>>>>>NO fertilization.



Most-Used Physical Forms of PZP-based Vaccine

Native PZP (Zonastat H):

A priming-dose emulsion of PZP/Adjuvant followed 3-4 wks. by a booster injection of PZP/Adjuvant with continued efficacy via annual booster.

PZP-22: *

A priming-dose emulsion of PZP/Adjuvant plus delayed-release pellets containing booster doses imbedded in polymers to give 1-yr and partial 2nd year efficacy.

* Field studies (2008-2016) showed that PZP-22 treatment followed in 2-3 years by a Native PZP booster would provide at least 5 years of effective contraception (ave. ~20% fertility) across 7 years. Untreated fertility rates are 65% or greater ([Rutberg et. al., *Wildlife Research*, 2017](#)).

PRIMER FACTS

PZP CONCENTRATION EFFICACY:

- ~ Aqueous, 0.5 to 0.6 ml
- ~ 50ug (poor) ; 65ug (moderate to high) ; 100ug (high)
- ~ A dose between 100-400ug (no significant difference)

ADJUVANT:

- ~ Adjuvant is mFCA (modified Freund's Complete Adjuvant) :
 - ~ 0.5-0.6 ml mineral-oil/emulsifier with cell walls from killed bacteria, well-suspended
- Note that booster adjuvant (Freund's Incomplete) is similar to above but has no cell walls.

EMULSION QUALITY:

- ~ quality dictates booster response
- ~ ideal consistency is between hand lotion and mayonnaise

Primer Shelf-life

SHORT TERM:

- ~ **PZP at 4-8 C in PBS is good for 1 week but at room temperature is good for < 24 hrs.**
- ~ **mFCA at room temperature is good for at least 3 days.**
- ~ **Emulsion in syringe at 4°C breaks down in 2-7 hours depending on the initial consistency.**
- ~ **If emulsion becomes sloppy, it must be re-emulsified before injection.**

LONG TERM:

- ~ **PZP stored at -20°C to -40°C retains full bioactivity for more than 5 years**
- ~ **mFCA stored at 4-8°C retains full bioactivity for more than 3 yrs.**

Controlled-Release Pellets for PZP-22 Vaccine

FOUR COMPONENTS:

- ~ Polymers (3 types, designed to release at approx. 1,3 and 12 months)
- ~ PZP in lyophilized form
- ~ QA-21 powder
- ~ Colored Dye (different color for each type)

CHARACTERISTICS:

- ~ ingredients survive to 120°C (well above boiling temp.) when embedded in polymers
- ~ pellets are small cylinders (approx. 1.5 mm X 2-4 mm.)
- ~ fit into barrel of 14-gauge hypodermic needle for injection

Pellet Shelf-life

- ~ Pellets are stable frozen or refrigerated
- ~ Should be stored with desiccant (moisture causes gradual breakdown)
- ~ Pellets can be stored in hypodermic needles with survival same as above
- ~ Best long-term storage is at -20 to -40 C for shelf-life at least 5 years (likely longer but needs testing)



