

## *Indian Standard*

# SOWING EQUIPMENT — SEED-CUM-FERTILIZER DRILL — TEST CODE

*( First Revision )*

### 1 SCOPE

This standard prescribes the method of testing for the performance of operation and soundness of construction of seed-cum-fertilizer drill.

### 2 REFERENCE

IS 6813 : 1993 'Specification for seed-cum-fertilizer drill (*first revision*)' is a necessary adjunct to this standard.

### 3 GENERAL

3.0 While carrying out the tests as recommended in 3.1 and 3.2, it is desirable that soil scientists and agronomists may also be associated in the test, if possible. The test prescribed in 3.2 (f) is for determining the soundness of construction, whereas other tests are for ascertaining the performance of the drill.

#### 3.1 Laboratory Test

The following tests shall be conducted in the laboratory:

##### a) Metering Test

- 1) *Calibration* — To determine the seed and fertilizer dropping rates obtainable at different settings and the variation among furrow openers when the machine is stationary, and
- 2) *Seed damage determination test* — To determine if any mechanical damage is done to the seed during the calibration.

##### b) *Uniformity of Seeding* — To determine whether the drill is placing the seed uniformly or not.

#### 3.2 Field Tests

The drill shall be operated in the field to test the following:

- a) *Field Operation* — To determine the range of seed and fertilizer dropping rates obtainable at different settings and the variation among openers while operating under field conditions and using the common kind of seed and fertilizer.
- b) *Placement* — To check the accuracy of placing the seed and the fertilizer in respect of each other. The ability to place the seed at various depths. The

performance of the covering devices and the amount of compaction of soil around the seed.

- c) *Power Requirement* — To check the draft in kgf, speed in km/hour, metric horse power and metric horse power hours per hectare.
- d) *Field Efficiency and Labour Requirement* — To check the field efficiency which is the ratio of effective field capacity to the theoretical field capacity expressed as percent and man-hours per hectare as labour requirement.
- e) *Ease of Operation and Adjustment*
- f) *Suitability and Soundness of Construction*

### 4 SELECTION AND PREPARATION OF THE DRILL FOR TEST

#### 4.1 Selection

The drill shall be selected at random from the production line as directed by the testing station complete with its usual accessories and in condition as generally offered for sale for commercial test report. The drill shall be new and should not be given any special treatment or preparation for test. The manufacturer may submit prototype for confidential test report. The nature of test report required by the manufacturer shall be stated.

4.1.1 The manufacturer shall supply operational manual, list of spare parts/parts catalogue and a specification sheet of the drill consisting of the items listed in the specimen report in Annex A, as well as any further data required to carry out the tests. These specification shall be verified by the testing station and reported in the *pro forma* as given in Annex A.

#### 4.2 Preparation of the Drill for Tests, Running in and Preliminary Adjustment

4.2.1 The drill shall be new and run-in by the manufacturer before test, under his responsibility in accordance with his usual instructions to users and in collaboration with the testing station.

4.2.2 The test report shall state the place and duration of running-in.

**4.2.3** The manufacturer may make adjustments during the period the drill is prepared for tests. These adjustments shall not be changed during the tests. In case it is found necessary to change the setting, alterations made shall be reported.

## 5 LABORATORY TESTS

### 5.1 Metering

#### 5.1.1 Calibration

Series of tests at full, three-fourths, one half, and one-fourth capacity of the hopper shall be conducted. The step by step procedure shall be as follows:

- a) Determine the nominal width of coverage of the drill. The nominal width is equal to the multiplication of the number of furrow openers and the spacing between the openers in cm.

*Example:*

$$4 \text{ furrow openers} \times 25 \text{ cm} = 100 \text{ cm} \\ = 1 \text{ m}$$

- b) Find the length of a strip, having the nominal width as determined in (a) above, necessary to make one hectare;

