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EVALUATION OF COMMERCIALLY AVAILABLE FERTILIZER. APPLICATORS FOR THEIR PRECISION AND UNIFORMITY OF APPLICATION

by

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INTRODUCTION

Uniform application of fertilizer is a prerequisite for the precise conduct of experiments of an agricultural station. A number of factors affect the precision of fertilizer application, such as (1) physical condition of the fertilizer, (ii) particle size, (iii) atmospheric humidity, (iv) hygroscopicity of fertilizer, and (v) metering mechanism of the fertilizer applicators (Mehring and Cummings 1930),

Metering mechanism of fertilizer applicator is one of the most important factors that affect the uniform application of a fertilizer. The accuracy of the three different commercially available fertilizer applicators was studied at ICRISAT Center for broadcast application and placement for Urea and Diammonium phosphate. The results of the study are discussed here (Fairbank 1930).

MATERIAL AND METHOD

The three fertilizer applicators that were tested for their performance were :

1. Ezee Flow
2. Cole Applicator
3. Barber Plot Applicator

Each of these applicators has a different metering mechanism.

Ezee Flow

This applicator has a gravity-drop metering mechanism through diamond-shaped openings in the bottom of the fertilizer hopper. The size of openings can be increased or decreased with the help of a shutter that slides to and fro and can be actuated by a lever. The lever can be locked in position on a graduated scale. The hopper has an agitator that gets drive from the transport wheels (Fig. 1).

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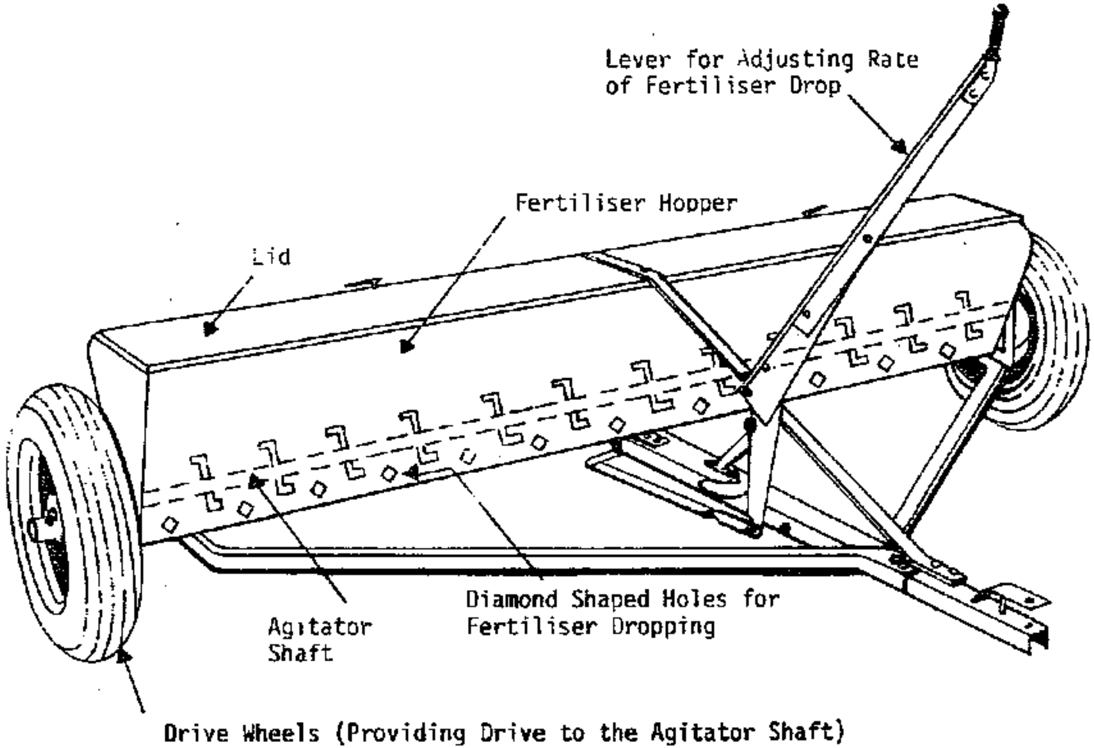

FIG1:EZEE FLOW FERTILISER APPLICATOR - DETAILS

Cole Applicator

It consists of two fiber glass hoppers mounted on a tool bar having an 'A' frame for mounting and hitching to the tractor. The bottom plate in the hopper revolves with the help of a Bevel gear and Pinion which is driven through tractor ground power take off (PTO), The drive cuts off when the equipment la lifted on the 3-point linkage and engages when lowered to the ground. The fertilizer in the hopper flows into the rotating plate, which is intercepted by a plate channeling the fertilizer down the flexible tubes and to the furrow openers. The incepting plate can be adjusted, depending on the rate of application required (Fig. 2).

