ANIMAL DRAWN
CRIDA DRILL PLOUGH

A SUCCESS STORY

ALL INDIA COORDINATED RESEARCH PROJECT ON

FARM IMPLEMENTS AND MACHINERY

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Fig.1: Traditional Practice of Seeding and Fertilizing

pass leads to uneven seed depth and patchy emergence. This practice results in unbalanced use of soil nutrients and moisture and thus in poor crop yield and low profitability.

This practice of seeding and fertilizing is most prevalent in dryland areas of Telangana and Rayalaseema regions of Andhra Pradesh and also in the states of Tamil Nadu, Karnataka. Maharashtra, West Bengal, Orissa and Punjab. The need for automatic drill was expressed by the farmers and extension agencies. Therefore, a drill-plough development has been an outcome of a need based and demand driven research.

Salient Features of the Machine

The drill unit consists of (1) hopper box, (2) shaft, (3) rubber agitator, (4) metering plate, (5) drive wheel, (6) covering blade, (7) hopper lid with transparent sheet, (8) mounting frame, (9) metering plate clips, and (10) seed and fertilizer pipes (Fig.2).

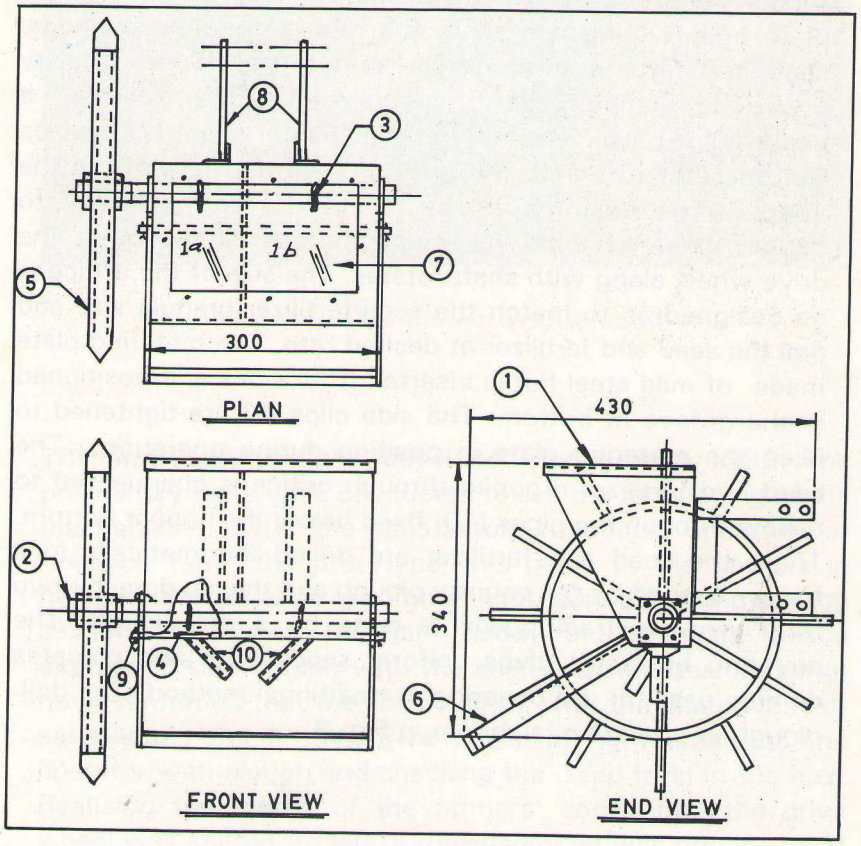

Fig.2: General Assembly of Drill-plough

The seed and fertilizer are stored in respective compartments of hopper box (1) with small compartment for seed (1a) and large for fertilizer (1b). The metering plates (4) fixed at bottom of the hopper have a hole at centre. Separate metering plates are made for each type of seed and variety of crops. The shaft (2) driven by drive wheel (5) rotates the rubber agitators (3) fixed on shaft with cross pins giving it a zigzag shape. The rubber agitators are exactly positioned above the metering plate hole. During operation, the rubber agitators push the seed and fertilizer through the orifice, facilitating gravity flow. The floating blade (6) covers seed and fertilizer with a uniform soil mass. The lid with transparent sheet (7) enables the operator to watch the level of seed and fertilizer in the hopper. The mounting frame (8) of the drill is bolted to country plough handle. As the plough operation begins, the drive wheel along with shaft rotates. The size of the orifice is so designed as to match the seed/fertilizer granule size and drill the seed and fertilizer at desired rate. The metering plate made of mild steel flat is inserted from sides and positioned in the groove at bottom. The side clips (9) are tightened to keep the metering plate in position during operation. The seed and fertilizer dropped through orifice is channelised to furrow through the pipes (10) fixed below the hopper bottom. Thus, the seed and fertilizer are drilled automatically in a furrow opened by the country plough and the job done by two farm workers traditionally is done by a drill-plough. The covering blade (6) gives uniform seed depth and obviates dummy pass for soil covering in traditional method. The drill-plough in operation is shown in Fig. 3.

