DO HENS REALLY GO OUTSIDE IF THEY ARE ALLOWED TO DO SO?

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Abstract

On an organic farm the possibility of registering the open-air run use of hens with RFID equipment was studied. Also the use of the open-air run by 70 laying hens was assessed. In the corridor between the poultry house and the outdoor area transceiver equipment was installed and the flock was equipped with a so-called transponder attached to a leg of each hen with a special strip.

The experiment showed that it is possible to register the in- and outdoor transmissions of hens with the special transceiver equipment. The used configuration showed that if a hen passes the transceiver unit very quickly (> 60 centimeter/second) information could be missed (what happened in around 11% of all the case). It is expected that with small technical modifications the technical performance can be improved and even a higher percentage of the transmissions can be recorded. Hens that fly over the unit at some height cannot be identified.

During all observation days the possibility to go outside was used by every individual hen. On average the hens were outside for 14 periods of approximately 30 minutes (approximately 7 hours outside). On average 50 hens (72%) were outside simultaneously. The hens were outside during about 60% of the time the open-air run was accessible.

General conclusion of the experiment: With RFID equipment the in- and outdoor transmission behavior of hens can be characterized.

Keywords: *RFID, identification, laying hens, transceiver*

1 Introduction

The way hens are kept is deviating from what is natural. There are initiatives from the society and the government to return to a more natural husbandry (Wageningen UR, 2004). Natural husbandry is an important well-being aspect (Bestman, M., 2002) for hens. Next to the poultry house were the hens can rest, eat, drink and produce eggs there can be open-air run were the hens can also forage. It is relevant to know whether all the hens indeed use the possibility to go outside.

Most animal identification systems do not have the anti collision possibility. This means it is not possible to identify more then one animal (identification code) at the same time with the same transceiver. There are transponders available that have the possibility of anti-collision but for animal identification these techniques are still under development. Special transceivers that do

have the possibility to read more then one transponder at the same time are another possibility. These techniques are already available for practical use. This equipment uses a central unit to activate the transponders that are in the field and uses several smaller reader units to read the identification codes of those transponders. With this technology it is also possible to identify the direction an animal is moving in.

2 Material and method

On an organic hen farm radio frequency identification equipment was installed in the passage from poultry house to open-air run. The hens on the farm had the opportunity to go outside during daytime.

2.1 The hen farm

For the research all the 70 hens that were kept in a poultry house were equipped with a glass transponder. In the poultry house was ad. lib. feed and water available to the hens. The nests were inside the poultry house and during the night the hens went to roost in the poultry house. Through a door the hens could go outside from around 8.15h in the morning until around 19.00h in the evening. During the night the door was closed. Food was spread outside ones every day.

Figure 1 A transponder was attached to one of the legs of the hens with a special string.

2.2 The equipment

With a special string a FDX-B injectable 19mm glass transponder was attached to one of the hens legs (figure 1). The strings were attached to the leg of the animal with a special plier. After the experiment the strings could easily be removed.

A transponder is a passive device that can transmit the programmed identification code. Passive means that the transponder does not us a battery but picks up energy from the electric magnetic field produced by a transceiver. The manufacturer of the transponder programs the transponders

identification code once. The transponder manufacturer guarantees the unicity of the identification code.

Normally a transceiver uses the same antenna for sending and receiving. With such a transceiver it is impossible to decode the id-code of several transponders at the same time. Industrial transponders are available where the transceiver can give a command that demands the transponders to answer randomly in one of the different time frames that are available for answering. This anti collision mechanism makes it possible to read more then one transponder in the transceivers field at the same time. These transponders and transceivers are not jet available for animal identification purposes.

During the experiment a special transceiver was used that makes it possible to read more then one transponder at the same time. This transceiver has two different types of antennas. One antenna is intent to charge the transponders with energy and several smaller receivers are attached to pick up the signals that are sent back from the transponders. These receivers are also only capable to decode the signal of one transponder at the same time. But because the receiver has only a small receiving area the chance of having more then one transponder in the transceiver field is limited. By positioning a number of receivers in a matrix the transponders can be read in a bigger area. The transceiver registers the transponder codes and also the position of the receiver that has received the id-codes. By analysing the sequence of the information that is stored by the transceiver the direction a transponder is moving in can be estimated.

