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Note

Design and development of a semi-automatic seeder for seeding mussels

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Abstract

Semi-automation has been introduced into the process of seeding mussels for mussel farming by the design and development of a mussel seeder. The seeder, which has an estimated cost of Rs. 2500, was successfully field tested and demonstrated to mussel farmers in Kerala. The chief advantages of the seeder are reduction in time taken for seeding resulting in increased efficiency and lower labour costs and reduction in physical strain during the process.

Commercial marine mussel farming in India, although mostly restricted to the maritime state of Kerala, is growing at a fast pace and production levels have touched 2000 tonnes in 2003. The technology which is an adaptation of the Spanish system of rope culture is mainly done in shallow (<3m depth) estuaries when marine conditions prevail (Appukuttan *et al.*, 2000). Conventionally, mussel seeding (attachment of young mussels to ropes) is done manually by stitching the cotton netting with mussel seed around the ropes at the farm site by the farmers. Refinements in the technology have been made to reduce capital costs (mainly on nylon ropes) by using alternate core materials (Flexible Plastic Strips – FPS) and pre-stitched cotton net tubes (Mohamed *et al.*, 2003; Kripa *et al.*, 2001).

Seeding is one of the most critical activities in mussel farming. The process which is physically demanding (as farmers have to kneel and bend down to do it) is crucial to the success of farming as the uniform attachment of mussel seed around the rope depends on how well it is done. Now, to reduce the physical strain and to increase efficiency during this process, a semi automated mussel seeder has been designed, developed and field tested. The design details and the advantages of the new process are presented in this paper.

Materials and methods

The seeder was first conceptualized as a design, and several prototypes with different materials like aluminum and wood were tested before an eventual design was finalized for field-testing. The seeder was field tested at the Central Marine Fisheries Research Institute's demonstration mussel farm in the Ashtamudi Lake in Kollam district, Kerala. The efficiency of the seeder was evaluated by comparing the time taken for seeding 1 m length using the conventional method and the semi-automatic seeder. The uniformity of attachment of seed around the central core material was judged by visual examination after 1 week when the mussel seed were attached.

Results and discussion

The seeder made from quality hardwood consists of the following parts (Fig.1).

PVC pipe: PVC pipes of 1m length are for providing rigidity to the pre-stitched cotton tubing during seeding. The diameter of the pipe is decided based on the size of the mussel seed. For seed of length 20-25 mm and 25-30 mm, the diameter has to be 6 cm and 7.5 cm respectively. Aluminum couplings of appropriate diameter are used to hold the pipes to the seed holder.

Mussel seed holder: A wooden rectangular basin (75 x 50 x 6 cm) with two circular openings of 9 cm diameter, which are spaced 16 cm apart, is used for placing the mussel seed. These openings are for holding the top part of the PVC pipe. To hold these pipes tightly, detachable aluminum couplings are used. Two hooks are provided on the wider side of the seed holder diametrically opposite the circular opening.

Base plate: The base plate (75 x 50 cm) is a wooden board for supporting the lower end of the PVC pipe. It has also two elongated slits of length 25 cm and width 1.5 cm through which the lower end of the core material can be passed and locked. A semicircular girdle with a height of 2 cm outside the elongated slit prevents tilting of the pipe.

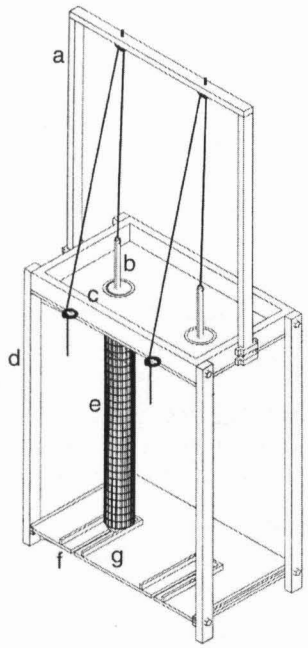

Fig.1. Details and parts of the mussel seeder - a = top stand; b = FPS; c = seed holder; d = vertical support; e = PVC pipe; f = notch for PVC pipe and g = base plate

Vertical support: The seeder is held together with the help of vertical supports. The two legs on each side are joined horizontally on top and bottom. The seed holder rests on this. The base plate is bolted to the bottom portion of the legs. The height between the holder and the base plate is 1m so that the PVC pipe can be inserted between these and held tightly.