Barber Plot Applicator

It has a 10-foot fertilizer hopper with a false bottom where a spiral auger housed in two semi-circular stainless steel tubes is clamped. The auger housing has slots at regular intervals on top for the fertilizer to enter the tube which is then moved by the rotating auger to be dropped through the bottom holes into the catchpans. The applicator can he used for broadcasting without the catchpans or for placement with the help of pans and flexible tubes which convey the fertilizer to the furrow openers. The hopper and the shanks are mounted on a tool bar attached to a tractor through an 'A' frame and pins, The spacing between the shanks can be adjusted according to the row spacing of the crop, The drive for the auger and the agitator comes from a ground wheel trailing behind the hopper, The drive train consists of sprockets and chains. The rate of fertilizer application can be increased or decreased by increasing or decreasing the rotation of the auger through a Sunflower gear. The Sunflower gear provides 36 positions at which the applicator can be adjusted and calibrated (Fig. 3).

All the three applicators were adjusted at a predetermined setting and then taken to the field to obtain the drop of fertilizer in a plot size of 1500 m^2. The test was replicated three times to find out the consistency of fertilizer drop under given field conditions, The fertilizer drop thus obtained in each plot was collected and weighed, Qantity obtained per plot was converted into kilograms per hectare and is shown in Table I, Similarly the drop from each spout was collected separately and is shown in Tables 2 and 3.

The test was carried out with two commonly used fertilizers;

I. Diammonium phosphate (18-46-0 NPK). The fertilizer is pelleted; the pellet size and texture are relatively uniform.

2. Urea (N 46%). It is a granulated, free-flowing fertilizer.

Both of these fertilizers were sieved through a wire mesh to obtain more uniform grades so as to eliminate any error arising due to variations in the particle size, The atmospheric humidity ranged between 16 and 20% at the time when the tests were carried out.

