

## ULTRASONIC VISUALIZATION OF THE CONCEPTUS DURING EARLY PREGNANCY OF DAIRY COWS

V. IVKOV, S. VESELINOVIĆ, R. MIČIĆ, D. KOŠARČIĆ, D. MEDIĆ, SNEŽANA VESELINOVIĆ,  
EVICA RAJČAN-ŠEPAROVIĆ and S. BODULIĆ

*Research Institute for Reproduction and AI of Domestic Animals Industrijska zona bb, 21235  
Temerin*

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*In the work the results of research both on embryo detection and diagnosis by means of ultrasonography during early pregnancy are presented. In the period from 23 to 36 days after artificial insemination (a. i.), a total number of 214 dairy cows were examined ultrasonically with a 5 MHz transducer. The presence of fetal fluids was noticed at 23 days and the embryo at 25 days after a. i. The use of ultrasonic diagnosis has an advantage over other methods for pregnancy diagnosis due to the possibility of visualizing the conceptus.*

*Key words: ultrasonography, visualization, pregnancy diagnosis, reproduction of dairy cows*

### INTRODUCTION

Modern and intensive dairy cow husbandry needs, among other things permanent work on their reproduction. The aim is produce 80% pregnancy and calving rate on each farm per year. For that purpose, as well as solving sterility problems, early pregnancy diagnosis is in use. There is a certain number of advantages of ultrasonography over other methods.

Considering that ultrasonography is based on visualization of the examined issue, it is possible to diagnose pregnancy after direct observation of the conceptus, while its absence indicates infertility.

By used of modern equipment for ultrasonography, it is possible, depending on probe characteristics, to detect the embryo earlier or later (Badtram et al., 1991).

The results of research on the accuracy of this method have been reported so far in many papers (Kastelić et al., 1988, Kastelić et al., 1991, Pierson et al., 1988). In our previous works we concluded that pregnancy may be reliably diagnosed at 28 days after insemination (Ivkov et al., 1992a, Ivkov et al., 1992b).

Except for pregnancy diagnosis, ultrasonography may be applied for measuring fetal development, and the detection of changes that cause pathological conception (Kahn, 1990). At certain stages of development it is possible to determine the fetal sex as well (Curran, 1992).



In this paper we present the results of an investigation of the possibility to use ultrasonography for visualization of the conceptus during early pregnancy of dairy cows.

#### MATERIAL AND METHODS

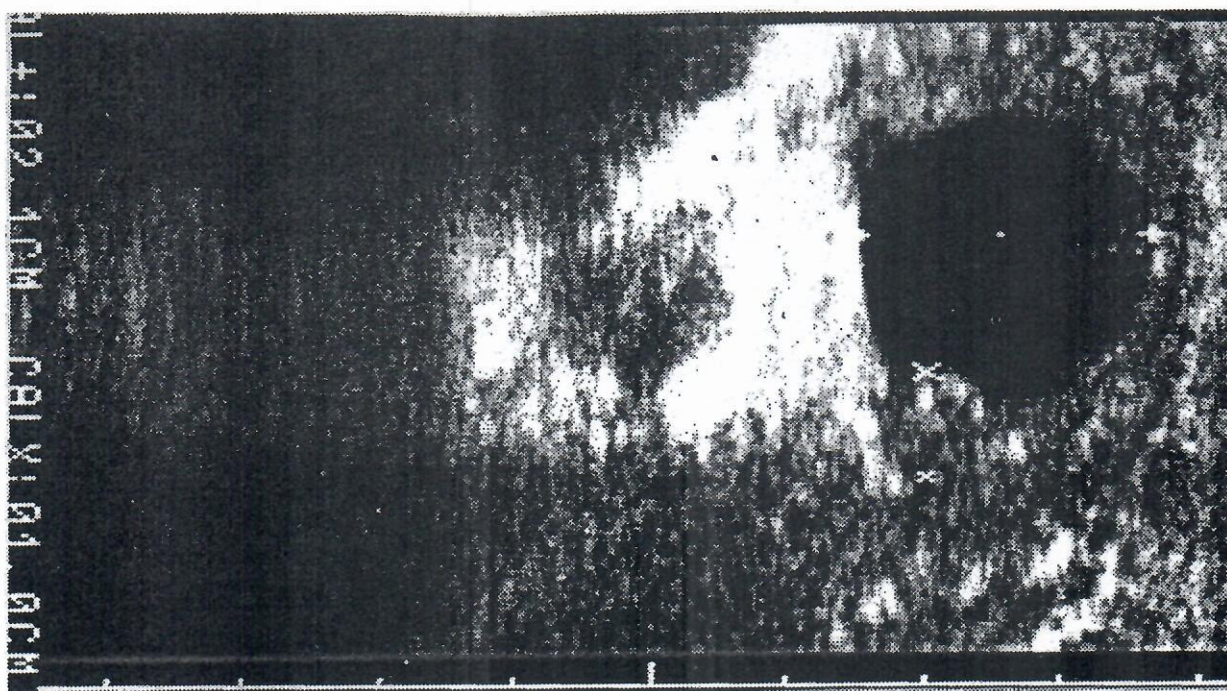
In this trial, 214 dairy cows, of the black and white, Holstein-Friesian breed were involved. They were kept fettered in byres (production conditions) and examined at 23 — 36 days after a. i.

