EFFICIENCY EVALUATION OF AGROSAW INDENTED SINGLE CYLINDER RICE SEED GRADER.

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ABSTRACT

A seed grading machine (AGROSAW INDENTED SINGLE CYLINDER) used different grains was evaluated for its efficiency in processing seeds of differe Nigeria rice varieties. The effect of physical properties of rice seeds on cleani efficiency, mechanical damage and cleaning loss of the grader were studie Evaluation result shows that optimal performance is obtained when the grader t and bottom screens perforations were 3.25x20mm and 1.85x20mm respective and the speeds for the drive and the blower adjusted to 1440rpm and 900rp respectively. Grain length/breath ratio of not less than 1.56 and feeding rate 300kg per hour to be most appropriate for optimal processing efficiency of t grader.

Key words: Rice, Seed, Grader, Cleaning, and Efficiency

INTRODUCTION

Freshly harvested seeds can not be used for storage or sowing purposes becau their physical conditions and quality need to be improved. Seed processi improves seed condition and its quality. It is a vital link between productic storage and distribution. The seed sets the upper limit of productivity. produ quality and price. Rice processing is a series of selected conditioning operati on harvested seed lot and this is based on the physical characteristics of the cr seed and the contaminants so as to obtain a marketable seed of establish standards. In Nigeria, the art of seed processing is still the traditional metho Farmers keep part of the harvested grain lot for the next planting season. Th practice has the disadvantage of transferring weed seeds from generation generation and low viability because of the presence of high percentage broke damaged, and immature grains as well as other impurities. Over the years fe multi-crop seed processing machines have been developed or imported and adopte to clean rice for seed and milling. However, their performances have not bee satisfactorily tested for the various rice varieties grown in Nigeria. This study wa therefore, initiated to evaluate the performance of Agrosaw indented sing cylinder, an imported seed grading machine from India at the National Cerea Research Institute, Badeggi.

MATERIALS AND METHODS

Relevant Physical and Proximate Properties of the Grains.

It was necessary to consider some physical and proximate characteristics of the rice varieties, as these were the main properties taken into consideration in designing the machine. Properties considered include length, width, length/width ratio, grain weight and the moisture content. This study was limited to five rice varieties (FAROs 11, 40, 36, 27, and 24.). The grain dimension was taken using micrometer and weight using sensitive balance (DanBaba and Nkama, 2001). Grain moisture content was measured by oven dry method at a temperature of 104^{0}C for 24hours (A.O.A.C. 1984). All other measurement was taken at room temperature. Three sets of different sizes of cleaning screens were used to determine the best screen combinations.

Description and Operation of the Seed Grader

Agrosaw Indented Single Cylinder seed grader was designed and fabricated by Osaw Agro Industries, India and was imported into the country for seed processing. In order to obtain seed stock of pre-determined degree of purity in one single pass. The separating devices sieves of various perforations and air box are united and mounted on a rigid main supporting frame to form one composite unit along with other sub units like feed hopper, bag hanger, electric motor etc. the sieve assembly is supported by four hangers, on which it oscillates. It composes of two superimposed sieving decks. The top and bottom screens are provided with a pair of tapers. The air box assembly is composed of rotary blower with chaff separator feed air trunk, lifter screen air trunk, and air regulating dampers with control lever. See plate 1