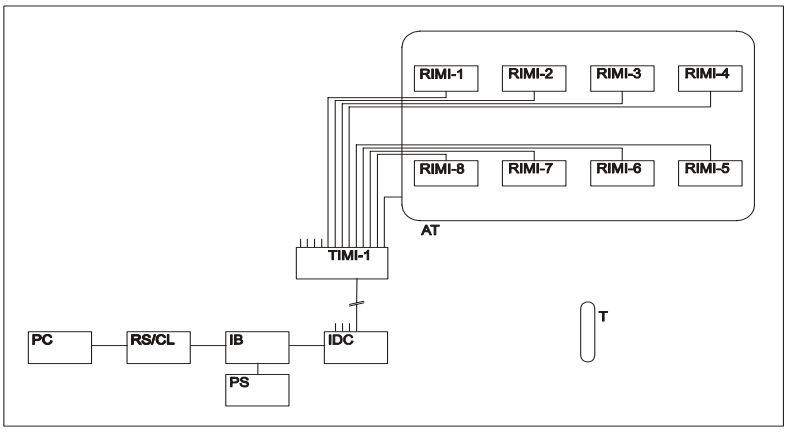

Figure 2 Schematic overview of the equipment.

In figure 2 a schematic overview of the transceiver that is used is given. The antenna AT is intent for the activation of the transponders (T). The RIMI (receiver individual milk-place identification) units 1 until 8 are the receiver modules. The antenna and the receivers are attached to a TIMI (transmitter individual milk-place identification), this TIMI is attached to an ID-controller (IDC) that by an interface bridge (IB) and a RS232 to current loop (RS/CL) convertor communicates with a personal computer (PC). The equipment is powered with a power supply that is attached to the interface bridge.

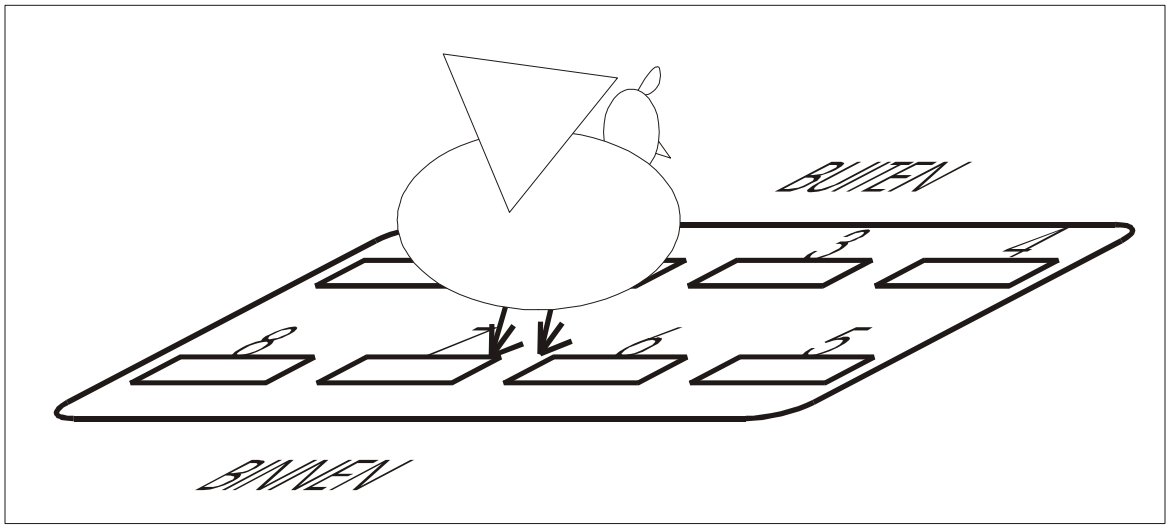

Figure 3 A hen moves over a matrix of readers, a transponder attached to the hens leg is activated by a big transmitter antenna.

