

MODERN EQUIPMENT AND MACHINE: CLEAN AND SANITIZE THE DAIRY FARM

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Generally, sanitation aid in control of livestock infectious diseases, as dung and urine is the main harbour for microorganisms like bacteria and virus and ticks and fleas, we need to destroy these organisms to reduce the infection and prevent economic loss. Reducing the contamination of the farm will improve the quality of milk and milk products and also reduce the mortality and morbidity percentage of animals in farm and increase the reproductive performance and fertility.

Dung and urine harbours microorganisms and ticks' and fleas. The bacterial causes were laminitis due to wet surface, mastitis that is highly economical as more than 80 percentage of the farm income from milk production, *Salmonella*, *E. Coli* and viral infections includes Foot and mouth disease (transmitted by food and water), pseudo cowpox and fungal diseases of Aflatoxicosis, Aspergillosis and tick by *Boophilus* sp. and fleas deteriorate the normal health of animal and causes economic loss like tick infestation causes depreciation of the value of hide and skin and reduction of milk yield by mastitis and reduction in reproduction efficiency by uterine infections. The cost for treatment of infection or disease is also accounts for economic loss.

Some studies said, foot problem like laminitis, cracked hoof is caused by continuous wet floor and poor sanitation, enteric diseases due to improper sanitation and cleaning which is transmitted by contact with contaminated faeces and fomites, mastitis also due to environmental contamination and cowpats acts as a reservoir for *Salmonella* or *E. Coli* O157:H7.

Equipments

Broom: Most commonly used in small farms for cleaning the shed. It is made from midrib of the coconut which is dried in sun and hot air oven at the temperature of about 60⁰ for 8 hours.

It is more flexible and lighter which cannot be used for huge amount of dung and can be used for cleaning the floor after removal of manure from the floor by using scrapper or shovel.

Shovel: It has stainless steel scoop attached with the handle made of wood which is used for removal of the manure from the floor and to move the dung from one place of farm to other end of the farm.

Rake: It is also made of stainless steel rods with wooden handle and it used to clean the spilled feed materials outside the manger where the spilled feed can be contaminated with dung or urine of animal.

Dung scoop: Made of stainless-steel with galvanized coating and it resist in rusting, light in weight and easy to use. It is to remove dung manually which can hold about 5 kg of dung.

Dung scrapper: Made of mild steel material with galvanized coating and the handle may be with steel or wood which can be able to adjust the height of the scrapper. It is used to move the dung or manure from one end of the farm to other end of the farm to make the place near the cattle clean.



Shovel



Rake



Dung scoop



Dung scrapper

Spade: Made of mild steel with zinc coated and the handle may be wooden or steel, it is to lift the dung or slurry from the floor and for to push the manure from one place to another place.

The above said equipment of shovel, rake, dung scoop, dung scrapper, spade are labour intensive.

Wheel barrow: The collected dung material is transported to dung dumping tank or manure pit by wheel barrow. It may be double wheeled and also single wheeled, but the single wheel

barrow may tumble quickly. Its carrying capacity of the manure is about 100 kg but it is also a labour intensive process in case of large farms.

Tractor trailer: It is for transport of the collected manure from the farm and disposal of it and has a carrying capacity of around 5000 kg. This is easy and quick disposal of manure with less labour requirement.

Flame gun: It is used for sanitation of the farm premises. Flaming material used is kerosene/gasoline/diesel after the pressure applied, the flaming material comes through the discharge box and it is ignited by using match stick or fire. The flame comes out of the discharge box at the pressure of about 16-100 lbs and discharge at the rate of 48.5 feet per second. Flame gun is used on metal frame or cement but not to be used in wood as it is ignited. The flame comes out of the gun is about 500-600 degree Celsius which can destroy all kinds of microorganisms, egg or larvae and external parasites in the floor or wall. Sanitation should be done before the entry of animals into the farm. It can be used inside or outside of the farm house. Flame gun is available in single nozzle or multi nozzle (majorly four).