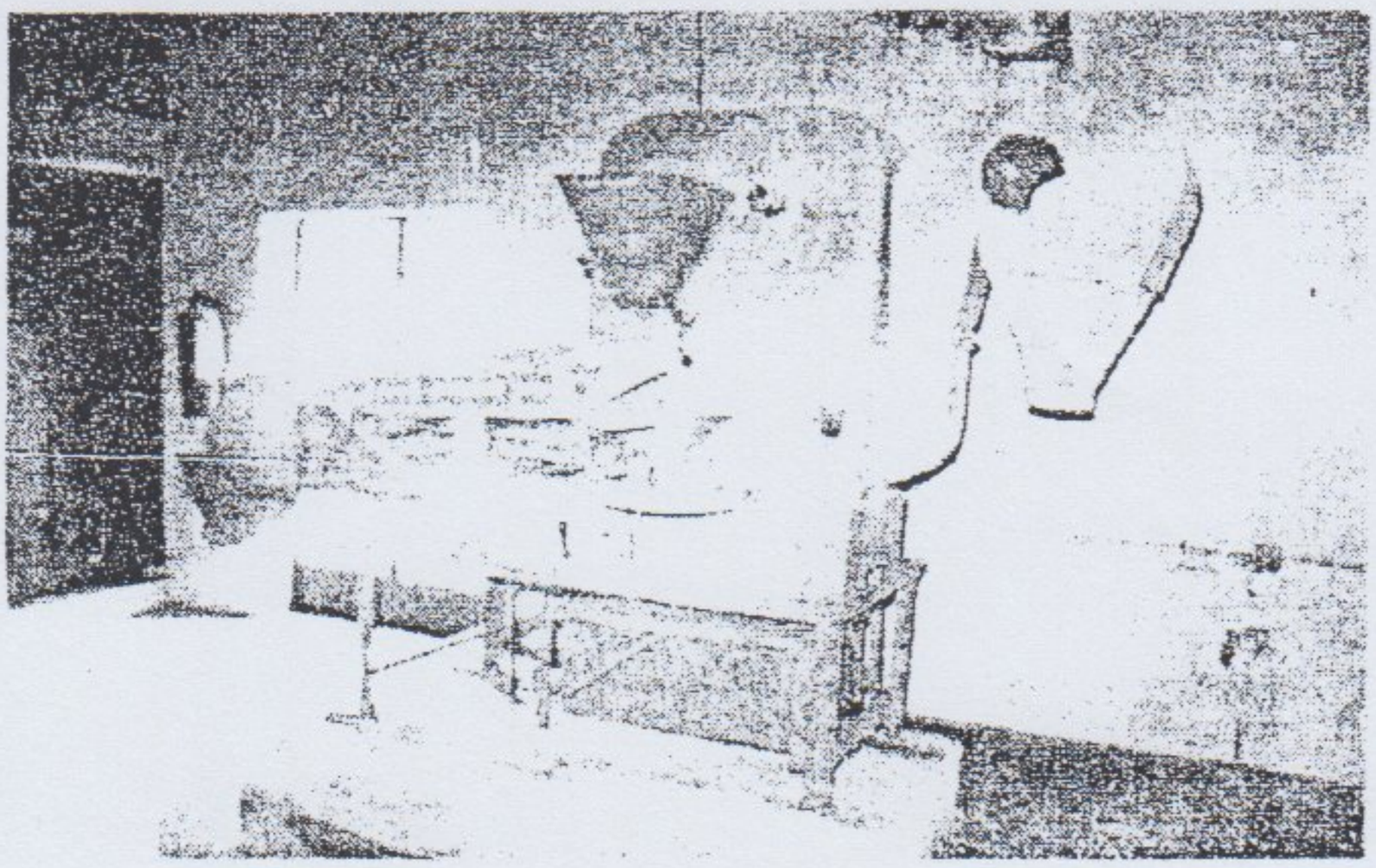

Plate 1. Picture of Agrosaw Indented Single Cylinder Seed Grader

Performance Evaluation

The performance was evaluated based on the following parameters.