*Example:*

$$\frac{10\,000 \text{ m}^2}{1 \text{ m}} = 10\,000 \text{ m}$$

- c) Determine the number of revolutions the ground wheel has to make to cover the length of the strip determined in (b) above. It is recommended that this should be done by actually operating the drill in the same field and soil conditions as will be used for the field operation test (3.2). Count the number of revolutions in a given distance, say, 100 metres. A 60-cm diameter wheel will probably make about 53 revolutions in 100 metres.
- d) From the value found in (c) above, select a number of revolutions of the ground wheel to cover a convenient fraction of a hectare, say, 1/25. A drill having a nominal width of 1 m and ground wheel diameter of 60 cm will require about 212 revolutions to cover 1/25 hectare.
- e) Calculate revolutions per minute of ground wheel in case of animal drawn drill and revolutions per minute of metering device in case of tractor-drawn drill. The travelling speed for animal-drawn drill should be 2.4 km/h and for tractor drawn drill the speed should be 3 and 5 km/h. A 60-cm diameter wheel makes about 21 revolutions per minute when travelling at a speed of 2.4 km/h.

- f) Jack up the drill so that the ground wheels turn freely. Make a mark on the drive wheel and a corresponding mark at a convenient place on the body of the drill to help in counting the revolutions of the drive wheel.
- g) Practise turning the wheel at the speed calculated in (e) above, if turning has to be done manually for animal-drawn drill.
- h) Select the seed and fertilizer from the following for conducting the test;

#### *Seed*

- 1) Small size ( mustard and bajra ),
- 2) Medium size ( wheat, sorghum and paddy ), and
- 3) Large size ( pea and gram );

#### *Fertilizers*

- 1) Calcium ammonium nitrate,
- 2) Ammonium sulphate,
- 3) Urea, and
- 4) Superphosphate.

The physical condition of the fertilizer shall be examined and reported.

- j) Put selected seed and fertilizer in the hopper. Place a sack or container under each boot.
- k) Set the rate control adjustment for the seed and the fertilizer for maximum drilling. Mark this position on the control for reference.
- m) Engage the clutch or on-off adjustment for the hopper, and rotate drive wheel at the speed as calculated in (e) above. Turning of the wheel of animal-drawn drill may be done manually and for tractor-drawn drill metering device should be rotated at a constant speed by suitable power arrangement.
- n) Weigh the quantity of seed and fertilizer dropped from each opener and record on the data sheet.
- p) Calculate the seed and fertilizer dropped in kg/hectare and record on the data sheet.
- q) Repeat the process indicated in (j) to (p) at least three times.
- r) Set the rate control levers for the minimum and for specified rate setting and run as indicated in (j) to (p). Mark this position on the rate control for future reference.

**5.1.1.1** Record the data according to Annex B.

#### **5.1.2** *Mechanical Damage*

For each of the tests conducted in 4.1.1, take one kg of seed from each sack and label with

test number, opener and rate setting. The seeds which would be used for metering shall be tested before and after the test to ensure its invisible (germination) damage and the samples of the seed obtained after passing through the metering shall be tested to ensure its visible damage. Count the number of seeds with visible damage. Take the mass of the damaged seeds in one kg of the sample and calculate the percentage of damaged seeds before and after the test.

**5.1.2.1** Record the data according to Annex C.

## 5.2 Seeding Uniformity

Carry out the following test to ensure the uniformity in metering.

### 5.2.1 Sticky Belt Method

Mount the drill on a stand and allow a 10 m long (centre to centre) belt to travel under the furrow openers or seed tubes in such a way that the speed of the belt is equal to the running speed of the drill. Arrange the drive on the driving wheel of the drill. In case the drive is taken directly to the feed shaft of seed, keep the relationship between the speed of the feed shaft and belt the same as that of the feed shaft and ground wheel. Apply a sticky layer of grease to the belt to facilitate the proper embedding of seeds without any displacement. Keep the seed/fertilizer tube as close to the belt as possible. The belt used should be painted and marked in centimetres of quick reading. Operate the drill and observe the number of seeds dropped for each metre of belt length for recommended seed rate. Repeat the test at least three times.

### 5.2.2 Sand Bed Method

If the facilities for conducting tests as given in 4.2.1 do not exist, then this method be used. Prepare an artificial levelled bed of 25 cm depth from fine sand and of a length of at least 5 m and the width equal to the nominal width of the drill. Allow the drill to travel over this bed with furrow openers or seed tubes lowered as near to the top surface of the bed as possible. Observe the number of seeds dropped and the average distance between two seeds for each metre of bed length. Repeat the test at least three times. For repeating the test, get the sand sieved for separating the grain from sand.