The antenna and the transceivers were assembled in a passage. The hen in figure 3 going from the inside to the outside will first be identified by one or more of the transceivers 5 to 8 and then through one or more of the transceivers 1 to 4. Goes the hen from the outside to inside then she will first be identified by 1 to 4 and then by 5 to 8. All the identifications are sequentially logged in a file. The reading frequency of the transceivers is around 3.5 readings per second.

2.3 The research

The research was done in October 2004. The equipment was installed on the 18th of October and also the transponders were attached to the legs of the hens on the 18th of October. The data was registered in the period from 19th until 26th of October 2004. The data was continuously logged and every day a backup was made.

The data was analysed in a number of steps what ultimately lead to a division per hen in two different categories: going outside! and going inside!. For such a registration at least one reading should take place on the inside (reader 5-8) and one reading should take place on the outside (reader 1-4). In some cases one of those readings was missing. If one of the readings was missing then the transmission direction of that hen became uncertain. The undefined transmissions were registered as going outside? or going inside?.

The research data does not allow statistical analyses. The results are presented as descriptive statistics (SPSS 12.01 for Windows 2003).

3 Results

In table 1 the number of registrations and the number of transitions are registered per day. On the 20th of October the back-up procedure failed and on the 25th of October there was a power failure, so on those two days there was no data registered. On the 26th of October two hens had lost their transponder.

Table 1 Number of registrations and the number of transitions that are registered per day.

Date	Registrations	Transitions	Hens
19 October 2004	56849	2519	70
20 October 2004	back-up procedure failed	-	-
21 October 2004	25794	2318	70
22 October 2004	25560	1912	70
23 October 2004	26765	2300	70
24 October 2004	30213	2651	70
25 October 2004	power failure	-	-
26 October 2004	42848	6748	68

In table 2 the transitions are translated into categories and based upon this data an assessment is made how much data is missed.

Table 2 Number of missed readings

Date	GoInside!	GoOutside!	GoInside?	GoOutside?	Missed [%]
19 October 2004	1045	1119	221	134	14
21 October 2004	919	1004	230	165	17
22 October 2004	742	795	208	167	20
23 October 2004	918	1002	238	142	17
24 October 2004	1096	1152	234	169	15
26 October 2004	3251	3369	112	25	2
Total	**7971**	**8441**	**1243**	**802**	**11**

The variation of the period the hens were outside was large. While the hens went outside they often stayed in the neighbourhood of the exit. Hence many short outside periods of a few seconds were registered. Over the 6 registration days there were three cases where hens were outside during the whole day. For the calculation of the average duration the hens were outside the periods shorter than 5 seconds and the three cases were the hens were outside all day were excluded. The 5 seconds breakpoint is set with a log-survivor function, see figure 4.

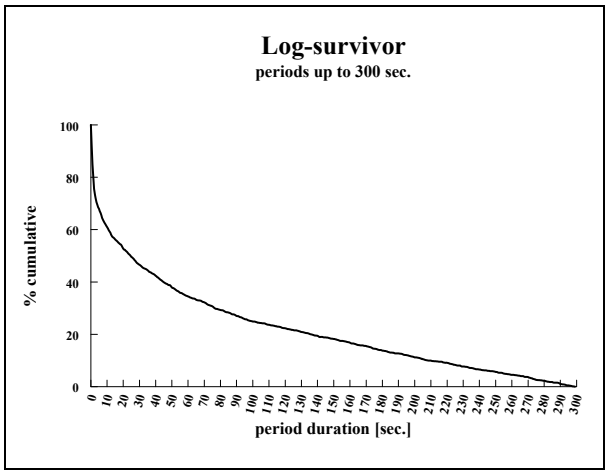

Figure 4 Log-survivor curve of the duration of the outside period, range 0-300 seconds.