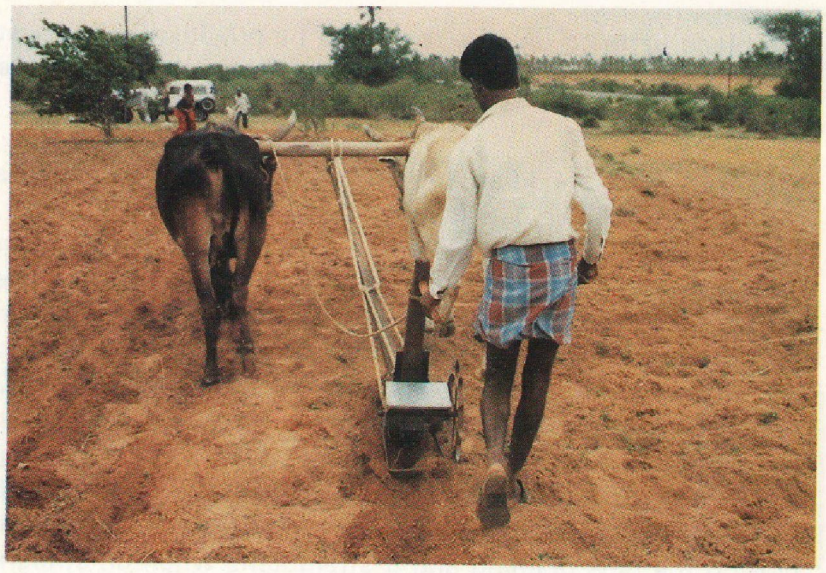

Fig.3: Drill-plough in Operation

Evolution/Design Process

The first prototype was developed during June 1992. The preliminary tests were conducted to see the functioning of the mechanisms. After the satisfactory functional operation at research farm, the prototype was given to the farmers in nearby areas for sowing sorghum crop during ongoing sowing season. A farmer, Mr Ram Reddy of Tupuguda village expressed satisfaction with the seed and fertilizer metering, however he felt that the soil covering with the blade was not satisfactory and the drive wheel at right obstructs the operator with plough and checking the seed level in the box. Realising the merits of the farmers' comments, the drive wheel was shifted to left, a transparent lid was provided and

the blade jumping up was restricted by providing stopper at top sides. This satisfied the farmers and the prototypes were made available for sale on demand.

Twenty seven modified prototypes were sold to farmers during second year. The metering plates for sorghum, castor, pigeonpea, groundnut, greengram, blackgram and sunflower were developed to meet the need expressed by farmers. The farmers who used groundnut seed for drilling reported seed breakage to the extent of 5%. This problem was looked into and it was solved by reducing metering plate thickness by 2 mm and using softer rubber for agitator. The farmers also reported the need of seed/fertilizer tube blocking during turning. A clipping of the bicycle rubber tube to seed/ferti pipe solved the problem. The tube gets folded during turn, closing the pipe opening and it straightens when on straight run. The final model was used by Mr Narsimha a farmer of Chidedu village for sowing castor.

The interaction with farmers helped in identifying the design defects and working out the solutions. The design was updated and finalised. It was exposed through State/National level exhibitions, demonstrations at Kisan Melas and a telecast on Doordarshan. The prototypes were multiplied and sold to needy farmers with full money-back guarantee for faulty design or non-suitability. Free technical service and spot guidance in operational difficulties were provided to the farmers on demand.

Above approach adopted in design process proved extremely useful to introduce quick modifications and upgrade the design wherever necessary and also in expeditious transfer and acceptance of the technology.

Performance of Machine

The data on draft requirement, field coverage, labour requirement, operation cost, crop stand and uniformity was collected from the farmers field. The field performance for sowing of sorghum crop by Mr Ram Reddy, a farmer from Tuppuguda village in Ranga-Reddy district is reported in Table- 1.

Table-1: Performance of drill-plough on farmers field

Parameter	Farmer's practice	Drill-plough
Draft, kg	35	40
Field capacity, ha/h	0.05	0.10
No. of labourers required for operation	3	1
Energy required, man-h/ha	57	10
Bullock pair, h/ha	19	10
Cost of operation, Rs/ha	375	185

The drill-plough covered double the area per hour mainly due to simultaneous soil covering which doesn't require dummy pass made in traditional practice. A ploughman alone is enough for operation, saving two farm workers required for dropping seed and fertilizer. The surplus human and bullock power available during crucial sowing season can be diverted for other operations. A saving of Rs. 190/- per ha in operational cost means that a 2 ha farmer can get back his investment (Drill-plough = Rs. 400/-) in one season.

The drill-plough was also used by farmers for sowing groundnut crop. The drill-plough gave highest plant spacing uniformity with 70% plant spacing falling in optimum range of 5-15 cm as compared to 40% in local method (Fig. 4).