The echo camera "ALOKA" was used with a 5 MHz probe, in B mode, using real time and a linear array. During work with the echo camera it is possible to stop the picture, and using the calipers (signs "X" and "+" for marking the details and also for measurement) to measure certain parameters. It is also possible to produce the picture on a printer — the ultrasonogram. The pictures were obtained on a "SONI" video graphic printer.

Once diagnosed as pregnant cows were again palpated for pregnancy at 60 days after a. i. while negative diagnosis was confirmed by the next insemination date.

#### RESULTS

In the period from 23 to 30 days after a. i. 58 cows were examined, of which 28 were pregnant. In this period a bright, echogenic ring may be visualized representing the wall of the uterine horn. Within the lumen of the horn a dark, nonechogenic area may be seen which are fetal fluids. In one part of such a



Ultrasonogram no. 1. Pregnancy 25 days after insemination. The embryo is near the caliper " + " on the uterine cross section

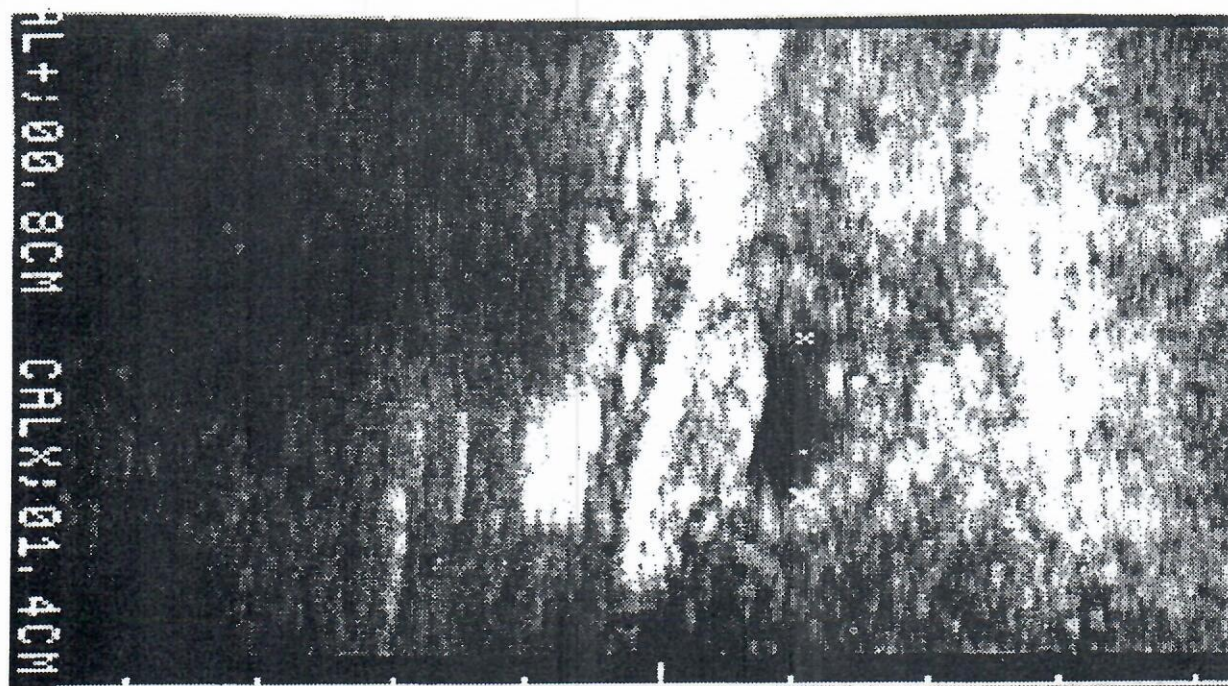


dark surface, close to the uterine wall there is a bright, echogenic line which is the embryo. An example is given by ultrasonogram number 1.