Wheel barrow



Tractor trailer



Flame gun

Dairy dung cleaning pump: It is to remove the dried dung material from the floor by pressuring the water flow from the nozzle of the hose. It is electrically operated having single phase AC220V, 1.5hp and has 50 m hose. It reduces the wastage of valuable water. About 40 litres per minute passage rate of water used in floor can clean 20 animal shed (i.e., 200 m²) capacity shed with 300 litres of water. Within 7-8 minutes and in animal about 17 litres per minute can clean an animal with 30 litres of water within 2 minutes. But in normal hose pipe connected directly with water pipe has diameter of about 1 inch will release proportionately large amount of water. It can be used with sanitizer or disinfectant mixed in water.

Automatic manure scrapper: Components of automatic manure scrapper are motor of 22 KV which can drive two scrappers, scrapper of straight blade or ‘V’ blade, corner wheel, rope or chain, electrical control. It can be used for rubber floor or slatted floor or concrete floor and the working efficiency is about 95%. There are two driving units one wind the rope and other release at the same time and the driving speed is about 9-10 metre per minute. There are three types of automatic scrapper 1. *Cable driven system* which can use for length of 182 metre and minimal power consumption with low maintenance cost and the mechanism is that the thick steel cable pulls the scrapper so there are no mechanical parts in manure, 2. *Hydraulic drive system* which can use for length of 60-metre-long, it has a power unit connected to a hydraulic cylinder for each alley and a draw moves back and forth moving the scrapper in steps at low speed. It takes long time than cable drive system and used for huge amount of manure load. 3. *Chain scrapper system* has only one moving part resulting in very low maintenance and long life and the scrappers are able to operate in alley with different length. Advantage of automatic manure scrapper is reduction of labour cost, easy to operate, install and maintain reduction of hoof problem and mastitis of the animal by reducing the wet manure from the floor and in rubber flooring wearing loss is less. Disadvantage of the equipment is that over time work causes wear of alley floor and makes slippery, wear of equipment if used on sand and the residue of manure after cleaning the floor by this scrapper is more.

Robotic manure scrapper: It is fully automatic for scrapping dung channel to keep it clean. It can work for about 18-20 hours per day with 4-5 hours for charging at night and has two batteries with 12 V capacities each. It moves with the speed of 9-18 m/min for frequent and log operation during the day time with scrapping capacity of 8,600m² and is animal friendly as any obstacles like wall, animal is sensed it changes its direction of movement. The robotic manure scrapper weighs about 500 kg with 100 litre capacity water tank for spraying of water on the floor with dried dung material. The scrapper width is about 180-210 cm. RS is mostly used on slatted floor with slurry manure as it can able to push only 100 kg of manure material. RS has inclined scrapper installed in front of the machine which moves the manure against the floor. Automatic lifting up to 7cm height is provided in scrapper for crossing the passage or gutter. RS is controlled by internet where online programming of when, where and how often to clean is programmed and there is no limit of number of routes. One study stated that, animal increased their movement from lying area to feeding area while

RS operating that increases feed intake. Another study said that, use of RS on floor manure cleaning reduces the emission of methane, carbon dioxide and nitrous oxide but increases the level of ammonia due to left over manure after scrapping.

Gutter cleaner: The manure moved by automatic scrapper or robotic scrapper is collected in gutter which is removed by gutter cleaner to the manure pit. The maximum length of gutter cleaner is about 50m. It works by hydraulic which moves the scrapper back and forth along the length of the gutter. It transport manure and fold them automatically in reverse mode. It helps in cleaning of solid, semisolid or liquid manure from the gutter.



Cleaning pump



**Automatic manure
scrapper**



**Robotic manure
scrapper**



Gutter cleaner

Manure vacuum pump: It is vehicle with scrapper and suction pump at front and carries with a large tank capacity of 2200-4800 gallons. The scrapper width is about 8.5-14 feet which has suction pump at centre i.e., between the two scrapper blades. The scrapper is adjustable according to the width of the passage. Unloading system (located at front above the scrapper) of the uploaded manure is with capacity of 3000 gallons (1100 litres) in 50 seconds. Flexible turning is available in accordance to the farm. It has a suction pipe of 15 feet long with 3 inches' diameter for suction of slurry from slurry pit and transporting to other places.

