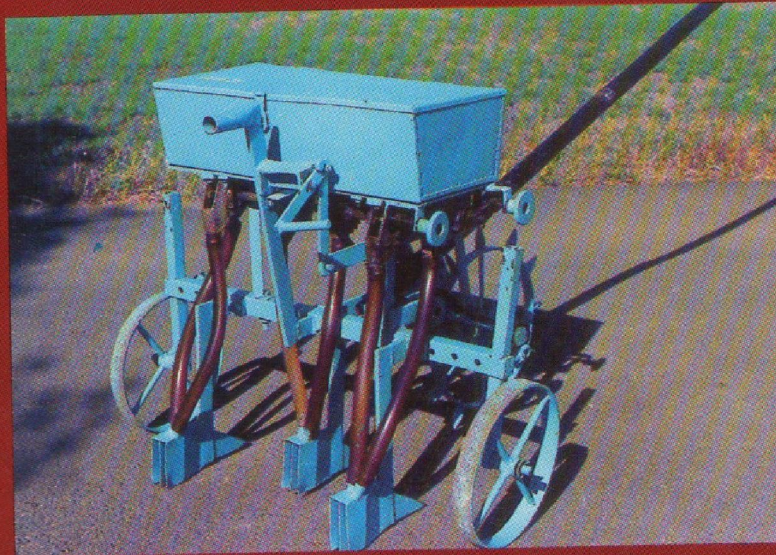


3

# ANIMAL DRAWN THREE ROW SEED-CUM-FERTILIZER DRILL



## A SUCCESS STORY



*ALL INDIA COORDINATED RESEARCH PROJECT ON  
FARM IMPLEMENTS AND MACHINERY*  
**CENTRAL INSTITUTE OF AGRICULTURAL ENGINEERING**  
Nabi Bagh, Berasia Road, Bhopal - 462 038, India



**ANIMAL DRAW  
THREE ROW SEED-CUM-FERTILIZER DRILL**

<b>Year</b>	:	<b>2000</b>
<b>Published by</b>	:	<b>COORDINATING CELL AICRP ON FARM IMPLEMENTS AND MACHINERY CENTRAL INSTITUTE OF AGRICULTURAL ENGINEERING Nabi Bagh, Berasia Road Bhopal-462 038, India</b>
<b>Implement designed &amp; developed by</b>	:	<b>NSL Srivastava Anurag K Dubey <i>CIAE, Bhopal</i></b>
<b>Compilation and Editing</b>	:	<b>D Chaudhuri MM Pandey <i>CIAE, Bhopal</i></b>
<b>Art, Cartography &amp; Proof Reading</b>	:	<b>Yashwant Bhokardankar SS Mandvikar <i>CIAE, Bhopal</i></b>
<b>Word Processing</b>	:	<b>Zackaria V John <i>CIAE, Bhopal</i></b>
<b>Reprography</b>	:	<b>Radheyshyam Kushwaha <i>CIAE, Bhopal</i></b>

## Introduction

Seeding and fertilizer placement are two operations which, if done in the desired manner, increase production by 15 to 25%. Two essential characteristics are uniform seed distribution and minimum variation in depth of sowing. In the black soil region of Madhya Pradesh, the important crops are soybean, pigeonpea, sorghum, maize, wheat and bengal gram. The black soil behaves peculiarly under varying soil moisture conditions. During *Kharif* season, when the soil moisture is above 25%, the soil becomes plastic and very sticky and it does not flow properly. When soil moisture recedes the soil becomes very hard and it poses problems in fine seedbed preparation and penetration of furrow openers. During *Kharif* season sowing is done at 2-5 cm depth while in *Rabi* under dry farming conditions sowing is done at 10 cm depth.

Although, tractor operated seed drills are commercially available, no suitable bullock drawn seed-cum-fertilizer drill was commercially available in this region. Keeping this in view, the development of a bullock drawn seed-cum-fertilizer drill was undertaken. The project was taken with a view to develop a machine, incorporating good features of existing machines used in different areas which could be suitable for black soil conditions and should be low cost so that it is within reach of small and medium farmers.