1. **Cleaning efficiency:** The ratio of the weight of clean grains that pass through the cleaning unit to the total weight of grains at the outlet of the grain retainer, expressed as a percentage.

$$\textbf{Cleaning efficiency (\%)} = \frac{\text{weight of clean grain received at grain outlet}}{\text{Weight of total grain received at the grain outlet}} \times 100$$

1. $$\textbf{Mechanical (visible) damage (\%)} = \frac{\text{cracked and broken grain received at the grain outlet}}{\text{Total grain received at grain outlet}} \times 100$$

2. $$\textbf{Sieve loss (\%)} = \frac{\text{clean grain obtained at sieve overflow + sieve underflow + stock grain in kg}}{\text{Total grain input}} \times 100$$

RESULTS AND DISCUSION

Physical/proximate Properties of Rice Varieties

The laboratory analyses of some of the physical/proximate characteristics of the different rice varieties are presented in table 1. The result reveals that the length ranges between 6.26 to 7.84mm with FARO40 having the highest. While the breath value ranges between 3.06 to 3.68mm with FARO 27 having the highest and FARO40 having the lowest value of 3.06mm. The length/breath ratio shows that FARO40 and 27 are medium grains (2.66 and 2.06 respectively). While FAROs11, 36 and 24 are bold grains. The weight and the moisture content determine the aerodynamic behavior of the grains. Result shows that 1000-kernel weight ranges between 22.7g for FARO40 to 30.06g for FARO24. The moisture content was generally low (between 10 to 12%).

Cleaning Efficiency

Fig.1 shows the effect of varietal characteristics on the cleaning performance, while keeping the sieve perforation (3.25x20mm for top screen and 1.85x20mm for bottom screen) and the feed rates (300kg/hr) constant. The cleaning efficiency increase as the grain gets bolder. A higher cleaning efficiency was recorded for FARO 36. This may be attributed to variety differences.

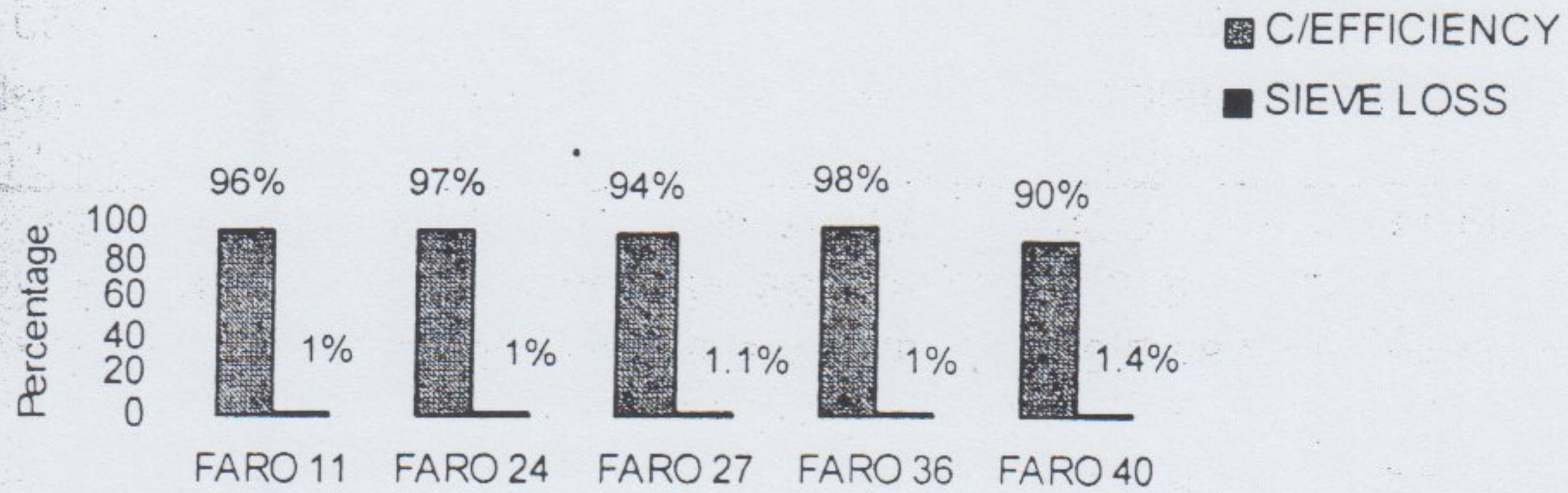

FIG. 1: **Cleaning efficiency/seive loss percentage of different rice variety**

Mechanical (Visible) Damage

It was evidenced that little or no visible damage was done to the seed during the process, as the percentage broken seed value is zero. This may be due to air aspiration, which tends to lift seeds and therefore reducing the impact force between the seeds and the top screen.