Sewage mud pump: The collected slurry is moves to the slurry storage pit or farm field by using sewage mud pump. It works on single phase 1.5 HP to 2 HP and can handle 20 mm to 50 mm solids. It discharges at the rate of 18,000 litres per hour and has 30-40 feet length hose pipe with diameter of 2 or 2.5 inch.



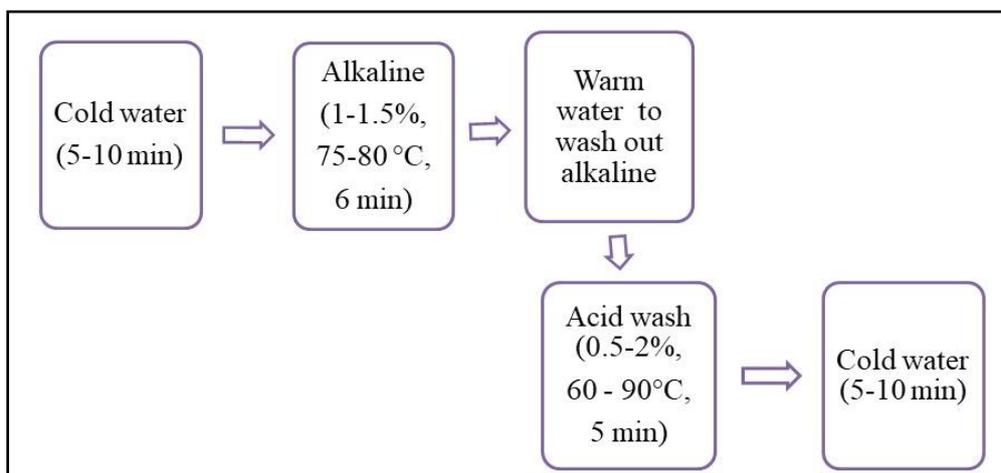
Manure vacuum pump



Sewage mud pump

Turning chain system: Manure which is pushed by the manure scrapper is collected in manure pit that is transported to manure storage area by use of turning chain system. The turning chain can travel at about 16.5 feet/min by a motor of 380V.

Clean In Place (CIP): Most important in dairy farm with milking parlour attached. It is used to clean without dismantling. It is the system of cleaning of the interior surface of pipeline, vessels, processing equipment and associated things without dismantling. It reduces the time of cleaning and is economic. Cleaning depends on character of contamination, application method and speed of penetration. Cleaning solution may be single use or recycled for multiple uses. It removes about 99.9% microbial contamination and elimination of residue of sanitizing agents. High turbulence flow should be given to cleaning solution.



Alkaline solutions are sodium hydroxide (commonly used), potassium hydroxide, and sodium bicarbonate with pH of 7. It saponifies fat and forms into soap which is removed by water. Acidic solutions are nitric acid, hydrochloric acid, citrate, phosphoric acid. It removes the protein and salt by denaturation which is removed by water wash. Sodium hypochlorite

used can kill gram positive and gram negative microbe. Level of clean is seen by physical removal, chemical and microbiological removal. If unclean, it contaminates milk and makes milk production loss.

Automatic CIP Unit Check Point

1. Milking finished
2. Clusters in position
3. Milk receiver empty
4. Hot water (60-80 degree Celsius)
5. Continuous cold water supply
6. Basic solution
7. Acid solution

Conclusion

In small farms, it is economical to use manual removal methods and in large farms it is economical to use automated equipment's. In rising of the labour problem for past few decades, it has become mandatory for adoption of automatic cleaning system in the large dairy farms. Instead of its high initial cost for its implementation, Clean In Place is used as economical cleaning and sanitation aid in milking parlors.

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