

## FIELD PERFORMANCE EVALUATION OF A SEED PLANTER

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### ABSTRACT

The National Centre for Agricultural Mechanization (NCAM) acquired a, Chinese made, easy to use, single row planter through Project Coordinating Unit (PCU) in order to carry out field performance evaluation with the aim of possible adoption in Nigeria. The planter, at a walking speed of 1.43 km/h gave field capacity and field efficiency of 0.061 ha/h and 81% respectively. Also, the percentage of stand established and percentage of seed dropped were 47% and 90% respectively. The field performance revealed that the single row planter has the potential to eliminate the stress associated with the traditional method of planting if the metering device could meter the seed precisely as calibrated.

**Keywords:** harrowed, maize, performance, planter, ploughed, seed.

### 1.0 INTRODUCTION

According to Isiaka et al. (2000), planting is one of the major labour demanding operations in the production of grains (maize, millet, sorghum, etc) and pulses (cowpea, groundnut, soybean, etc). Majorly, planting of farm crops by the peasant farmers in Nigeria is done manually.

This traditional practice suffers from low output per man-hour and is also very tedious. Common among the field crops planted in Nigeria are maize, soybean, cowpeas, groundnut, cotton, sorghum, okra and kenaf (Laidende and Verma 1994). For uniform maturation it is essential that all seedlings within a field emerge in a very short time span (Pumphrey et. al., 1979). Laidende and Verma (1994) noted that planting of almost all crops on small and peasant farms is carried out manually except on large mechanized farms where

Tractor drawn seeders were used. Knowing fully well that almost 90% of the crops produced in the country are manually cultivated, the stooping posture during manual planting brings about fatigue, backache and reduced work output. Isaka et al. (2000) stated that in the traditional method of planting, it is done with the use of various devices such as sticks, hoes and cutlasses. Hand and heel of the foot are equally used to create a depression in the moist soil and 2 - 3 seeds are dropped into the hole and covered with loose soil. This traditional method is very slow and tiring due to constant bending of the person while dropping the seeds. In order to eliminate the negative side effects of the traditional method of planting, the National Centre for Agricultural Mechanization (NCAM), Ilorin in Nigeria acquired a Chinese made single row seed planter through Project Coordinating Unit (PCU) for evaluation, trials and possible adoption.



The basic objective of this research was to conduct the field performance evaluation on the single row planter. The specific objectives are to: -

1. perform a field test on the planter.
2. Determine the planter's planting efficiency.

## 2.0 MATERIALS AND METHODS

The Chinese made seed planter was evaluated in the field. The planter, as shown in figure 1, was designed to plant various types of grain seeds available such as maize, cowpea, soybean, guinea corn, groundnut, etc. However, for the purpose of this work, maize grain was used for the evaluation of the Chinese made seed planter. The planter is provided with an adjustable plastic cylinder with indents at specified distance on the surface of the cylinder. This no doubt makes it adaptable to plant other crops by replacing the plastic cylinder with the spare that has different number and distance of indents for seed metering. The field test was carried out on a ploughed and harrowed land located within the Centre's premises. The experiment was laid out in a randomized complete block design (RCBD). The plot used was divided into eight different rows at an interval of 0.6m to each other. The plot has a rectangular dimension of 10m by 4.2m. The readings taken for analysis are: -

- 1.number of seeds dropped per hole.
2. seed planting distance in cm.
- 3.planting depth.
- 4.planting time.
5. weight of seed.

Bolufawi (2000) used some of the above parameters for the evaluation of a planter.

The planter's planting efficiency was determined by summing up the calculated percentages obtained for 2 and 3 seeds dropped on the plot.

## 3.0 RESULTS AND DISCUSSION

The planter was evaluated at an average walking speed of 0.4 m/s (1.43 km/h). The seed used for the performance evaluation is maize with the following physical average dimension:

- Length = 11.29 mm
- Width = 8.71 mm
- Thickness = 4.73 mm
- Weight = 0.3 g

The soil condition as at the time of planting operation is as detailed in Table 1. From the analysis of the data obtained, the planter had a planting efficiency of 47.65% and 90.42% in terms of percentage of number of stands established and percentage of number of seeds dropped respectively as detailed in Table 2. The result further revealed that 41.80% of the holes were not planted at all and only 10.55% were planted with one seed/hole. However, agronomic practices recommend 2 to 3 seeds/hole thus the evaluation did not recognize one seed/hole as adequate to be considered as planted.