Sieve Loss

The sieve loss varied from 1% - 1.4% as shown in fig 1. Though higher loss was recorded when the feed rate was reduced below 150kg/hr, drive and blower speeds increased to 1600rpm and 1000rpm respectively. This may likely be as a result of the volume of materials handled by the vibrating sieve plates. Thus, the material has the tendency to bounce on the sieve plate and taken out of the sieve plate assembly.

Recommended Parameter Combination for Optimum Performance

The best oscillation mixes the seed well on the screen. If drive speed is too low all seed will not come into proper contact with the screening surface and if the speed is too fast, seed will hop or jump down the screen and will not be screened properly. The recommended parameter combination for optimum cleaning efficiency and minimum visible damage and sieve loss may be obtained at the feed rate of 300kg/hr. With longer and bolder seeds at sieve perforation of 3.25x20mm for top and 1.85x20mm for bottom screens, while keeping the drive and blower speeds at 1400rpm and 900rpm respectively.

Table 1. **Physical characteristics of different rice varieties.**

Variety	Grain Length (mm)	Grain Breath (mm)	Length/ Breath ratio (mm)	1000 kernel weight (g)
FARO 11	6.26-6.38 -6.3	3.32-3.36 -3.25	1.94	26
FARO 40	7.84-7.26 -7.56	3.06-2.64 -2.84	2.66	22.7
FARO 36	6.75-6.80 -6.76	3.76-3.68 -3.73	1.81	24.5
FARO 27	7.45-7.38 -7.84	3.82-3.68 -3.81	2.06	23.8
FARO 24	6.43-6.53 -6.49	3.46-3.44 -3.44	1.89	30.06

* Mean values highlighted in bracket

Table 2. **Levels of Contaminants in Different Rice Samples**

Variety	purity (%)	FM (%)	OCS (%)	IS (%)	WS (%)	MC (%)	BG (%)	CS (kg)	SL (%)
F-11	83	5	none	10	1	10	none	41.5	1
F-40	84.6	4	none	8	2	10	none	42.3	1.4
F-36	85	2	none	11	1	11	none	42.5	1
F-27	72.5	6.4	none	16	4	12	none	36.25	1.1
F-24	77	8	none	12	2	12	none	38.5	1

Note: pure seeds + foreign matter + other seeds + sieve loss = 100%, 50kg of each variety was used.
F = Faro, FM = foreign matter, OCS = other crop seed, IS = immature seed, WS = weed seed, MC = moisture content, BG = broken grain. CS = clean seed and SL sieve loss.

Table 3: **Cleaning efficiency, mechanical damage and sieve loss of different rice varieties.**

	FARO 11	FARO 24	FARO 27	FARO 36	FARO 40
Cleaning efficiency %	97	97	94	98	90
Mechanical damage %	0	0	0	0	0
Sieve loss %	1	1	1.1	1	1.4

CONCLUSION

The following conclusions can be drawn from the experimental results:

1. Agrosaw Indented Single Cylinder seed grader can be used to clean local rice varieties. Though efficiency increases with increase in grain length and size. The cleaning efficiency was found in the range of 90% to 98%.
2. Sieve loss was observed to increase with increase in the speed of the blower and drive above 900rpm and 1440rpm respectively. And also low feed rate below 150kg/hr and low blower and drive speeds below 900rpm and 1440rpm respectively.
3. Visible mechanical damage was not observed. Indicating the suitability of the machine for seed processing.
4. The recommended speeds of the drive and blower; feed rate and screen perforations are 1440rpm, 900rpm, 300kg/hr, 3.25x20mm, for top screen and 1.85x20mm for the bottom screen respectively.
5. There is the need to intermittently clean the air-sucking component of the machine as most of the threshing done by the local farmer is on dusty ground.

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