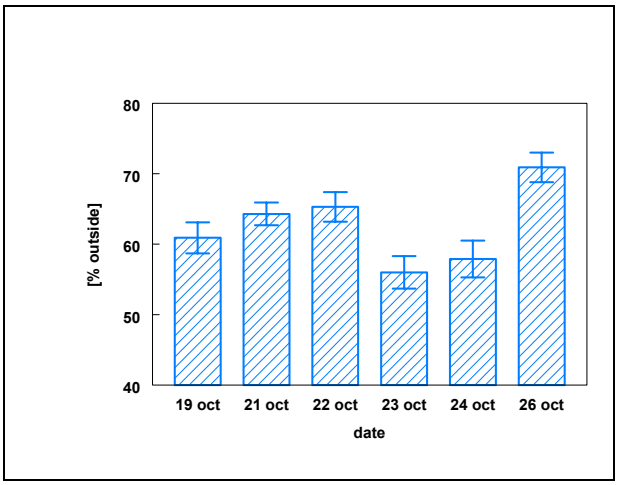

Figure 5 Average percentage of available time that the hens were outside.

In figure 5 the average percentage of the time is given that the hens were outside during the period the open-air run was accessible for the hens. On average the hens were 63% of the available time outside.

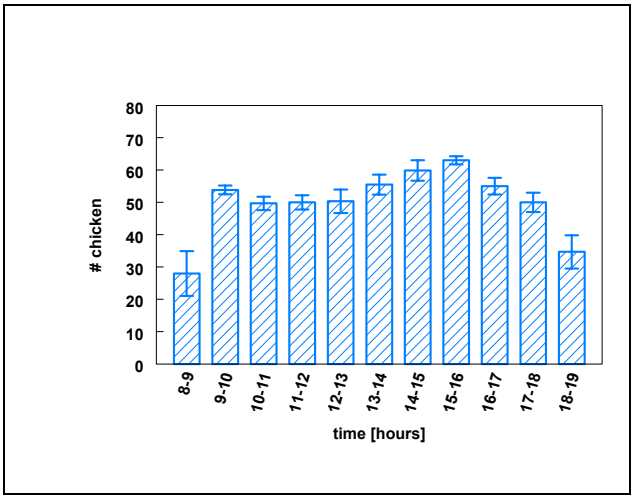

Figure 6 The number of hens that were outside at the same time per hour of the day.

Figure 6 shows the number of hens that were outside at the same time, distributed over the day, averaged over the 6 registered days. On average 50 hens of the 70 hens (72%) were outside at the same time.

The hens were not outside continuously, but they went inside regularly. On average the hens were outside for 14 periods of 30 minutes. The number of outside periods and the average duration of these periods deviates (see the figures 7 and 8).

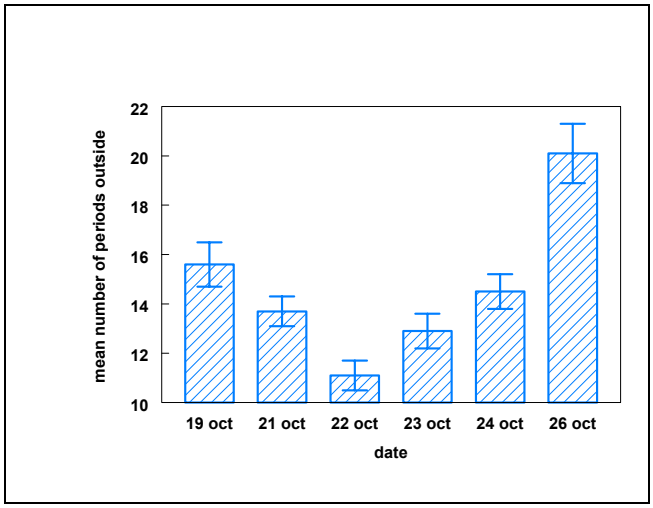

Figure 7 Average number of periods that the hens were outside per day.