In the course of the evaluation, it was further discovered that the planting distance was preset and could only be varied by changing the metering cylinder. This implies that for the planter to plant various crops, there may be the need to have more than one metering cylinder in order to accommodate various seeds and planting distances for planting operation.



During the evaluation, the theoretical planting distance was 31cm but in reality the metering cylinder gave an average planting distance of 45cm. This showed that the seed planter cannot establish the expected number of plants on the field. Thus, there is the need to incorporate an agitator into the metering cylinder to prevent clogging of the seed.

The seed planter, when operated at walking speed of 1.43 km/h, gave field capacity of 0.061 ha/h and field efficiency of 81%, as shown in Table 3. The result conforms to Farm Mechanization Planning as reported by Konaka, (2003).

The performance of the seed planter revealed that it is comfortable to operate and it has eliminated the stooping posture usually encountered while planting using traditional methods. The specification of the planter under test is presented in Appendix I

#### 4.0 RECOMMENDATION AND CONCLUSION

The seed planter tested in the Centre had the advantage of eliminating the stooping posture usually encountered in the traditional method of planting. The seed planter also has the advantage of planting seeds faster when compared with the traditional method of planting. Before the adoption of the single row planter, the Centre should look into a way of modifying the seed planter to make sure that seeds are planted at equal planting distance to one another as obtained from design calculation of planter calibration.

Any other distance either lesser or greater than the expected calculated planting distance for the planter under test will result in either over populating the number of plants stands established in the field thereby affecting the growth of crop or under populating the number of plants in the field thereby lowering the crop stands per area of field, renders the planter inadequate.

Furthermore, there is the need to investigate the metering of the seeds to the planting cylinder.

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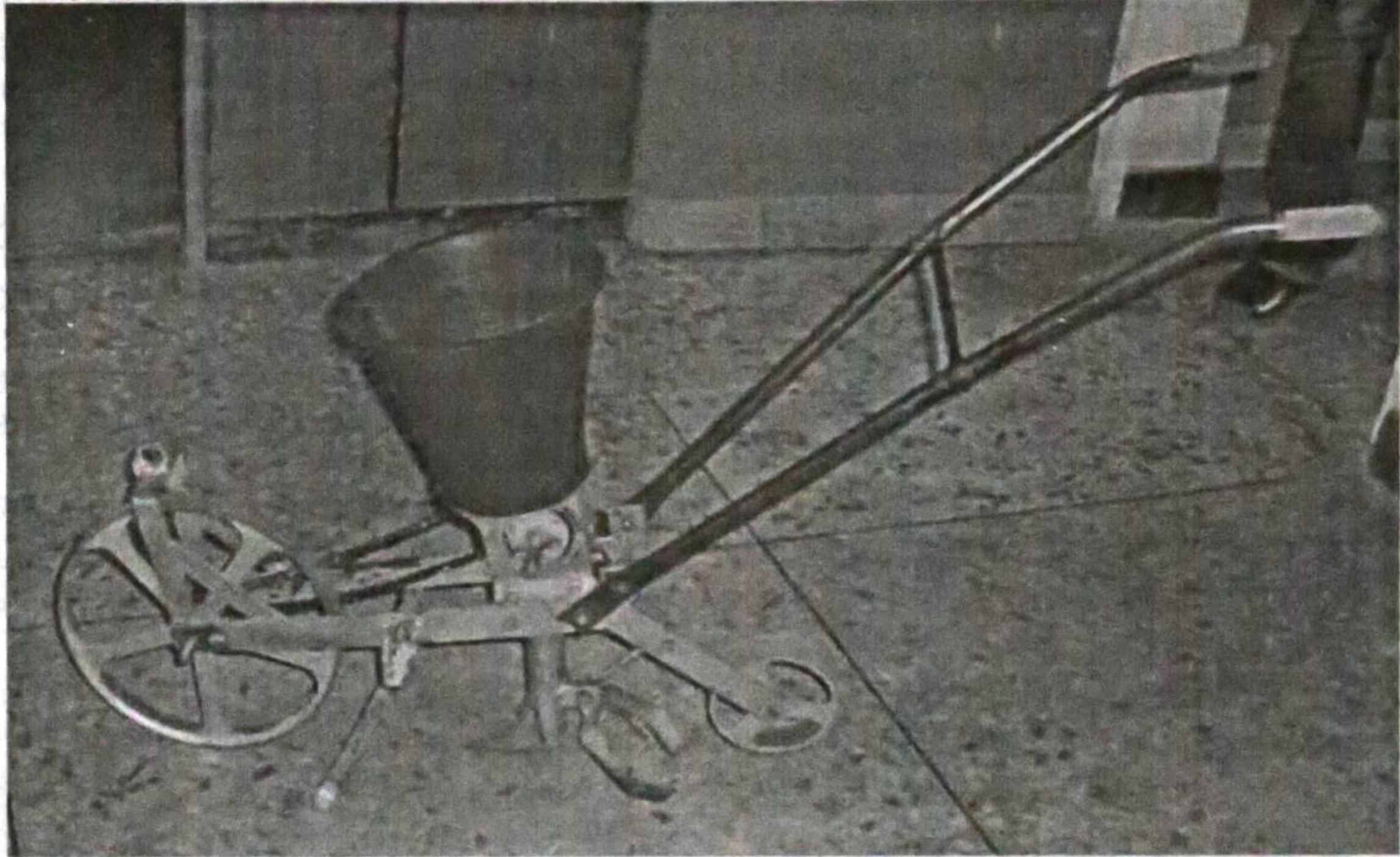


