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Applying Salmonella vaccination at the top of a UK pig production pyramid

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Introduction

Salmonella is widespread in pig farms, causing both disease in humans and economic costs for society, regulators and pig farmers. The reduction of zoonotic non-typhoidal *Salmonella* in animals at slaughter can improve the safety of meat and offal for human consumption, and reduce the risk of cross-contamination on the slaughter line. Previous UK studies have shown sow vaccination can reduce *Salmonella* prevalence (Davies at al., 2016; Smith et al., 2018). However, vaccination is unlikely to be cost-effective on most pig farms producing finisher pigs, as most infections are subclinical (Gavin, 2018). The continuing supply of infected pigs to breeding and rearing farms undermines the effectiveness of other interventions applied to reduce *Salmonella*. It has been proposed that reducing transmission at the top of a production pyramid might improve control throughout the pyramid whilst remaining cost-effective.

Material and Methods

This study used a single production pyramid, following a closed multiplier farm and 2-3 representative farms at each of the following levels: gilt mating unit and surplus breeding stock, breeding, rearing, and finishing farms. Following a baseline visit to the farm, sows and piglets in the multiplier herd were given a live attenuated vaccine against S. Typhimurium, according to the manufacturer's recommendations. Repeat visits to this farm were carried out 6, 9, 12 and 15 months after the start of vaccination. Farms directly receiving pigs from the multiplier (gilt mating unit and two surplus finisher farms) also received a baseline visit before vaccinated piglets arrived on these farms, then were visited 9 and 15 months after vaccination commenced. Baseline visits to three outdoor breeder farms and two rearer farms they supplied were carried out at around 6 months into the study, shortly before the vaccinated mated gilts were placed on the breeder farms, with follow-up visits at 12 and 18 months. The two finisher farms supplied were visited at the 6 and 18 month time points. Pooled and individual floor faeces and environmental samples were collected at each visit, ensuring sufficient samples were collected within each pig stage to allow for estimations of prevalence and serovar diversity within and between stages. Samples were cultured by a BPW, MSRV and Rambach agar method using a modification of the ISO 6579:2002 (Annex D) method, as described previously (Martelli et al., 2014). Positive isolates were serotyped using standard methodology (Jones, McLaren and Wray 2000). Typhimurium strains cultured from the multiplier farm and the farms directly receiving their weaned piglets (i.e. the gilt mating unit and the surplus breeding stock farms) were tested to differentiate the vaccine strain Typhimurium from wild-type. At each visit, data on farm management practices was also collected, to monitor any other changes that may have influenced the prevalence of *Salmonella* over time.

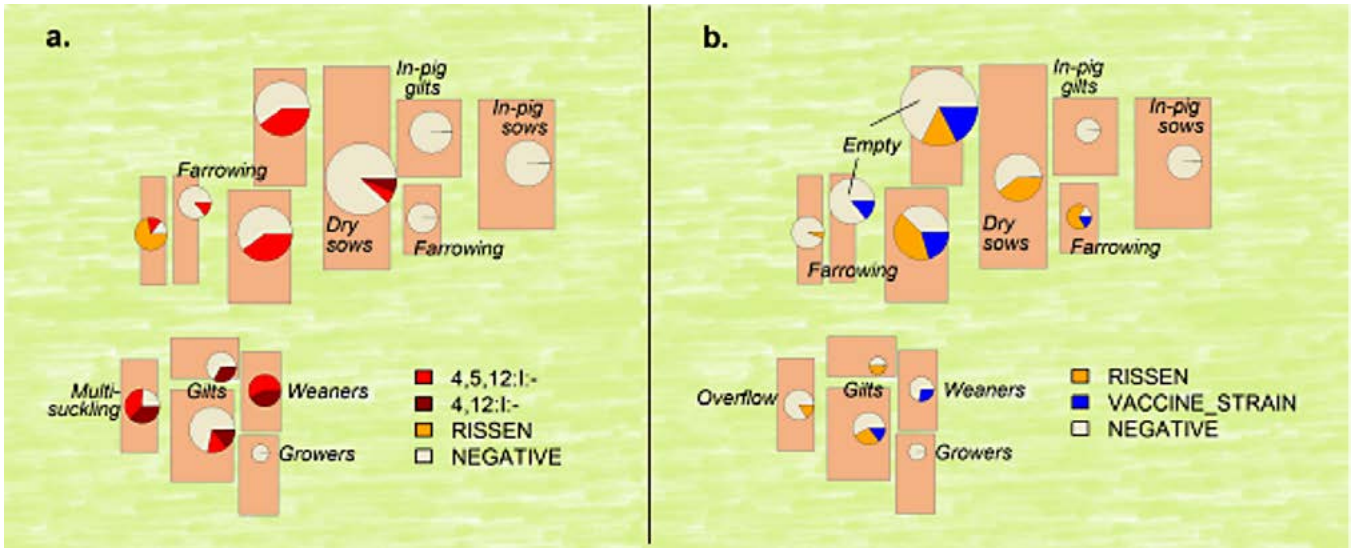

Figure 1: Distribution of Salmonella serovars scaled according to the number of samples per building

Results

At the initial visit to the multiplier farm, *Salmonella* prevalence in pooled samples was 38.2%, with mainly monophasic S. Typhimurium detected, plus a few S. Rissen isolates in a single farrowing shed (Fig 1a.). Following vaccination, the prevalence of monophasic S. Typhimurium steadily reduced and S. Rissen became the predominant serovar. Similar results were observed in the farms directly supplied by the multiplier. Clinically, the farmer reported a reduction in scouring in weaned pigs, and the gilt mating unit was able to stop the use of apramycin for prevention of enteric disease in weaners received from the multiplier unit. At the final visit to the multiplier farm, only vaccine-strain Typhimurium and S. Rissen were detected (Fig 1b.). Some reduction in monophasic S. Typhimurium was observed in other farms in the pyramid, although detection of other serovars, particularly S. Newport, increased and overall *Salmonella* prevalence did not decrease in these farms.

Discussion and Conclusion

Vaccination of sows and piglets on a closed multiplier farm demonstrated that the control of monophasic S. Typhimurium was achievable. The spread and persistence of S. Rissen, and the detection of this serovar at the final visit in empty sheds that had been cleaned and disinfected showed that, overall, biosecurity was sub-optimal. However, as this serovar is relatively non-pathogenic in pigs and people, the farm was satisfied with the results of the vaccination programme. The farms directly supplied with vaccinated weaners by the multiplier herd showed a similar change in the dominant serovars from monophasic S. Typhimurium to S. Rissen, highlighting the role that pig movements play in maintaining infection and environmental contamination on farms. Lower down the pyramid, in the outdoor breeder, rearer and finisher farms, some reduction in S. Typhimurium was also observed, although the fact that other serovars maintained *Salmonella* prevalence at a similar level to the pre-vaccination period suggests that eradicating these opportunistic infections from this environmental niche may not be realistic.

This study indicates that vaccination of pigs in a closed gilt multiplier farm was effective in reducing a serious zoonotic *Salmonella* serovar on this farm and also demonstrated improvements in herds further down the pyramid.

References

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