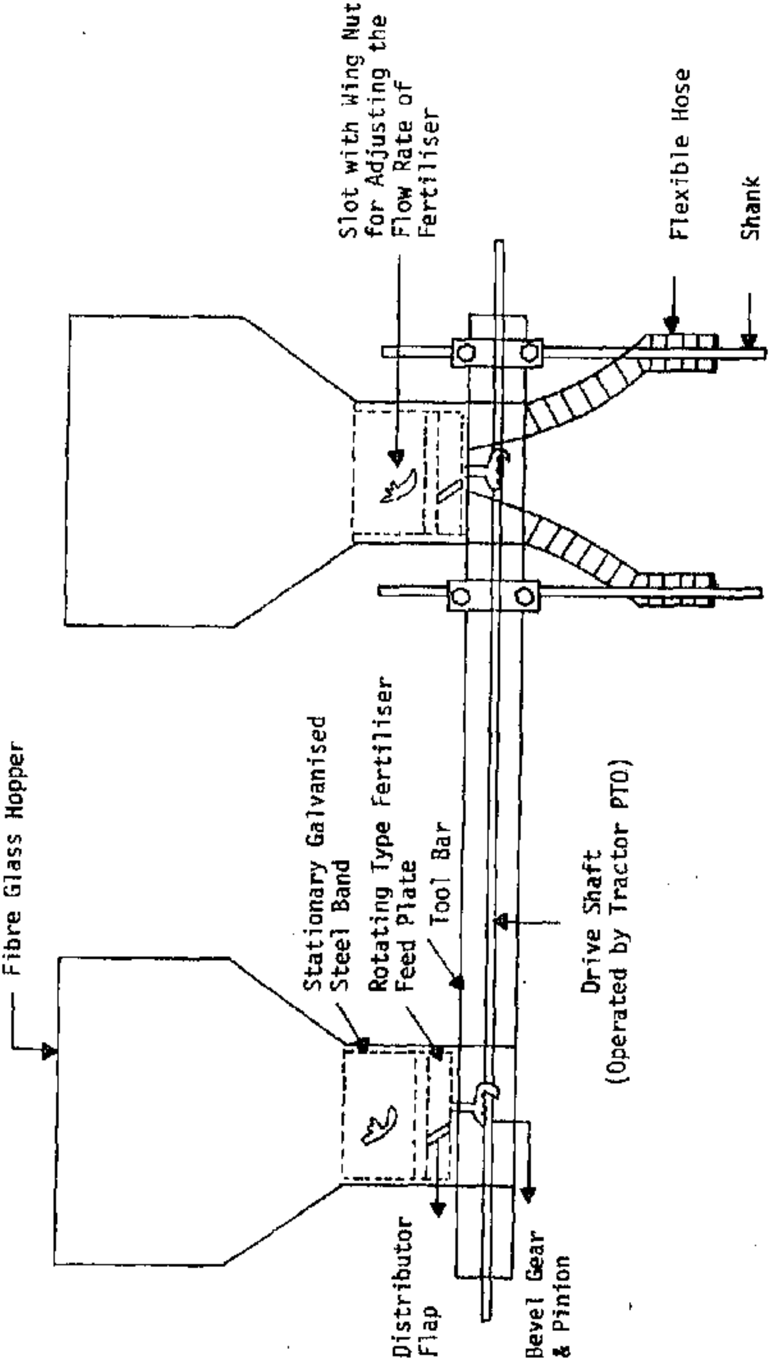

FIG.2: DETAILS OF COLE FERTILISER APPLICATOR

Table 2 — Consistency of total drop of fertilizer kg/ha through different spouts of Barber Applicator

Fertilizer	Number of Spouts I	II	III	IV	Mean
Urea	62.3	91.7	84.0	87.4	81.3
Diammonium phosphate	75.8	98.4	97.1	100.4	97.9
Mean	79.0	95.0	90.6	93.9	

Statistical Analysis

Effect	F Test	SEM (0.05)	LSD (0.05)
Fertilizer	S	1.1	3.5
Spout	S	1.6	4.9
Interaction	S	2.3	6.9

As is evident from Table 2, the drop of fertilizer through different spouts of Barber applicator differed from one another. As regards performance in relation to fertilizers (Urea and Diammonium phosphate) there was hardly any difference.

It is evident from Table 3 that the Cole applicator performed similarly for both Urea and Diammonium phosphate as far as their drop was concerned. There existed variation between drops through different spouts, but variation was very marginal and showed a trend of similarity.

Table III — Comparison of the drop through different spouts of Cole Applicator (kg/ha)

Fertilizer	Spout I	II	Mean
Urea	98.8	99.9	99.4
Diammonium phosphate	98.7	99.2	99.0
Mean	98.7	99.6	

Statistical Analysis

Effect	F Test	SEM	LSD (0.05)
Fertilizer	N.S	0.2	-
Spouts	S.	0.2	0.7
Interaction	N.S	0.3	

