



Limits in extensive swine husbandry – a case study of Turopolje pig production system in Croatia

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ABSTRACT

Turopolje pig production system could be define as an extensive swine production system in which large areas of pasture and woodland are used (more than 3 ha/pig) with low investment in housing and feeding. The aim of this paper was to analyze the state in Turopolje pig population in relation to reproductive traits and brucellosis outbreaks. The obtained results showed the slow increase of breeding (12 vs. 138 sows and 3 vs. 18 boars) and effective population (9.6 vs. 63.7) from 1996 to 2009, respectively. As main reasons fore that state were detected low farowing index (1.0 to 1.33), small litter size (4.44 and 4.21 total born and born alive piglets, respectively), high mortality of piglets in suckling period (up to 35%) and consequently low number of weaned piglets per sow per year (4.45) as well as brucellosis outbreaks (44.16 % and 30.12 % serologically positive blood samples in year 2008 and 2009, respectively). In order to changes of that state urgent development of health management program and improving in production system (housing, feed supplementation, keeping area) are needed.

(Keywords: Turopolje pig, production system, liter size, brucellosis)

INTRODUCTION

The extensive swine production could be defined as a system in which large areas of land are used with low investment in housing and feeding (Honeyman *et al.*, 2005). In this system pigs are mostly kept outdoor and have a freely access to pasture and soil. If this production system is coupled with intensive management practices can result in acceptable production level, high quality of pork and excellent animal welfare (Honeyman *et al.*, 2001). Generally is accepted that old pig breeds such as Turopolje pig is well adapted to extensive conditions (Đikić *et al.*, 2002). Turopolje pig is originally created as a pig adapted to extensive farming in periodically flooded forests of English oaks and marsh meadows in continental climate (Đikić *et al.*, 2002; Đikić *et al.*, 2006). In all phases of “Turopolje pig production system”, pigs were kept outdoor with extensive using of woodland (>3 ha/pig), except the farrowing and suckling period in which sows and pigs are kept in wooden field building type “stanci” with restricted moving area in wood environment Feeding is based on utilization of natural resources such as pasture, acorn and soil with addition of 0.5 kg of corn seed/pig, especially in suckling and late fattening period as well in winter season with snow (Jurić *et al.*, 1997). Production level of this production system could be highly influenced by weather conditions and control of diseases. In the past it was reported about outbreaks of some

diseases (swine fever, brucellosis, leptospirosis) which limits the increase of breed size and production level (Cvetnić *et al.*, 2002; Cvetnić *et al.*, 2003; Roić *et al.*, 2007). The purpose of this paper was to analyze the state in Turopolje pig population in the period from 1996 to 2009 in relation to reproductive traits and brucellosis outbreaks.

MATERIALS AND METHODS

The size of population

The size of breeding population (number of sows and boars, total reproducers) and number of farms were analyzed in period between 1996 and 2009 using a data of Annual reports - Pig breeding of Croatian Livestock Center (CLC, 1997 to 2010). The effective size of population (N_e) was calculated according to formula by Falconer and Mc Key (1996):

$$N_e = 4 \cdot \frac{Nm \cdot Nf}{Nm + Nf} \quad (1)$$

where N_m is number of male (boars) individuals and N_f is number of female (sows) individuals.

Reproductive parameters

Data were collected in the period from 2000 to 2009, in several farms, representing two major parts of the current farming area of Turopolje pig, Turopolje field – woodland area near Zagreb and Natural park “Lonjsko Polje”. It was collected data from 529 litters and 388 sows registered in Herdbook of Turopolje pig breed. Sows were kept on all farms under similar conditions in outdoor production system with extensive using of woodland and pasture. Collected data include: farowing index, number of piglets (total born, born alive and weaned piglets) per litter and per sows and year.

Serological test

During the year 2008 and 2009 blood samples from 385 and 83 animals were collected, respectively and were serologically tested to *Brucella suis* infection. The Complement Fixation Test (CFT, Institut Pourquier, Montpellier, France) was used as test for serological testing on brucellosis. The result of the test was interpreted according to producer recommendations.

RESULTS AND DISCUSSION

The program of renewal and conservation of Turopolje pig breed was started in the year 1996. At the beginning in herdbook were registered only 12 sows and 3 boars. In the next three years (Table 1) population was standardized and number of breeding animals were consolidate to 36 sows and 6 boars in 1999, what could be used as a basic year for considerable increase in number of breeding population. In the period from 1999 to 2008 the size of breeding population was increased near the 5 times in number of sows and 6 times in number of boars registered in herdbook. The increase in number of boars and sows resulted in the increase size of effective population, from 20.6 to 98.6 in year 1999 and 2007, respectively. According to the FAO criteria for determining breeds at risk (Loftus and Scherf, 1993), Turopolje pig was in critical status from 1996 to 2003 and in the status of endangerment from 2003 to 2008. But in 2008 the numbers of sows and boars was decreased about 21% in relation to 2007 and was not significantly changed during the year 2009, primarily due to outbreak of brucellosis in Turopolje pig population.

Table 1**Breeding population of Turopolje pig in Croatia**

Year	Total reproducers	Sows	Boars	Effective size of population	Farms
1996	15	12	3	9.6	-
1997	25	17	8	21.8	-
1998	19	13	6	16.4	-
1999	42	36	6	20.6	5
2000	45	40	5	18.8	5
2001	50	45	5	18.0	4
2002	74	70	4	15.1	3
2003	105	99	6	22.6	2
2004	125	116	9	33.4	2
2005	143	129	14	50.5	3
2006	150	137	13	47.5	4
2007	193	164	29	98.6	4
2008	145	130	15	53.8	5
2009	156	138	18	63.7	5

Source: Annual report – pig breeding, HPA (1997–2009).