In non pregnant cows only the echogenic uterine wall may be seen without the fetal fluids.

In this period in some cows we may see two cross sections, depending on the uterine spiralization. In the pregnant horn we may see dark areas of fetal fluids in both sections. Fetal fluids were first visualized at day 23, while the embryo proper was detected 25 days after a. i.

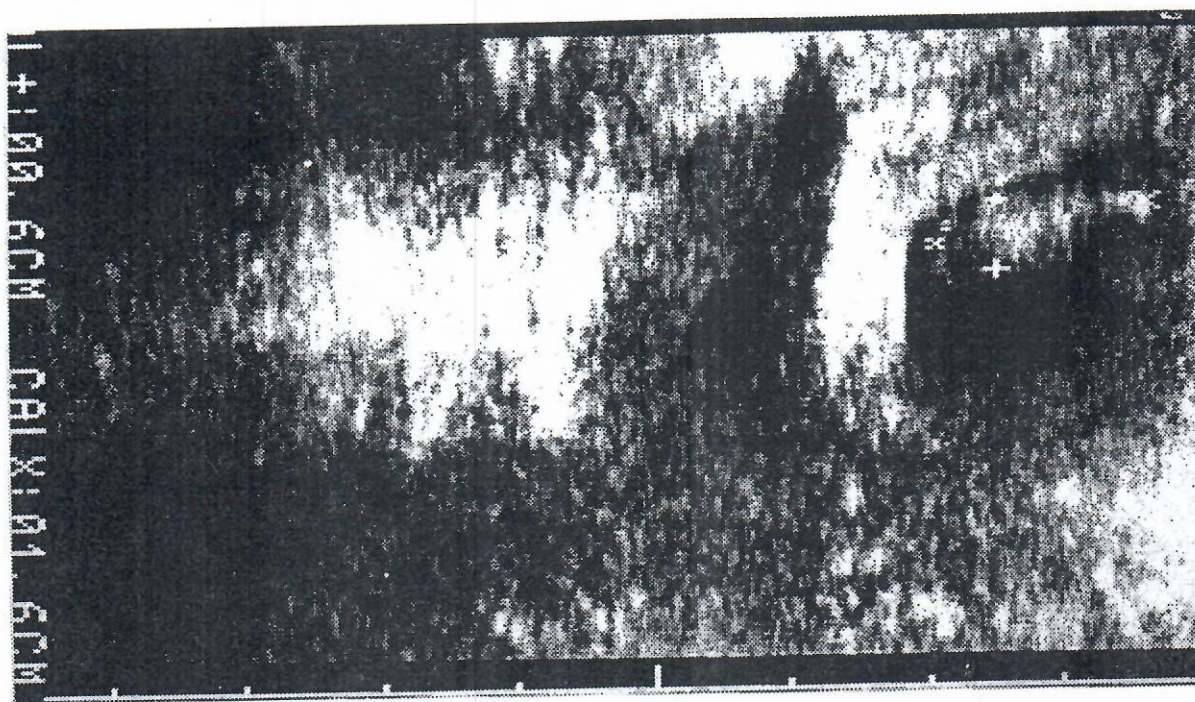
Further advancement of gestational age leads to a change of embryo shape and an increase in dimensions. Starting from a bright spot the embryo becomes a thin line, then a half moon, or letter "C". There is also an increase in fetal fluid volume which consequently leads to enlargement of the pregnant horn. This is expressed by enlargement of the dark nonechogenic surface. In the period from 30 to 33 days after a. i., 74 cows were examined, among which 42 were pregnant. An example of a 33 day old pregnancy is given by ultrasonogram number 2.



Ultrasonogram no. 2. Pregnancy 33 days after insemination. The embryo is marked by caliper "X"

In the group of cows at 33 to 36 days after insemination there were 82 females, of which 61 were pregnant. In this period sudden growth of the conceptus may be noticed ultrasonically by the increase in dimensions. It is possible now to perceive the future body regions and short bulges which will be legs. An example is shown by ultrasonogram number 3.





Ultrasonogram no. 3. Pregnancy 36 days, caliper " X " measures the length, and caliper " + " the width of the embryo

#### DISCUSSION

There are many reports in the world literature on visualization of the early conceptus in cows.