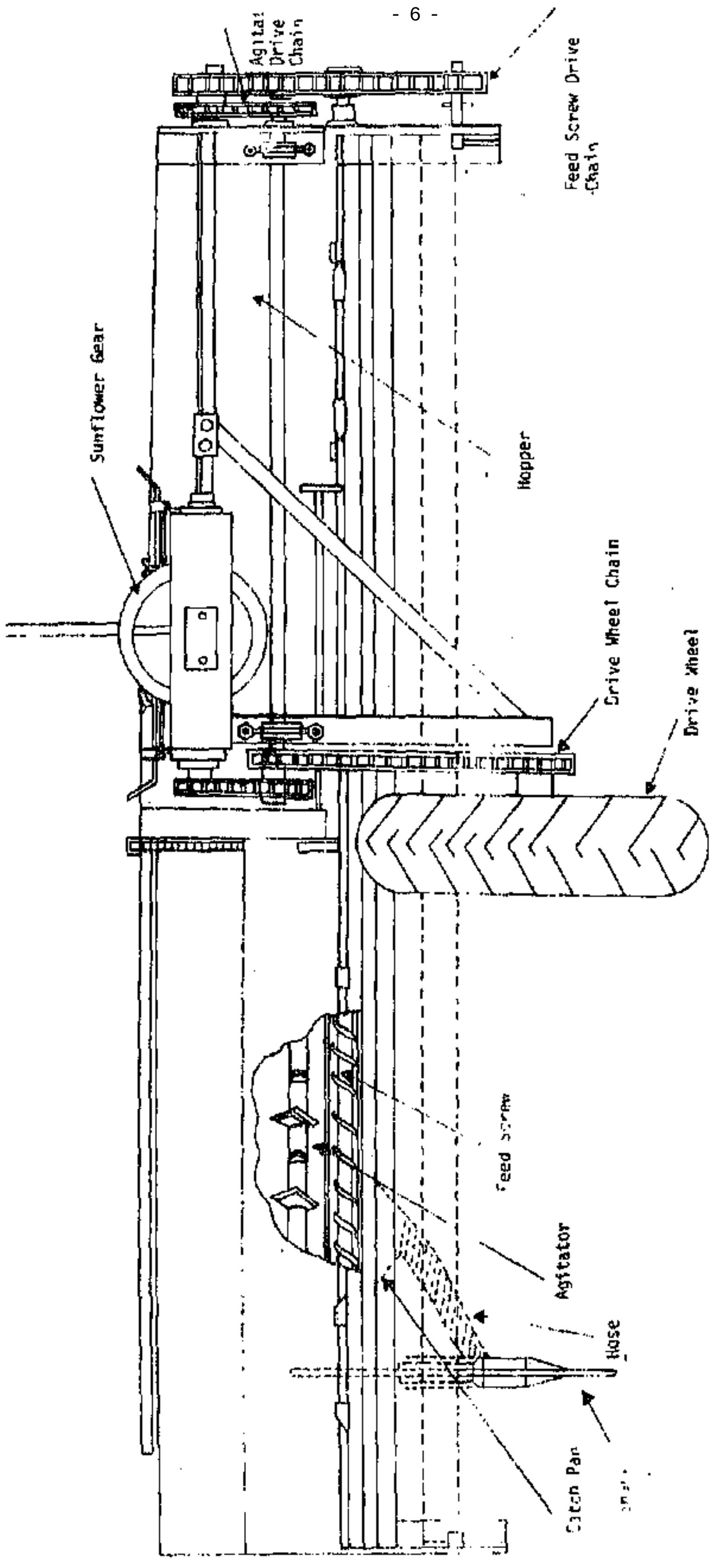

FIG3: BARBER FERTILISER APPLICATOR - DETAILS

Tables 2 and 3 show comparison of Barber and Cole applicators for fertilizer drop through the spouts in the case of Urea and Diammonium phosphate, respectively.

In experimentation where the cultivars are evaluated for their genetic potential and compared against a standard 'check' rate per hectare is not as critical as uniform application of fertilizer between the rows or throughout the experiment.

RESULTS AND DISCUSSIONS

Table I Consistency of total drop of fertilizer in kg/ha

Fertilizer	Urea				Diammonium phosphate				
Applicator	RI	RII	RIII	MEAN	RI	RII	RIII	MEAN	MEAN
1. Ezee Flow	58.3	133.3	46.6	79.4	61.6	73.8	58.8	64.8	72.1
2. Cole	92.2	99.5	99.6	99.4	98.4	99.4	98.5	98.8	99.1
3. Barber	93.3	95.0	94.4	94.2	112.0	113.0	114.0	113.0	103.5
MEAN				91.0				92.1	

Statistical Analysis

Effect	F Test	SEM	LSD (0.05)
Applicator	Sig	7.6	24.1
Fertilizer	N.S	6.2	
Interaction	N.S	10.8	

As is evident from Table I, the three applicators differed with respect to their accuracy of application. The Ezee flow applicator was least accurate of the three, whereas the Cole and the Barber applicators did not differ significantly from each other.

With respect to two different fertilizers, i.e., Urea and Diammonium phosphate, the applicators did not differ and there was no significant interaction between the applicators and the type of fertilizer used.

The poor performance of Ezee flow can be attributed to its metering mechanism, which is nonpositive and unreliable. The metering mechanism of Cole and Barber is positive and not so sensitive to the grade of fertilizer and field variations.

CONCLUSIONS

The performance of Ezec flow was very unreliable because of nonpositive metering mechanism for both Urea and Diammonium phosphate, while the performance of Barber and Cole applicators in maintaining consistency over fertilizer drop for both the fertilizers was reliable because of positive metering mechanism, Both the applicators performed equally well for the two different fertilizers (Urea and Diammonium phosphate).

Going through the data on the drop obtained through different spouts of Barber and Cole applicators, both the machines performed in a similar manner. There existed variation in the drop of fertilizer through each spout, However in case of the Cole applicator, variation was very marginal, The reason again can be attributed to the metering mechanism of both the applicators and the granule size of the fertilizers.

LITERATURE CITED

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2. Fairbank G.E, 1930, Fertilizer placement machine for experimental plot work. Agr. Eng. 31, 556-564