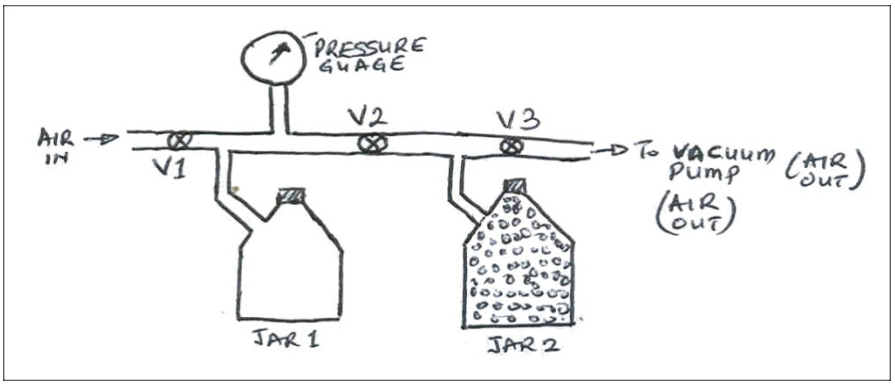

Thousand Kernel Weight

For small seeds, 1000 kernels are weighed and a parameter known as the thousand-kernel weight (TKW) is determined. An electronic weighing balance having a sensitivity of 0.10g is used.

Coefficient of Friction

The static coefficient of friction was obtained on four structural surfaces namely mildsteel, plywood, concrete and glass. In the case of plywood the direction of movement was parallel to the grain. A tilting table (constructed by the Department of Agricultural Engineering, UNAAB) can be used. The surface to be tested is fixed on the tilting table and the seeds are poured into a cardboard paper ring of diameter 10cm by 2cm deep until the ring is full. Care is taken to raise the ring slightly so that it did not touch the surface. The table is then slowly tilted by a gentle screwing device until movement of the seeds down mounted against the edge of the tilting table. The tangent of the angle of friction is the coefficient of friction

AERODYNAMICS PROPERTIES

The properties include particle diameter, frontal area, terminal velocity and drag coefficients.

Before the introduction of the first set of machines, contaminants were removed from seeds by hand. A mixture of grain and straw was spread in a thin layer on the threshing floor and the large contaminant particles mostly pieces of straw, were removed with a rake. The remaining contaminants larger than the grains were removed with broom or goose wing. Light contaminants were removed by throwing the grain against the wind which lifted the contaminants and ensured partial separation. This manual process is usually time and energy consuming and the efficiency of separation is low. This led to the invention of cleaning machines. The operation of those machines as reported by Adegbulugbe (1983) consist almost solely of separating non-edible impurities such as rubble, lumps, stick, straw, stringe and trapped irons which are obvious. The major characteristics used in separation are size, shape, density, surface texture, terminal velocity, electrical conductivity, colour and resilience (Koya and Adekoya, 1994; Lucas and Olayanju, 2003). These determine what methods of cleaning can be used and their level of efficiency. Most cleaning operations used physical and aerodynamics properties of grain either singly or in some combination. This depends primarily on the grain being cleaned, the quantity of weeds and other contaminants in the mixture and the purity requirements that must be met.

Test Equipment

Terminal velocity of seed, the velocity at which the seed remains in suspension, is measured by using a vertical air tunnel (Figure 1). It consists of the following components: a frame, wind tunnel, plenum chamber, flow straightener, centrifugal blower, electric motor, pitot tubes and inclined manometer filled with coloured water.

The centrifugal fan was mounted on a frame and it provides air current for the equipment. A vertical tunnel which was coupled to the fan is 1200mm long with 100mm x 100mm cross section. An adjustable flap at the top of the fan allows variation of admission of air from the fan into the tunnel. The tunnel was built with mild steel sheet but the front was covered with 2mm thick transparent plastic material for observation. A window was cut at the front of the test section, and below it is a small screen braced to cover the inside of the section. This was to break small eddies behind the vanes and to keep the seed from falling into the chamber (Figure 2).

Air current was monitored in the tunnel with a pitot-static tube mounted inside the tunnel below the product-holding screen. These were two in numbers; the total pressure pitot tube and the static pressure pitot tube. The former is a right-angled bent tube with long arm being 290mm and short arm being 95mm. The static tube is straight with 200mm^2. The diameter of the glass tube is about 10mm.

The out ports of the pilot static tube were connected to the two arms of a - coloured water filled manometer. It is made with a 10mm diameter glass tube inclined at 12^0 to the horizontal. It has a length of 440mm; longer limb 320mm and shorter limb 320mm. The manometer was installed on a – 700mm long, 400mm wide and 12mm thick plywood. Two-holes were drilled at the top of the frame to hold the rubber corks through which manometer limbs passed out. The manometer was connected to the pilot tubes by Ø 10mm rubber tubes. A ruler was screwed to the frame below the manometer. This is to aid the reading of the rise of the liquid.