Indian Farming 76 (02): 25-26; February 2026

Intra-uterine insemination: Revolutionising productivity in pig farming

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Artificial Insemination (AI) is the most used reproductive biotechnology in swine industry. Traditionally, two to three billion sperm are deposited into the cervix in 90 mL extended liquid boar semen. Although, this achieve satisfactory conception rate but use high number of sperms per insemination, indicating its poor effeciency. To overcome above constraint, Intra-Uterine Artificial Insemination (IUAI) has been developed using specially designed catheter in which semen is deposited into the uterus. In this, lesser number of sperms are required to achieve good farrowing rate and large litter size. This technique enhances the genetic gain faster than traditional method. Besides, it needs lesser time to perform AI. Coupled with frozen semen, sexed semen and embryo transfer technology, IUAI will be the next generation reproductive biotechnology which holds great promises for pig farmers.

Keywords: Artificial insemination, Genetic gain, Pig, Reproductive efficiency

AMONG all reproductive biotechnologies in livestock, Artificial Insemination (AI) is the most impactful and has significantly improved the productivity of livestock. The main reason behind the success of AI is that male gametes can be collected, processed and evaluated in the laboratory for its fertilising ability. Therefore, AI has been adopted on a large scale in cattle, buffalo and pigs. In case of pig, AI has improved the genetics of global swine population in a very short time. Also, AI resulted into significant improvement in pig population because of its short gestation period and litter bearing capacity. In Western Europe and North America, more than 95% of female pigs are bred by AI. In case of India, less than 0.01% of breedable sows are being bred by AI. In traditional cervical AI, large volume of semen (80–90 mL) having 2–3 billion live sperms is deposited in cervix. The conception rate in this method is between 60–70%. However, the main drawback of this technology is that large number of sperms are required which leads to wastage of male germplasm. Because of this, only few sows can be bred from a single boar ejaculation. Also, there is considerable loss of semen in the form of backflow (10–20 mL). Besides, it takes more time to do AI (around 8–10 min). New methodological developments in AI is necessary to meet the demands of emerging sperm technologies, as cervical AI has very low efficiency and produces poor fertility outcomes. In recent time, considerable emphasis has been given to improve the efficiency of traditional AI by reducing the number of sperm required per service without compromising farrowing rate or litter size.

A tactic used to fulfil these demands is the semen deposition close to the oviductal fertilisation location through Intra-Uterine Artificial Insemination (IUAI) or Post-Cervical AI (PCAI). It is possible to reduce the amount of newly and diluted inseminated spermatozoa by half while maintaining farrowing rates by the use of intrauterine insemination. The IUAI enables the non-surgical deposition of semen into the uterus by placing the sperms in the uterus after the cervix, just prior to the uterine bifurcation. IUAI can be carried out with concentrations as low as one billion spermatozoa per dosage due to a decrease in the amount of physiological and mechanical barriers that could cause spermatozoa to be lost during their transit up to the oviduct. In addition to increasing the impact of individual boars on both genetic advancement and reproductive efficiency, this would enable farms to increase sow: boar ratio as maintaining a breeding boar on pig farms is a costly affair. In IUAI, a special catheter is used to do insemination. It consists of using an inner cannula through the traditional catheter allowing semen deposition in the uterine

lumen (after the cervix and before the uterine bifurcation). Several commercially available transcervical (intra-uterine) insemination catheters designed to place semen 15–20 cm past the end of the cervix, in the uterine body. Therefore, by reducing the sperm transit time through the cervix, IUAI allows the use of lower semen volume and number of sperm cells than traditional AI without impairing reproductive performance. In general, one to two billion sperm are used in 40–50 mL insemination dose in IUAI process.

Table 1. Comparison of traditional cervical AI and intra-uterine AI in pig

Parameters	Traditional cervical AI	Intra-uterine AI in pig
Volume of extended semen required	90 mL	40-45 mL
Sperm dose per insemination	2-3 billion	1-1.5 billion
Time required for insemination	5-10 min	3-5 min
Semen doses prepared from a single ejaculate	8-12 doses	16-24 doses
Numbers of sow inseminated from single ejaculate	4-6 sows	8-12 sows
Backflow of semen during insemination	Yes	No
Farrowing rate	60-70%	70-80%
Litter size	8-10 piglets	8-12 piglets

Advantages of IUAI

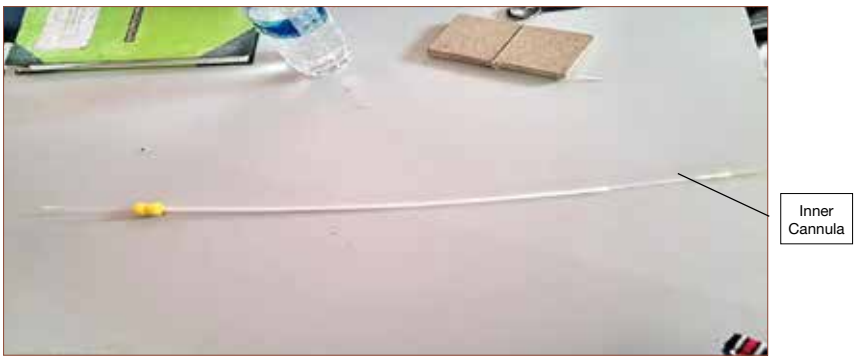
- Reduction in the number of sperm cells and the volume of insemination dose, allowing the production of a greater number of insemination doses per ejaculate and optimising the use of boars of higher genetic index. The reduced insemination of sperm cells results in a lower paternal genetic cost per dosage.
- No backflow of semen during IUAI: Backflow decreases the conception rate as sperm cells are lost in the process.
- IUAI takes less time to perform the insemination, thereby, allowing more insemination in a commercial setting.
- As more insemination doses are produced per ejaculate, thereby reduction in breeding boars and a reduction in the costs of boar acquisition and maintenance.
- IUAI could allow other technologies like embryo transfer, frozen semen, and sexed semen to be adopted on a larger scale swine industry.

Disadvantages of IUAI

- Insertion of an intra-uterine catheter is more difficult in gilts than sows and requires a breeding technician to have more skill as compared to conventional AI.
- There is an increase in the cost of insemination catheters.
- There is a chance of injury to uterine body and cervix if used by unskilled person.
- If not used properly, chances of introducing infection in the uterus.

Procedure

- Clean the vulva with a clean dry paper towel.
- Spread the lips of the vulva with one hand and gently insert the catheter into the vagina pushing forwards and upwards for the first 6–8 inches.
- Advance until resistance is felt.
- After the catheter is locked in place, gently push the inner cannula inside till the end.
- Resuspend the semen by gently rotating the cochette.
- Open the cochette and place on the inner cannula. Lift the catheter and apply gentle pressure to fill the catheter and begin the insemination.
- Begin rubbing the underline to stimulate uterine contractions.
- Normal services take 3–5 min; gilts may take longer.
- The catheter can be removed by clockwise rotation of the catheter.



Intra-uterine catheter used for IUAI in pig

SUMMARY

Insemination using intra-uterine catheter reduces the dose of sperm cells drastically as compared to conventional cervical catheter which requires three billion cells per dosage whereas in intra uterine insemination, half of the dose can be used without affecting the fecundity. IUAI also helps in temporarily alleviating lack of doses in case of insufficient number of boars. However, caution must be taken regarding proper sanitation as well as gentle handling to prevent introduction of infections or cause injuries to the cervix and uterus.

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