As shown in *Table 2*, in the year 2008 and 2009 about 44% and 30% of tested blood samples of Turopolje pigs were serologically positive to *B. suis* infection, respectively. According to Croatian legislation, all serologically positive animals to *B. suis* infections could be excluded from population. In spite of this, a lot of animals were excluded from breeding population what could explain decrease in number of breeding animals in Herdbook in 2008 and similar number of breeding animals in 2009.

Table 2**Seroprevalence of brucellosis in Turopolje pig breed in year 2008 and 2009.**

Year	Total number of blood samples	Serological positive blood samples	
		Total	%
2008	385	170	44.16
2009	83	25	30.12
Total	468	195	41.67

Swine brucellosis is contagious disease in pigs caused by the bacteria, *Brucella suis* that could be transmitted to humans. Infection occur primary in domestic and feral pigs, while wild boar (*Sus scrofa*) and/or European hare (*Lepus europeus*) could be assume as a natural reservoir of *B. suis*. The most common symptoms of brucellosis include non-specific reproductive disorders such as infertility, abortion at any stage of gestation, stillbirth, weak pigs and *orhitis* in boars. The disease spreads by semen during coitus and by ingestion or inhalation of bacteria in reproductive fluids, placenta, aborted fetuses, urine or milk. Pigs kept in extensive production systems such as Turopolje pig

production system are highly exposed to *B. suis* infection. In Turopolje pig production system pigs are mostly kept outdoors with extensive using of pasture and woodland. Housing is based on natural covering or in primitive woodenly buildings type “Stanci”. Pigs often graze together with other species of domestic animals and mate naturally. All of this increases the possibility of direct contact among pigs from different owners as well as with wild boar (Cvetnic et al., 2003). In addition, earlier study (Cvetnic et al., 2009) suggest that brucellosis occur enzootic in Croatian population of wild pigs, especially in breeding area of Turopolje pig. In spit of this, presence of *B. suis* in pigs environment and extensive production system could be explaining for occurring and high prevalence of brucellosis in Turopolje pig population. It was reported about some other contagious diseases (leptospirosis, swine fever) in pigs and/or in wild animals in breeding area of Turopolje pig (Cvetnic et al., 2002; Roic et al., 2007), what emphasize problems in control of infectious diseases in Turopolje pig production system. In addition, slow increasing of breeding population could be explained due to low farrowing index, high mortality during suckling period, low interest of family farms and lack of pastures and forests areas for keeping of pigs (Table 3).

Table 3

Reproduction traits of Turopolje pig breed

Year	Number of litters	Farrowing index	Number of piglets					
			Average per sow			Average per litter		
			Total born	Born alive	Weaned	Total born	Born alive	Weaned
2000	37	1.12	6.24	6.15	4.85	5.57	5.49	4.32
2001	23	1.10	6.14	5.95	3.90	5.61	5.43	3.57
2002	11	1.00	-	-	4.55	-	-	4.09
2003	36	1.00	4.78	3.33	2.83	4.78	3.33	2.83
2004	120	2.00	6.57	6.57	1.32	3.29	3.28	0.66
2005	39	1.00	3.21	3.13	3.08	3.21	3.13	3.08
2006	20	1.33	7.40	7.40	7.13	5.55	5.55	5.35
2007	34	1.17	6.66	6.48	6.41	5.68	5.53	5.47
2008	29	1.16	5.96	5.88	5.32	5.14	5.07	4.59
2009	60	1.02	5.64	5.34	5.15	5.55	5.25	5.07
Total	529	1.19	5.26	5.02	4.45	4.44	4.21	3.90

The results in Table 3 shown low farrowing index (in average 1.19) and high variability in number of total born piglets per litter and sow (3.21 to 5.68 and 3.21 to 7.40 piglets per litter and sow, respectively.) In the same time more than 90% of total born piglets were born alive, while mortality during suckling period varied between 2% and 35%. Except was in year 2004 when was observed 2.0 litters per sow, but only 3.29 total born piglets/litter and 80% of mortality during suckling period. These results suggest that Turopolje pig production system as an extensive system is more dependent on environmental conditions (weather conditions, keeping area and availability of natural feed resources – growing plants, forest fruits, and soil animals) and one farrowing per year in warm season with abundance of vegetation is sufficient. Contrary, if used as a usually practice two farrowing per year one of these come in cold and humid season what could have a strong influence on survival of young piglets. The whole population

of Turopolje pig was fragmented in two large herds with more than 50 reproducers each and several small family herds with 3 to 10 animals each in relatively small breeding area. That distribution could contribute to higher decreasing in size of Turopolje pig population due to outbreaks of infection diseases.

CONCLUSIONS

Traditional Turopolje pig production system could be define as an extensive swine production system in which large areas of pasture and woodland are used (more than 3 ha/pig) with low investment in housing and feeding. As a main limiting factors in this system were obtained: outbreaks of infections diseases (brucellosis, swine fever, leptospirosis), low farowing index (1.0 to 1.33), small litter size (4.21 piglets born alive), high mortality of piglets in suckling period (up to 35%) and consequently low number of weaned piglets per sow per year (4.45). This could explain slow growth in size of Turopolje pig population since 1996 to 2009 (in total 42 vs. 156 breeding animals in year 1999 vs. 2009, respectively). In order to changes of that state urgent development of health management program and improving in production system (housing and feed supplementation in suckling period) as well as marketing of traditionally Turopolje pig meat products are needed.

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