## Traditional Practices Followed and Need for Development

The traditional practice followed in Bhopal region is either sowing behind a country plough or using a '*dufan*' or '*tifan*'. These use manual metering for seed. The proper distribution of seed or fertilizer greatly depends on skill of operator. Also, it is not possible to maintain uniformity of depth of sowing. Besides the person operating the plough or *dufan*, at least two more persons are required.



Under this situation it was felt an animal drawn machine with positive metering which could sow all the crops and apply fertilizer in rows in black soil would be very useful to the farmers for precise and timely sowing operations.

### **Salient Features of the Machine Developed**

The CIAE bullock drawn three row seed-cum-fertilizer drill consists of a main frame, seed and fertilizer boxes, seed metering mechanism, furrow openers, depth cum transport wheels and drive mechanism. The main frame consists of box section tool bar of 40 x 40mm cross section and 900mm length made by welding two angle iron of 40x40x5 mm size. Over this tool bar other sub-assemblies are mounted. The tool bar is provided with a number of holes to vary the row to row spacings of furrow openers.

The machine has a common box with separate compartments for seed and fertilizer. The box has a lid on the top and at the bottom are fitted metering mechanisms for seed and fertilizer which consists of standard die-cast aluminium fluted rollers of 12 and 8 flutes respectively. The adjustment for quantities of seed and fertilizer are done by rotating a knob fitted on a screw rod. By this action the fluted rollers move in and out of their housings and thus the rate of seed discharge is adjusted.

The furrow openers are shoe type. Single openers with combined boot are used for seed and fertilizer placement in dispersed band. In order to avoid clogging of soil, the design of furrow openers is such that it is closed at bottom and delivery of seed and fertilizer is from the rear side of furrow openers. A projected plate at the rear of furrow openers helps in separating the seed and fertilizer in the furrows. Two depth cum transport wheels of 250 mm diameter are provided for transport of machine. The drive to the seed and fertilizer metering mechanism is obtained through a 450 mm

size ground wheel and a chain and sprocket arrangement.

### **Evolution/Design Process**

At the first stage, three potential commercial models of three row bullock drawn seed-cum-fertilizer drills and planters namely, Jyoti planter, Jyoti seed-cum-fertilizer drill and PAU-Sherpur seed-cum-fertilizer drill (which is recommended for sandy loam soil conditions) were chosen for making modifications to suit black soil conditions. The seed-cum-fertilizer drills employed fluted roller mechanism for seed metering and an agitator and hole arrangement for fertilizer metering. Inclined cell plate and vertical cell roller type metering mechanisms were used in the planters for seed metering. In the seed-cum-fertilizer drill, there was no arrangement for power cut off. Hoe type furrow openers were used. The drive wheel was not having any lug for improved traction. The depth of furrow openers with respect to wheels was adjusted by moving the axles of the two wheels up and down in a slotted bracket which was not very convenient.

The above unit was operated in the field and the following problems were encountered:

- (a) Slippage of drive system
- (b) Adjustment of furrow openers
- (c) Clogging of furrow openers
- (d) Performance of seed metering mechanism was satisfactory but that of the fertilizer metering was not proper. There was no provision for adjustment of fertilizer rate.



The above machine was modified as follows:

- (a) A non-clogging shoe type furrow opener was provided. This furrow opener was closed at the bottom so that seed and fertilizer were delivered from rear side and the opening did not clog even when soil moisture was high.
- (b) An arrangement for lifting of furrow openers at headlands and during transport position was added. For this purpose the furrow openers were mounted on a separate frame with their telescopic mounting on the main frame.
- (c) Improved drive wheels of 400 mm diameter with proper helical type lugs were provided and an additional arrangement for folding type spikes was made. The wheels did not give jerk during transport on road due to proper spacing of lugs.

