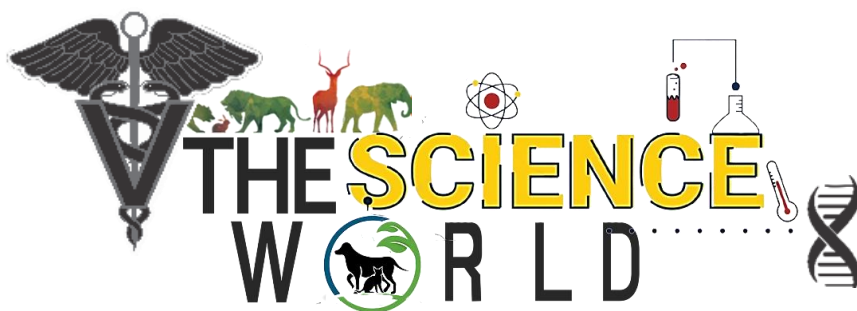




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Popular article

Long-Acting Injectables (LAIs) in Dairy Animals: Less Stress, More Benefits

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For dairy farmers and veterinarians, one of the toughest jobs is handling animals repeatedly for treatments. Every extra injection means stress for the cow, labour for the farmer, and a chance of missed doses. This is where long-acting injectables (LAIs) are changing the game.

What are LAIs?

LAIs are special formulations designed to release medicines slowly in the body after a single injection. Instead of giving several daily doses, one shot can keep the drug active for days or even weeks. This steady drug release is possible because the medicine is held in a depot at the injection site and seeps into the bloodstream at a controlled rate. Pharmaceutical scientists achieve this in different ways: suspending drug particles in oil, using in-situ gels that harden after injection, or making biodegradable microspheres that steadily release medicine. Materials like poly(lactic-co-glycolic acid) (PLGA) and polycaprolactone (PCL) are often used because they safely break down in the body while giving predictable release.

Benefits in dairy animals:

Cattle and buffalo are herd animals and restraining them repeatedly is difficult. Each round of handling not only stresses the animal but can also reduce milk yield and sometimes cause injuries. A single LAI dose reduces these problems, maintains therapeutic levels of medicine in the blood, and often leads to better cure rates. Many Long-acting formulations are available in the field practice including long-acting formulations of oxytetracycline, amoxicillin, enrofloxacin, ivermectin, moxidectin etc. One shot of these LAIs gives cover for



several days, reducing the need for repeat handling. However, residues in milk must be carefully monitored and withdrawal periods for milk and meat must always be strictly observed. By reducing repeated dosing, LAIs also improve treatment compliance by farmers. This is especially helpful in smallholder systems, seasonal disease outbreaks, or when veterinary access is limited.

Technologies behind LAIs:

Different technologies allow medicines to last longer in the body:

1. Aqueous suspensions: Simple water-based suspensions that release slowly.
2. Oily injections: Oil-based formulations that slow absorption.
3. In-situ depots: Liquids that solidify after injection and gradually release drug.
4. Microspheres & nanoparticles: Advanced biodegradable carriers offering precise control over release.
5. Implants: Solid devices under the skin, mainly used for hormones or growth support.

Hormonal LAIs and Reproductive benefits:

Beyond antibiotics and antiparasitics, LAIs are finding use in reproductive management. Progesterone depots are valuable for oestrus synchronization in cattle. They bring groups of cows into heat at the same time, making artificial insemination programs more efficient and reducing labour. By maintaining steady hormone levels, these depots improve conception rates, shorten calving intervals, and increase overall productivity of herd.

Challenges with LAIs:

Despite their benefits, LAIs are not a one-size-fits-all solution. There are important responsibilities to consider:

1. **Drug residues:** Some LAIs persist in milk or meat for long periods. Withdrawal times must always be followed to protect food safety.
2. **Antimicrobial resistance:** Prolonged low-level antibiotic exposure can encourage resistant bacteria. LA antibiotics should only be used under veterinary guidance.
3. **Injection-site reactions:** Some formulations can cause local swelling or lumps.
4. **Cost:** Advanced technologies like biodegradable microspheres are promising but more costly to produce than traditional oily suspensions. Farmers may also hesitate to adopt them unless they are affordable and well-tested in local herds.
5. **Variations:** There are always chances of species-specific variations in efficacy and safety.



Future Goals:

Researchers are working on better *in-vitro–in-vivo* correlation (IVIVC) models, which predict how a drug released in the lab will behave in the animal. Such studies help ensure LAIs work as intended and reduce surprises in the field. The future of LAIs in dairy practice is promising. Lower-cost biodegradable carriers, species-specific testing, and government–industry–academia collaborations could make them more widely available for livestock farmers.

Conclusion:

Used responsibly, long-acting injectables (LAIs) can reduce stress for animals, lessen labour for farmers, improve productivity and welfare, and ensure safer milk and meat for consumers. The golden rule, however, is that LAIs work best under veterinary supervision, with strict adherence to withdrawal times and careful antimicrobial stewardship. With these safeguards in place, LAIs have the potential to transform dairy animal healthcare into a system that is not only more efficient but also kinder to animals and safer for consumers.

