ETI ENGINEERING AND TECHNOLOGY IN INDIA
Volume 4 | Issue 1 | April, 2013 | 22-23

RESEARCH NOTE

Performance of pneumatic planter for sorghum seeds

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ABSTRACT : The performance of a Pneumatic planter was studied with an objective to select required gear ratio for recommended seed rate of sorghum. For picking single seed, the multi groove metering plate with seed hole (3 mm diameter) and vacuum pressure of 2 kPa were used throughout the experiments. The average values for plant to plant spacing, mean miss index and multiple index, actual field capacity and field efficiency were 101.1 mm, 2.01 per cent, 3.8 per cent, 0.77 ha/h and 89 per cent, respectively.

KEY WORDS : Pneumatic planter, Sorghum, Seed rate, Performance indices

Article Chronicle : Received : 28.09.2012**; Accepted :** 01.04.2013

How to cite this Article : Kumar, Ranjeet, Nandede, B.M., Padhee, D. and Singh, Harsh Vardhan (2013). Performance of pneumatic planter for sorghum seeds. *Engg. & Tech. in India,* **4**(1) : 22-23.

Horizontal plate planters with cells on the periphery, for precision planting of seeds were developed in India (Datta, 1974). These were popular and widely accepted, but the problems of higher seed damage, missing and multiple drops were common. To overcome these problems, planters with inclined and vertical plates were developed (Shafii and Holmes, 1990; Guarella *et al.*, 1996). Pnematic metering device has an advantage of metering irregular shaped seeds. Such devices are suitable for planting of groundnut, cotton, pigeonpea, maize, soybean, sorghum, mustard, okra and radish. Conventional seeding devices require higher seed rate, which leads to wastage of costly seeds and additional cost of thinning, resulting in increased the production cost. Use of pneumatic planter increases seed germination efficiency at reduced seed rate as compared with conventional planters.

Inter row and intra row spacing for sorghum is an important factor for optimum crop yield. The parameters for the evaluation of planter include spacing between seeds (Hollewell, 1992; Parish *et al*., 1991), per cent multiples and misses (Brooks and Church, 1987) and spacing index (Hofman, 1988; Jasa and Dickey, 1982). The pneumatic seed-metering device is useful for uniformity of seed spacing. An attempt was made to evaluate pneumatic planter developed at CIAE (Central Institute of Agricultural Engineering), Bhopal to justify its use in planting of sorghum seeds.

The pneumatic planter consists of main frame, aspirator blower, disc with cell type metering plate, individual hopper, furrow openers, PTO driven shaft, ground drive wheel etc (CIAE, 2005).

The pneumatic planter was calibrated for sorghum seeds in the laboratory. The PTO was operated at 550 rpm resulting in the rotation of the blower at 2720 rpm to create proper vacuum in the seed metering unit. Then the ground wheel of the pneumatic planter was rotated 20 times with constant speed manually. The different seeds were col1ected on the poly-ethylene sheets underlying the furrow opener. The number of seeds in the col1ection sheets was measured.

The procedure was repeated at different gears of main driving shaft with the same setting.

The time taken (*s*) to distance travelled (m) during operation was determined using stopwatch. The forward speed of tractor (km/h) was calculated by following equation.

$$\text{Forward speed of tractor} = \left(\frac{\text{Distance}}{\text{Time}}\right) \text{x } 3.6$$

The actual field capacity, theoretical field capacity and

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Table 1 : Sorghum seed rate obtained at different gear combinations

Gears on primary driving shaft	Gear combinations between ground wheel and main driving shaft			
	20/14	20/20	14/14	14/20
Ist Gear (26)	31.28	21.91	21.02	15.38
IInd Gear (22)	26.44	18.54	18.11	13.12
IIIrd Gear (20)	24.12	16.85	16.44	11.79
IVth Gear (16)	19.27	13.48	13.33	9.37
Vth Gear (14)	16.85	11.79	11.60	7.98

field efficiency were calculated as follows:

AFC = Ac / Tt

TFC = (W x S) / 10

FC = (AFC / TFC) x 100

AFC = actual field capacity (ha/h), TFC= theoretical field capacity (ha/h), Ac= actual area covered (ha), Tt= time taken (hr), FC= field efficiency (%), W=width of machine (m), S= forward speed (km/h).

The miss index (I_{ms}) is the ratio of number of spacing (Nms) and total number of measured spacings (N). The multiple index (I_{mt}) is the ratio of number of spacings and total number of measured spacings (N)

Ims = (Nms / N) x 100 Imt = (Nmt / N) x 100

Field performance of the pneumatic planter was evaluated for sorghum seeds at 40 × 10 cm spacing in three well prepared plots each (24 × 12 m). The soil moisture content was 9.0 ± 2 %. (dry basis). Pneumatic planter was set according to the observations obtained in laboratory evaluations. The procedure outlined in RNAM Test code and procedure (1995) for seedling equipment was followed. The pneumatic planter was powered by 40 hp tractor (Tafe 585 DI) which was operated at an average forward speed of 3.6 km/h. Pre-experimental trials had been undertaken to adjust the working parts such as speed of pto shaft, furrow openers, depth adjustment. A mark was made on the lever of the three point linkage to set the depth of operation of the furrow opener at 30 mm.

The seed rate of sorghum obtained for different combination and for different gears of primary driving shaft is shown in the Table 1.

Table 1 revealed that the gear having 14 teeth mounted on the axle of ground wheel, attached to the gear having 20 teeth mounted at the ends of the primary driving shaft and fifth gear *i.e*. having 14 teeth mounted on the middle of the primary driving shaft gave the required seed rate (7.98 kg/ha) and was within the recommended seed rate (7.5-8kg/ha). Based on the results of laboratory tests, the performance of the pneumatic planter was carried out in field. Performance parameters of the planter such as the plant to plant spacings, mean miss index and multiple index, actual field capacity and field efficiency were determined. The average values of the field trials conducted were found as 101.1 mm, 2.01 per cent, 3.8 per cent, 0.77 ha/h, 89 per cent, respectively. The pneumatic planter was thus, found suitable for sorghum.

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