The modified machine was evaluated for sowing of wheat and Bengal gram crops in two types of fields, one having enough trash and another trash-free. In trash-free field working of machine was satisfactory but in trashy-field lot of trash was found to get collected in front of the furrow openers due to low ground clearance which was 15 cm when 40 cm diameter wheels were used. The wheels were later changed to 60 cm diameter which gave about 25 cm ground clearance. A comparative field trial of this prototype was carried out along with a two-row seed-cum-fertilizer drill, *dufan* and *chans*.

The machine gave good performance resulting in higher plant emergence and yields. Experience of field trials revealed that there was great scope for simplifying the design of seed drill cum planter to reduce weight of machine, economize in

co and reduce draft requirement. This led to the development of final prototype of the machine (Fig.1).

### Performance of the Machine

The three row seed-cum-fertilizer drill was tested in the laboratory and field. Field tests were carried out on CIAE farm and in farmers field during *Kharif* and *Rabi* seasons. In all about 60 ha of sowing was done.

The following tests were carried out during laboratory testing:

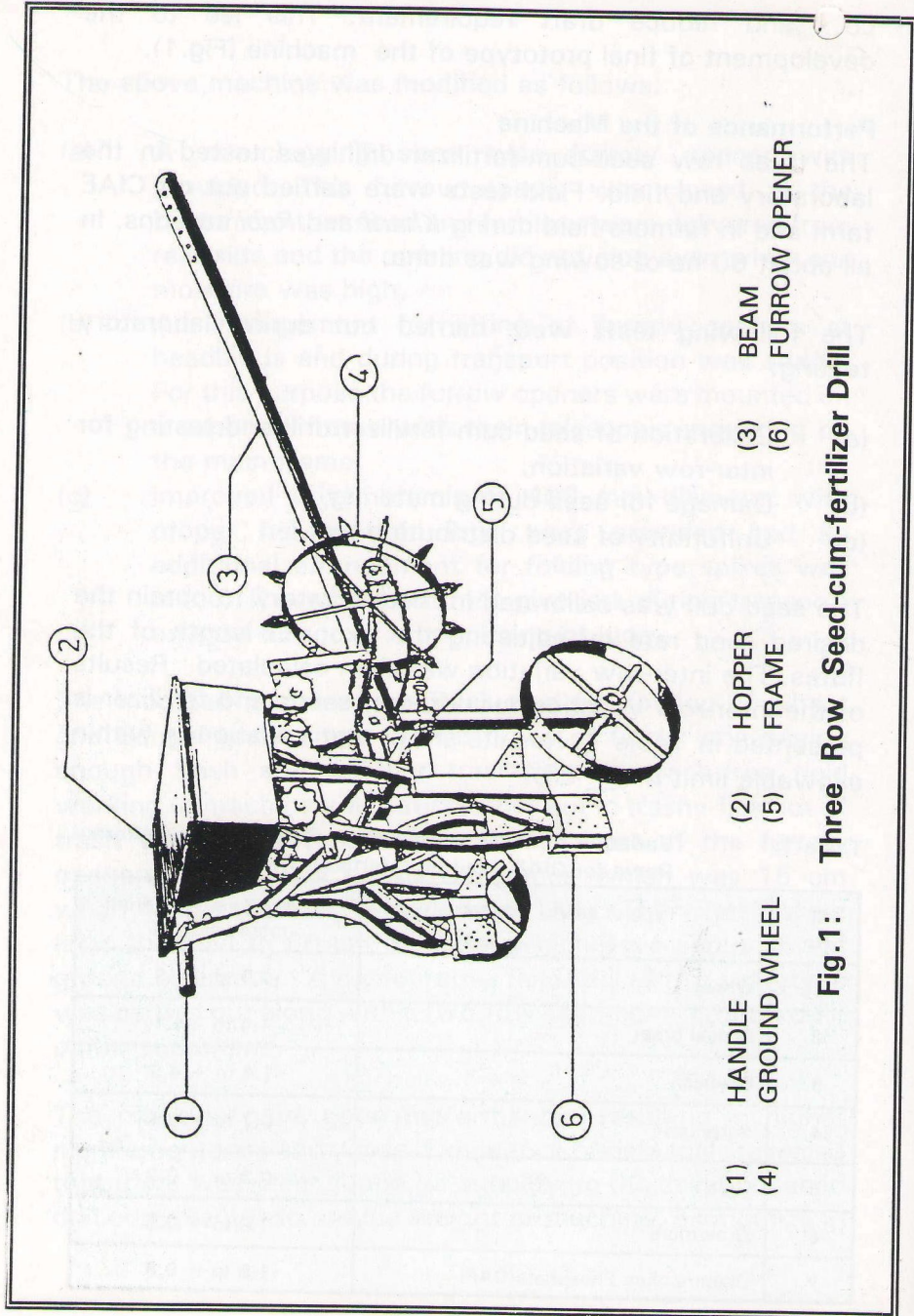
- (a) Calibration of seed-cum-fertilizer drill and testing for inter-row variation,
- (b) Damage for seed during metering,
- (c) Uniformity of seed distribution test.