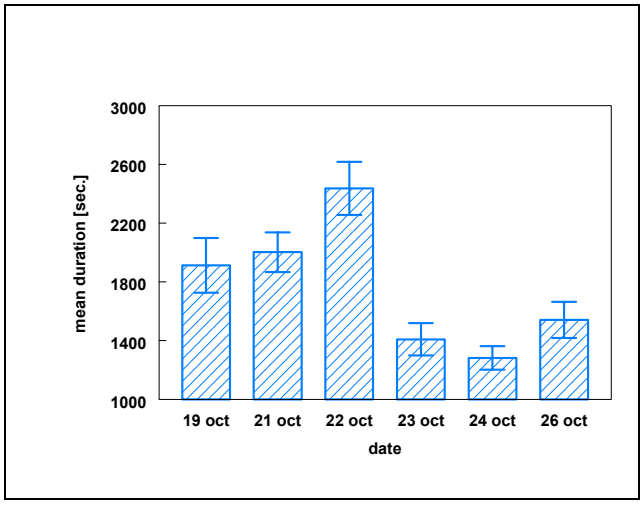

Figure 8 Average duration of a period that the hens were outside.

4 Discussion

The discussion is divided into two parts. First there is an analysis of the possibility to register the open-air run use of hens with technical means and there is an analysis of how the open-air run is used during the registration period.

4.1 Registering open-air run use with RFID equipment.

It is possible to register with RFID equipment the open-air run use of hens. The simultaneously passing of more then one hen at the same time of the passage way is not a problem if the distance between the hens is not too small. The registered data shows that with around 11% of the registrations there is one of the readings missing. There are several causes possible for the missing readings:

- A 19 mm injectable transponder produces enough signal to be read within a radius of 15 centimetre from the hart of an transceiver. With a reading frequency of 3.5 Hz a guarantied speed of 1 m/s over the middle of the antenna is possible. If a hen passes in

the middle in between two readers then reading is guarantied with a speed < 0.6 m/s. It is easy for a hen to reach such a speed.
- A hen that flies over the readers and stays away more then 15 cm of the heart of the transceiver will not be identified.
- If there is more then one transponder in the field of one receiver then no transponder or only the transponder with the strongest signal will be identified.
- Losing the strings with the transponders.

There are a number of possibilities to limit the number of missing registrations:
- A bigger injectable transponder (26mm) can be attached to the hens legs. This transponder produces a bigger signal where through the readability distance can be increased from e.g. 15 to 20 centimetres.
- By increasing the reader matrix density where through there is a bigger overlap in the reading field of the different readers.
- An extra row of readers can be installed where through the change of recognising a walking direction can be increased.
- Mechanical adjustments can be applied where through the passage speed of the hens is limited.

4.2 Open-air run use of hens.

On all observation days all hens have been outside. On the average the hens were outside 60% of the available time, this depends on the weather conditions, but also on the moment the open-air run is accessible for the hens. In the weekend (23 and 24 October, see figure 5) the open-air run was opened one hour later then normal. However the hens came inside at the same time as normal. As a result the hens absolute and in terms of percentage were outside during a shorter time. On the 22nd of October the entrance of the open-air run was blocked through activities of the farmer, so the hens were outside for a longer period. On the 26th of October it was warm, the hens were often outside for a shorter period but frequently went inside to drink.

On the registration days it never happened that all the hens were outside at the same time. The number of hens outside deviates only a little. The first and the last hour the hens could be outside showed a larger variation in the number of hens that were outside.

5 Conclusion

The registration of the use of an open-air run of hens is possible with RFID equipment. The positioning of the transponder reading equipment is critical. The density of the reader matrix is of influence on the reading reliability. The size of the transponder is also playing an important role.

The open-air run is used by every hen. In general hens are not outside continuously, but the hens regularly go inside to eat and drink. On average hens were outside 14 periods of half an hour, so approximately 7 hours and on average 72% of the hens were outside at the same time.

6 References

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Bestman, M, 2002: Kippen houden zonder verenpikken. Louis Bolk Instituut, publ. no. LV47.