Top stand: The top wooden stand of height 105 cm from the seed holder consists of two vertical poles connected by a horizontal pole which can be fixed to the sides of the holder. The horizontal pole is provided with two metal rings, which are aligned to the center of the circular opening on the holder. The rings on the top stand, opening in the mussel seed holder and the end of the elongated slit on the base plate are aligned so that the core material can be held vertically in the center of the PVC pipe.

All the above-mentioned five parts can be easily assembled within 5 minutes at the farm site with the help of nuts and bolts and are detachable making the seeder a portable unit. The cost of a single unit of mussel seeder made of Mahogany wood is Rs.2500. Although 12 mm diameter nylon ropes are conventionally used as core material, the use of 5 cm width flexible plastic strips (FPS) which are used to make camp cots and chairs have been recommended as a cheaper and durable substitute for seeding (Mohamed *et al.*, 2003). FPS is commercially available as 100 m rolls.

Items necessary for seeding are the core material such as FPS and the pre-stitched cotton tubes. The pre-stitched tubes are prepared from biodegradable cloth (e.g. cotton mosquito net) which are cut into required length (1.25 m) and width (slightly larger than outer width of the PVC tube) and machine-stitched longitudinally. These are kept ready before the seeding process is initiated.

Seeding process: The pre-stitched tube is first pulled over the PVC pipe and the FPS is passed through the PVC pipe. The lower end of the pipe is closed by tying the pre-stitched tube and the FPS. Then the pipe covered by the pre-stitched tube is inserted into the mussel seeder between the seed holder and the base plate. The lower knotted end is slid under the elongated slit and the knot holds the pipe and the pre-stitched tube in position. The upper end of the pipe is aligned to the circular opening on the mussel seeder and is held in position by the coupling. The upper end of the FPS is tied to a 3 mm nylon rope, which is passed through the ring on the top stand and tightly tied to the hook provided on the side of the seed holder. Cleaned, separated and sorted mussel seed are placed in the seed holder from where it can be slipped into the pipe. When it is filled to the brim, the pipe alone is lifted up slowly until it is above the seed holder. Then the knot on the hook is loosened enabling the pipe to be slipped out. Finally, the seeded mussel tubing can be easily slid out of the seeder and knotted at the top. These tubes can be stocked immediately in the farm. Where the depth at culturing area is more and if horizontal

Table 1. *Advantages of the mussel seeder*

Use	Advantages
Semi-automation of the process of filling the seed – seeding	*Reduction in labour and time.* Manual stitching of 1m rope by the conventional method takes 8 minutes compared to 2 minutes in the seeder.
	Uniformity in attachment of mussel seed around the FPS. Mussel seed get attached more evenly around the FPS than in the conventional method.
	Reduction in physical exertion. The seeding can be done easily without kneeling or bending for long duration, eliminating the physical stress in those engaged in seeding work, especially womenfolk

method of stocking is followed, then these can be joined by tying the ends to one another to get the required length.

The relative advantages of the newly developed mussel seeder in terms of time taken for seeding, uniformity of attachment of the seed and relative physical exertion are given in Table 1.After successful field trials, the seeder was demonstrated to mussel farmers and panchayat officials at Korapuzha (Kozhikode Dt), Vallikunnu (Malappuram Dt) and Padanne (Kasaragod Dt) in North Kerala. The response of the farmers was graded as good considering the advantage of reduction in time taken for seeding and the resulting decrease in expenditure on labour. Farmers were of the opinion that the seeder can be used as a common facility by all mussel farmers in a village unit. The village panchayat officials have included the seeder in the subsidy component given to mussel farmers.

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