The seed drill was calibrated in the laboratory to obtain the desired seed rate by adjusting the exposed length of the flutes. The inter-row variation was then calculated. Results of the inter-row variation for different seeds and fertilizer is presented in Table 1. Results show that variation is within allowable limit of  $\pm 5\%$ .

**Table-1: Variation of Seed and Fertilizer Rates among Different Rows for CIAE Seed-cum-fertilizer Drill**

Sl. No.	Type of seed / fertilizer	Range of variation from rated value, %
1.	Wheat	-4.9 to +4.9
2.	Bengal gram	-1.4 to +4.1
3.	Soybean	-1.4 to + 4.3
4.	Sorghum	-0.7 to + 3.8
5.	Urea	-0.3 to + 0.3
6.	Growmore	-1.3 to + 0.6
7.	Diammonium Phosphate(DAP)	-1.6 to + 0.8





- |     |              |     |        |     |               |
|-----|--------------|-----|--------|-----|---------------|
| (1) | HANDLE       | (2) | HOPPER | (3) | BEAM          |
| (4) | GROUND WHEEL | (5) | FRAME  | (6) | FURROW OPENER |

Fig.1: Three Row Seed-cum-fertilizer Drill



Observations for seed damage due to metering were recorded visually and also the results were confirmed through germination tests. Results are presented in Table 2. The damage of seeds due to metering was minimum (0.50%) for wheat and maximum (2.82%) for soybean.

Results of seed distribution test on grease belt are presented in Table 3 for wheat and soybean crops. It is noticed that there was considerable variation in seed spacing among different rows. However, difference in average values between the different rows were small. Results of field tests are presented in Tables 4 and 5.

**Table-2: Mechanical Damage to Seeds**

Sl.No.	Wheat	Seed Damage, %
1.	Wheat	0.50
2.	Bengal gram	0.12
3.	Sorghum	2.18
4.	Soybean	2.82
5.	Maize	1.84
6.	Groundnut	1.26

**Table-3: Uniformity of Seed Distribution on Grease Belt under Field Conditions**

Sl. No.	Variable	Output Data		
		Wheat	Soybean	
1.	Number of seeds per metre length			
	(a)	Range		
		1 st row	21-53	16-32
		2nd row	23-53	19-26
	3rd row	17-54	20-33	

	(b)	Average value		
		1st row	40.50	24.14
		2nd row	40.78	23.71
		3rd row	39.35	24.28
2.	Average number of seeds per metre length for all rows		40.21	24.04
3.	Percentage variation among rows,		-2.1 to +1.4	-1.4 to +1.0

**Table-4: Summary of Results of Field Trials with CIAE Seed-cum-fertilizer Drill**

Sl.No.	Variables		Values
1.	Depth of placement of seed and fertilized		Could be varied from 25-125 mm
2.	Separation of seed and fertilizer		
	(a)	Horizontal	10 mm
	(b)	Vertical	Nil
3.	Draft		45-65 kg
4.	Row to row spacing		Field capacity in ha/h
	(a)	20 cm	0.074-0.099
	(b)	22.5 cm	0.083-0.100
	(c)	30 cm	0.100- 0.125
	(d)	45 cm	0.167-0.200
	(e)	60 cm	0.200-0.250