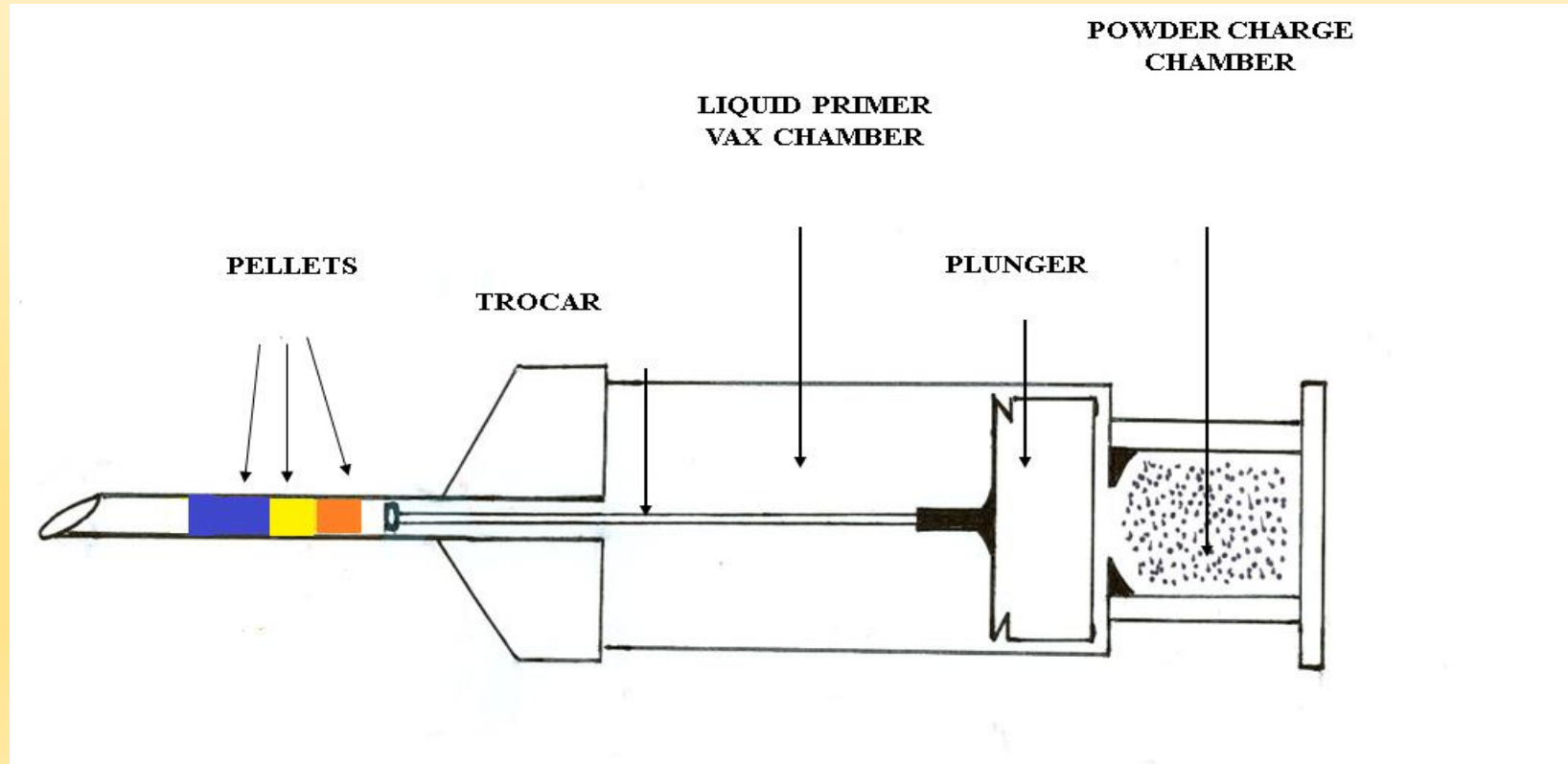
Field Delivery of PZP-22 Vaccine

In field Corrals:

- ~ Trocar (syringe) in jab stick for pellets
- ~ hand injection for primers

Remote Delivery:

- ~ dart (see fig.)



Quality Control and Efficiency

Finding SOLUTIONS !!!!!