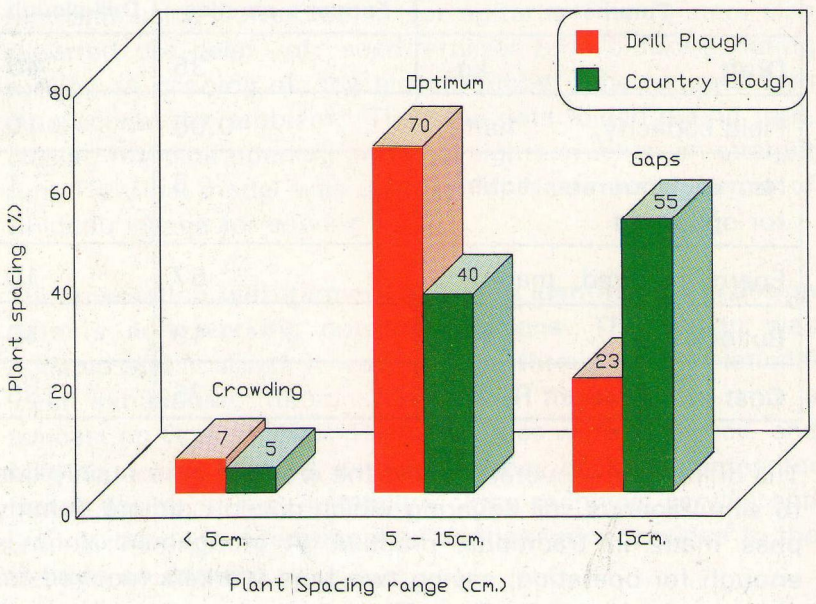

Fig.4: Plant spacing of groundnut (TMV-2) on farmers field using drill-plough

The difference in the crop stand of groundnut, 20 days after sowing obtained by using drill-plough and local practice is shown in (Fig.5). The crop was sown on same day by Mr M Nagaiah, a farmer from Mambapur village in R.R.District in Andhra Pradesh.

Uneven soil cover on seed due to erratic inversion of soil mass during dummy plough pass and unregulated seed dropping by inexperienced farm workers were isolated as key factors causing poor crop stand,when local method of sowing was follows:

Fig.5: Crop stand of groundnut obtained by showing with conventional practice (left) and drill-plough (right)

Status of Technology

The drill plough has become popular in dryland areas due to following benefits over traditional technology.

(a) Drill-plough requires only 1/6th of human and half of the animal energy per ha compared to traditional method. It requires only 7.5 kWh/ha energy compared to 16.5 kWh/ha in a traditional practice.

(b) It covers double the area and ensures timeliness in seeding, a crucial operation in drylands agriculture.

(c) The use of drill-plough results in saving of Rs 190 per ha in operational cost alone and thus the pay-back period for initial investment is only one season, even for a small farmer.

(d) The machine can be manufactured in small village workshops using commonly available material.

(e) It has not only made country plough versatile but also increased crop production and profitability of dryland farmers with small holding.

Appendix- I

Specifications of the Drill Plough

1.	Dimensions		
	Length, mm	:	430
	Width, mm	:	410
	Height, mm	:	420
2.	Metering System for seeds and fertilizer	:	Stationary metering plate with opening and a rubber agitator
3.	Method of changing seed/fertilizer rate	:	By changing metering plate

Appendix-II

Production and Supply of Machine

The prototypes were fabricated at Central Research Institute for Dryland Agriculture (CRIDA) workshop to meet the immediate demand from the farmers. The design was transfered to Andhra Pradesh and Tamil Nadu Agro Industries Development Corporations who have started the production in their respective states.

Statewise supply of drill-plough fabricated at CRIDA

State	Number of Units
Andhra Pradesh	195
Tamil Nadu	14
Maharashtra	12
Karnataka	4
Punjab	3
West Bengal	2
Goa	1

* *The demand for 1830 units was registered by the visiting farmer's to CRIDA stall at Kisan-95 Agricultural Trade Fair at Pune, during December, 1995*

Appendix-III

List of Manufacturers and their Volume of Production

Name of the manufacturer	Volume of production
CRIDA, Hyderabad	231
Tamil Nadu Agro-Industries Development Corporation, Madras	10000*
Andhra Pradesh Agro-Industries Development Corporation, Hyderabad	10

* *Based on letter from Secretary, Agriculture, Government of Tamil Nadu*

List of Interested private Manufacturers*

Sl.No.	Name of the Company
1.	M/s P S R Engineering Company, Hyderabad, Andhra Pradesh
2.	The Karnataka Agricultural Implements and Allied Industrial Cooperative Society Limited, Hubli, Karnataka
3.	M/s Farm Implements Private Limited, Madras, Tamil Nadu
4.	M/s Versatile Engineering Works, Arava-kurichi, Tamil Nadu
5.	M/s Agro-tech Fabricators, Hyderabad, Andhra Pradesh
6.	M/s Mekins Agrotech Industrial (Pvt.) Ltd., Hyderabad, Andhra Predesh
7.	M/s Shancellor Promotors & Builders (Pvt.) Ltd., Calcutta, West Bengal
8.	M/s Shakti Engineering Company, Jalna, Maharashtra

* *The transfer of the design to above Industries is in process, as per ICAR guidelines.*