**Table-5: Seed Emergence, Plant Population and Crop Yield for Various Crops Sown with 3-row CIAE Seed-cum-fertilizer Drill**

Crop (variety)	Average seed emergence, %	Plant population (2 weeks after sowing No./m <sup>2</sup> )		Average yield of crop, q/ha
		Recommended	In test plots	
Soybean (JS-2)	75	25-40	36.4	19.10
Sorghum(Cstt-5)	78	15-20	16.6	22.10
Wheat(WH-147)	82	100-160	130.00	34.51
Bengal gram (Radhey)	80	20-30	35.00	16.00

The depth of sowing with seed-cum-fertilizer drill could be easily adjusted from 25-125 mm. The seed-cum-fertilizer drill placed seed and fertilizer at the same depth but there was a horizontal separation of 10 mm. The draft of the seed drill varied from 45 to 65 kg. At higher soil moisture, the draft was less. Field capacity of machine varied depending upon row to row spacing. Values of field capacity at different row spacings are presented in Table-4. Results of plant emergence, plant population and yield are presented in Table-5. Yields were generally 5-10% higher than those with local method of sowing.

The cost of operation with machine worked out to be Rs 227/ha as compared to Rs 718/ha by local 'Chans'.

#### **Status of the Technology**

The seed-cum-fertilizer drill was distributed to farmers in three adopted villages of the Institute under village saturation programme. Farmers gave a favourable response to this machine. This machine was then released for extension.

## Appendix-I

### Brief Specifications of CIAE Three Row Seed-cum-Fertilizer Drill

1. Frame
  - Box section size, mm : 40x40x5
  - Materials for box section frame : MS angle 35x35x5
  - Materials for bracket for beam,mm : MS flat 40x10
2. Transport cum depth wheel
  - Dia, mm : 250
  - Wheel rim, mm : Made of MS flat 40x5
  - Wheel hub, mm : Made of MS rod 25 mm dia
3. Ground wheel drive : Spoke type, front mounted, floating type
  - Rim diameter, mm : 350
  - Lug height, mm : 50
  - Material of hub, : MS bar 25 mm dia
  - Material of rim & lugs : MS Flat 25x5 mm
4. Seed metering mechanism
  - Type : Fluted roller
  - Material : Die-cast aluminum /nylon-plastic
  - No. of flutes : 12



5. Fertilizer feed mechanism

Type	:	Fluted roller
Material	:	Die-cast aluminum/nylon-plastic
No. of flutes	:	8

6. Ground wheel sprocket No. of teeth

(a) big	:	19
(b) Small	:	14

7. No. of teeth of seed & ferti. feed shaft sprocket

: 19

8. Chain

: Motor cycle chain 1.8 m long, 12.5 mm pitch

9. Overall weight, kg (Empty, without beam)

: 50

10. Overall dimensions (LxWxH, mm)

: 1000x1000x780

**Appendix-II****List of Manufacturers and their Volume of Production**

<b>Name of the manufacturer</b>	<b>Volume of production</b>
Prototype Production Center CIAE ,Bhopal-462038	350
M/s Fine Fabrication Works, 104,sector-I Industrial area, Govindpura, Bhopal-462023	25
M/s Trimurthy Agro Industries, 19, Sector-I, Industrial Area, Govindpura, Bhopal-462 023	30
M/s Shri Manak Industries, 211, Sector-C, Indrapuri, Bhopal-462 022	5
M/s NAFED Krishi Yantra Udyog, B-481, Industrial Estate, Bhiwadi, Dist.:Alwar-301 019	45
M/s Fabro Tech Engineers, 2-B/1, Road No.9, Industrial Area, Govindpura, Bhopal-462 023	25
M/s Suraj Sales Corporation, C-1, 502, GIDC Estate, Odhav, Ahmedabad-382 415	10
Agricultural Engineer, Divisional Agricultural Engg. Workshops Putlighar, Bhopal-462 001; Adhartal, Jabalpur; Pologround, Indore; Satna and Gwalior (MP)	165