- **Issues addressed 2017-2018 as part of a BLM contract to produce PZP-22**
 - ~ **Static electricity reduced by Alpha-particle emitter**
 - ~ **Pellet materials-handling loss reduced by > 20%**
 - ~ **Pellet production efficiency increased by >30%**
 - ~ **Pellet PZP content assayed for each pellet batch**
 - ~ **PZP-batch bioactivity determined via titer testing in mice**
 - ~ **Testing of pellet shelf-life maximum in progress**
 - ~ **Comparison of polymer-release characteristics from different suppliers**



**Preliminary Fertility Projections for PZP-22
Based Contraception In Wild Horse
Management**

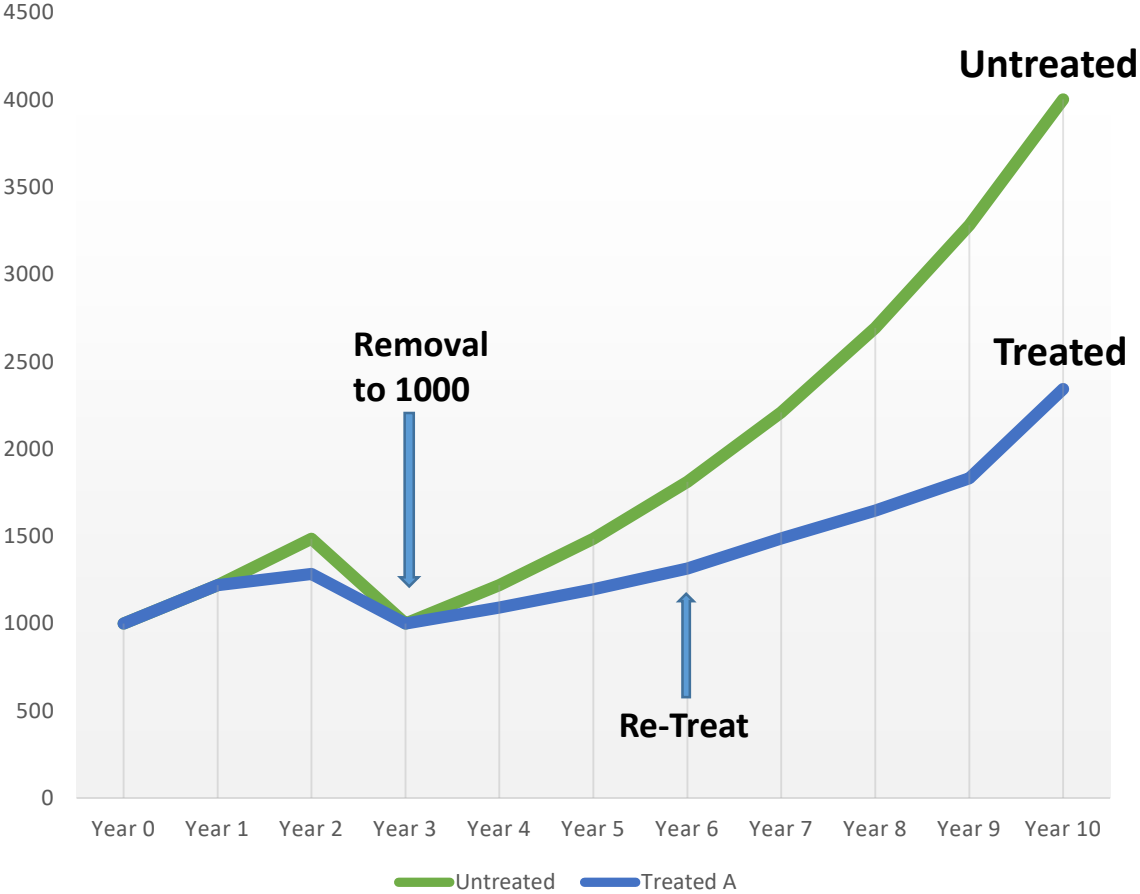
Assigned projection characteristics

- ~ **Starting Population: 1000 horses**
- ~ **Sex Ratio : 1:1**
- ~ **Mares as % of population : 38%**
- ~ **Foaling Rate: 62%**
- ~ **Foal survival rate: 93%**
- ~ **Gather access to horses: 80%**