This, Boyd et al., (1988) reported about the possibility to visualize the embryonic vesicle at day 9 and enlargement 19 days after a. i. The embryo proper was visualized at 13, the embryonic heart beat at 22 days, as well as the allantois (23 days), and the amnion (29 days). However a 7,5 MHz transducer was in use. Such a powerful probe enables the detection of details earlier than the 5 MHz transducer, which we used moreover they used an echo camera with magnification (zoom effect) as a difference from our system. Similar results were obtained in an experiment with heifers (Kastelić et al. 1988) in which it was possible to detected pregnancy signs earlier than in cows. This is probably the consequence of the greater absorption of the ultrasonic beam through the physiologically enlarged uterine wall in multiparous females.

We obtained similar results in comparison with reports with the same conditions as ours. Fetal fluids were detected within 23 to 27 days after a. i. (Szenci et al. 1988), while Totey et al. (1991) visualized the embryonic vesicle at 18 days, embryo proper at day 19, while embryonic heart beats were detected with mean 22.6 days which is earlier than our experience. At 32 days they observed the embryonic eye while the embryo size averaged 16 mm. We obtained a similar result which is presented by ultrasonogram no. 3. Kahn (1990) detected the heart of the embryo within 30 days which corresponds to our finding.

Pierson and Ginther (1988) and Szenci et al. (1988) consider that at 33 days the embryonic shape is finalized, which we would conclude as well.



Using a 3,5 MHz probe (Chaffaux et al., 1986) fetal fluids may be detected at 28 days while embryo proper is seen at day 33. This is a little later than with the 5 MHz transducer which we used in this trial and is related to the performance of the probe used.

Jones et al. (1990) diagnosed pregnancy in the period from 27 to 31 days of gestation (5MHz probe) by detection of fetal fluids but no attempt was made to visualize the embryo proper, which we obtained as well but with the difference that the embryo was clearly seen after 30 and more days of pregnancy.

Our results, obtained in research on visualization of the conceptus by use of ultrasonography, agree with those reported in the literature. Small differences in days are caused by use of different equipment and the previous experience of the operator. This modern method allows us more opportunities both for early pregnancy diagnosis (and infertility) and to obtained knowledge about early pregnancy of dairy cows.

Ultrasonic, early pregnancy diagnosis informs us of the real pregnancy rate after artificial insemination, revealing embryo mortality before day 40 and providing the opportunity for transrectal manual palpation.

As an non invasive diagnostic method is fully usable for field and research work.

#### CONCLUSION

According to these results we consider that:

Ultrasonography, as a methods for early pregnancy diagnosis, is very perspective and has advantages over other methods (RIA, ELISA progesterone determination, transrectal manual palpation). Due to the possibility of visualizing the uterus and the embryo inside it, we may be sure that pregnancy has been established.

Our research showed that use of a 5 MHz transducer in cows enables visualization of the fetal fluids at day 23, the embryo proper at day 25, embryonic heart beats after 30, and the final shape of the embryo at 36 days after a. i.

In addition, use of this method makes it possible to supervise pregnancy in cows with labile gestation, and to detect embryonic changes which contribute to pathological gravidity and even an abortion.

Ultrasonography reduced the period from insemination to examination by palpation, which is especially an advantage for non pregnant cows. Unsuccessfully inseminated cows may be adequately treated earlier, to induce a fertile estrus and insemination. This way we significantly reduce the average service period and improve other reproductive parameters on farms.

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#### ULTRASONOGRAFSKA VIZUALIZACIJA PLODA TOKOM RANOG GRAVIDITETA MLEČNIH KRAVA

V. IVKOV, S. VESELINOVIĆ, R. MIĆIĆ, D. KOŠARČIĆ, D. MEDIĆ, ŠNEŽANA VESELINOVIĆ,  
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#### SADRŽAJ

U radu su prikazani rezultati istraživanja detekcije ploda i postavljana dijagnoze tokom ranog gravititeta mlečnih krava. U periodu of 23 do 35 dana posle osemenjavanja vršen je ultrasonografski pregled sa sondom od 5 MHz i snimanje na štampaču. Prisustvo plodovih voda kao jedan od znakova graviditeta može se uočiti sa 23 dana, dok se pojavu zametka uočili sa 25 dana. Primena ultrazvučne dijagostike graviditeta je u prednosti nad ostalim metodama zbog mogućnosti vizualizacije samog ploda.