Fig.1 The Pictorial View of the Seed Planter

APPENDIX I . Specification of a Single Row Planter

External Diameter of Hopper (mm):	224
Internal Diameter of Hopper (mm):	140
Height of Hopper (mm):	220
Hopper Material:	Plastic
Number of Driven Sprockets provided for the Planter :	2
Number of Driving Sprockets provided for the Planter :	1
Diameter of Driving Sprocket (mm):	58
Diameters of Driven Sprocket (mm): (1)	(1): 58, (2): 67
Number of Seed Cells :	3
Diameter of Land Wheel (mm):	297
Diameter of Compaction Wheel (mm):	134.5
Transmission Device:	Chains and Sprocket

Table 1. Physical Properties of the Soil during Planting

Depth (cm)	MC (%)	BD (g/cm <sup>3</sup> )	CI (N/cm <sup>2</sup> )	SS (MPa)
0 -7	5.69	1.42	2.76	0.002
7 -14	6.22	1.48	5.51	0.005
14 - 21	6.40	1.55	92.33	0.016

MC = Soil Moisture Content (%); BD = Soil Bulk Density (g/cm<sup>3</sup>); CI = Cone Index (N/cm<sup>2</sup>); SS = Shear Strength (Mpa)



**Table 2. Summary Results of Seeds Dropped per Line**

	A	Frequency of the number of seed dropped					B	C
		No drop made	1	2	3	4		
Replicate1	32	12	4	16	0	0	20	36
Replicate2	32	12	7	11	2	0	20	35
Replicate3	32	14	4	13	1	0	18	33
Replicate4	32	14	3	12	3	0	18	36
Replicate5	32	11	5	14	2	0	21	39
Replicate6	32	16	1	15	0	0	16	31
Replicate7	32	13	2	16	1	0	19	37
Replicate8	32	15	1	14	2	0	17	35
Total number of stands established	256	107	27	111	11	0		256
Total number of seed dropped		0	27	222	33	0		282
Percentage of number of stands established (%)		41.80	10.55	43.36	4.29	0		100
Percentage of number of seed dropped (%)		0.00	9.57	78.72	11.70	0.00		100

**A** = Number of stands expected to be established by the planter from design calculation within the given distance

**B** = Total number of stands established by the planter

**C** = Total number of seed dropped

**Table 3. Field Performance Test Data of a Single Row Seed Planter**

Operation	Area of Operation (ha)	Planting Depth (cm)	Average Time of Operation (h/ha)	Working	Working Speed when Planter was Loaded (km/h)	Field Efficiency (%)	Field Capacity (ha/h)
Planting	0.42	4.00	16.53	2.20	1.43	80.80	0.0605

SOIL TYPE: Sandy loam