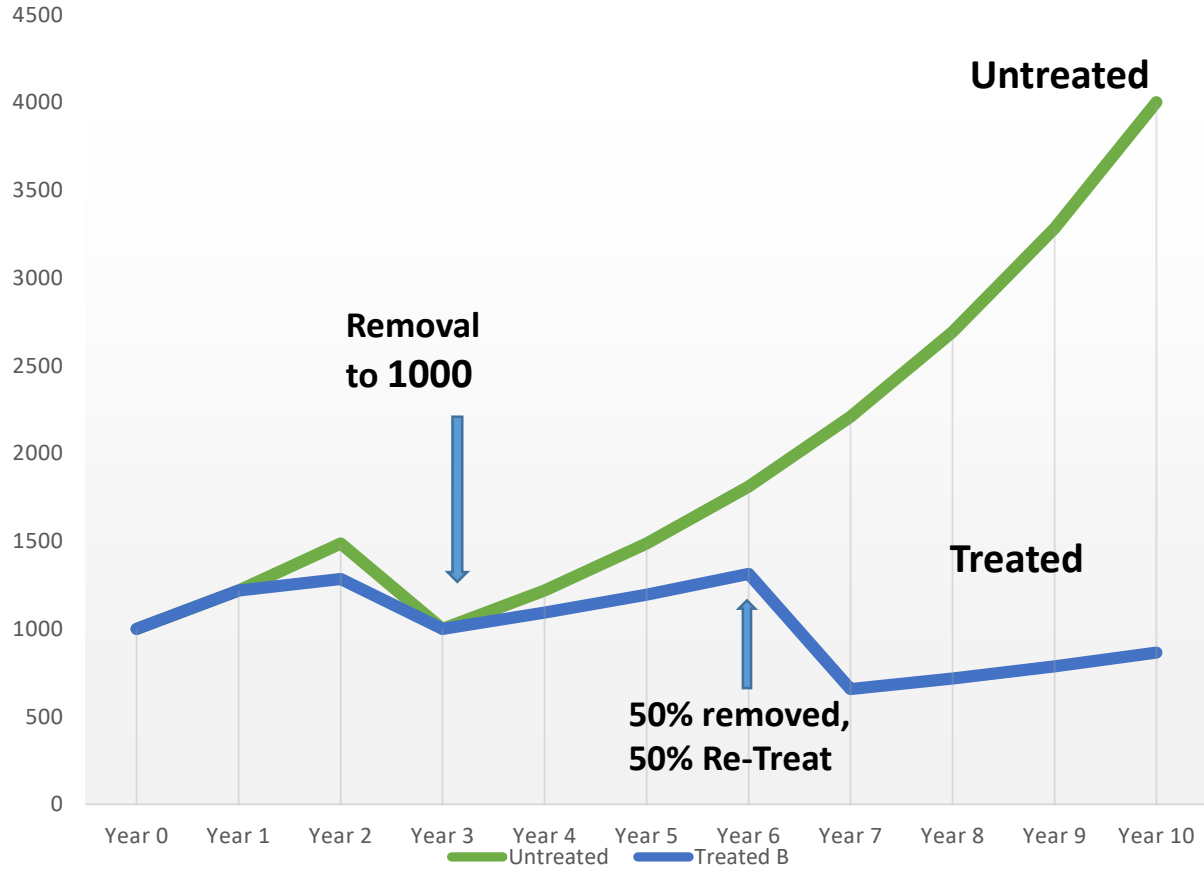


Fertility projection comparison between Untreated and Treated Models

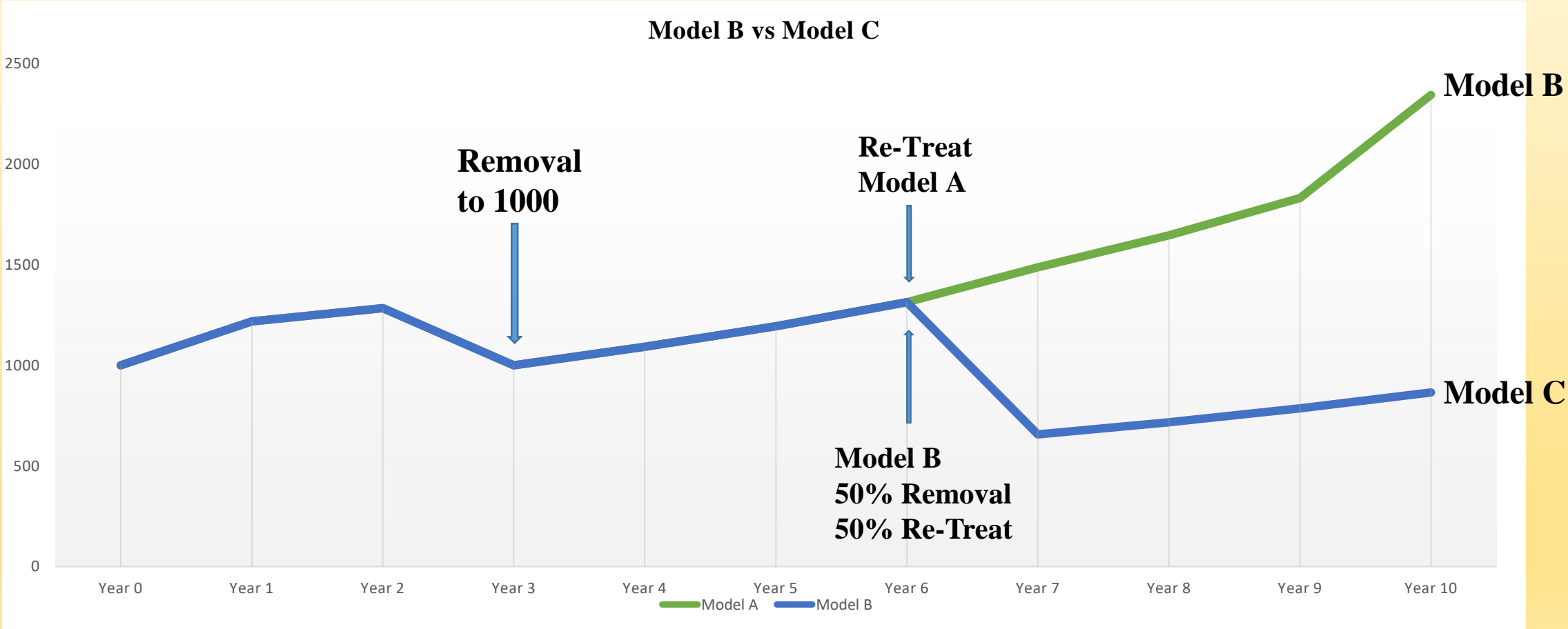
Catch/Re-treat/Release (Model A vs Model B)



Catch/Re-Treat50%/Release50% (Model A vs Model C)



Comparison of year-7 booster with/without partial removal



Cost/Foal Projections Across 10 Years for 3 Management Scenarios

A

B

C

Untreated + Removal (Year-3)	Treated + Removal (Yr-3) +CTR (Yr-7)	Treated + Removal (Yr-3) +CTR 50% and Removal 50% (Yr-7)
Total horses removed = 4814	Total horses removed = 2855	Total horses removed = 2063
COST = \$ 231, 070, 200 *	COST = \$ 137, 040, 000 *	COST = \$ 99, 024, 000 *

* Based on \$48,000/horse lifetime captivity (doesn't include gather costs of approx. \$800K each gather).

Also, PZP-22 vaccine costs = <0.004% of a given Scenario cost [i.e., \$ 494,000 (Model B), \$ 369,000 (Model C)]

Foals not Born:

~ A-B = 1959

~ A-C = 2751

~ B-C = 792

Cost Savings:

~ A-B = \$ 94,030,200

~ A-C = \$ 132,046,200

~ B-C = \$ 38,016,000

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