**5.2.3** Record the data according to Annex D.

## 6 FIELD TESTS

### 6.1 Field Operation

Operate the drill in a well prepared seedbed, that is, at least 15 cm deep, firm, fine structure, smooth and level; relatively free of surface trash and at good moisture content. The size of the

trial plot shall not be less than 0.1 ha and 0.2 ha for the animal drawn and tractor operated drills respectively. As far as possible the shape of the plot should be a rectangular one with the sides in the ratio of 2 : 1. Follow the general procedure as for calibration (see 5.1.1) except remove the ends of the seed and fertilizer tubes from the furrow openers and attach a bag to each end to collect the seeds and fertilizer whichever is the case. Also mark off in the field a distance, that when traversed, will represent a convenient part of a hectare. Use the same kind of seed and fertilizer as used in calibration test [see 5.1.1 (h)]. Repeat at least three times for maximum, minimum and recommended feed rate settings. Use the same identical adjustment settings as in calibration test (see 5.1.1) as far as possible. Mark the positions on the rate control mechanism.

**6.1.1** Record the data according to Annex E.

### 6.2 Placement

**6.2.1** Operate the drill in the field under the same good seed bed conditions (see 6.1), and with average depth setting of the furrow openers. Cover at least 100 m of row length. Carefully remove the soil without disturbing the seed and the fertilizer at several spots (a minimum of 5) in each row. Measure the depth of the seed below the soil surface and the vertical spacing of the fertilizer with respect to the seed. Do this by laying a plank across the row and measure downward from its lower edge to the seed and to the fertilizer. It will not be necessary to measure the horizontal spacing accurately as this is not as critical as the vertical spacing. It will be much easier to locate the seed and fertilizer if maximum rates of application are used. Also the fertilizer is more easily located if white lime is mixed with it.

**6.2.2** Repeat the procedure as given in 6.2.1 at minimum and maximum depth settings of the furrow openers.

**6.2.3** Record the data according to Annex F.

### 6.3 Power Requirement

#### 6.3.1 For Trailed Drill

- a) Insert a dynamometer in the hitch to measure the draft in kgf. The draft is defined as the horizontal component of the pull, parallel to the line of motion. If the line of pull through the dynamometer is not horizontal, then measure the angle, the line of pull makes with the horizontal and calculate the horizontal component (draft). A direct reading spring type dynamometer will be satisfactory.

- b) Lay off a space of 50 m in the middle of a long row and mark each end of this space with an easily distinguished pole. If the field is small one may have to be satisfied with a shorter row. Divide this marked space in a minimum of 5 runs.
- c) Operate the drill as in 6.2.1. Start the drill well in advance of the first pole marker and be sure it is operating smoothly when it reaches this pole. As the drill travels the marked run length, record the dynamometer reading. The more the readings taken the better the results are. Calculate the average of all the readings taken within a particular run. A stop-watch or other accurate timepiece should be used to record the time for the machine to traverse the marked run length. From this value calculate the speed of travel in metre per second. Also calculate the wheel slip and theoretical field capacity.
- d) Compute the power as follows:

Metric horsepower =

$$\frac{\text{Draft in kgf} \times \text{Speed in metre per second}}{75}$$

- e) Repeat the procedure indicated in (a) to (d) at least three times to arrive at average power requirement.

#### 6.3.1.1 Record the data according to Annex G.

#### 6.3.2 For Mounted Drill

- a) Lay off a space of 25 m in the middle of a long row and mark each end of this space with an easily distinguished pole. Divide this marked space in a minimum of 5 runs.
- b) Attach a direct reading spring type dynamometer in front of the tractor. Use another tractor to pull the tractor on which the drill is attached.
- c) Operate the drill as in 6.2.1. Start the drill well in advance of the first pole and be sure it is operating smoothly when it reaches this pole. As the drill travels the marked run length, record the dynamometer reading. The more the readings taken the better the results are. Calculate the average of all the readings taken within a particular run. A stop-watch or other accurate timepiece should be used to record the time for the drill to traverse the marked run. From this value calculate the speed of travel in metres per second. Also calculate the wheel slip and theoretical field capacity.

- d) Detach the drill from the tractor and record the draft required only to pull the tractor (with which the seed drill was attached in the same manner as in (c) above. Take care that the tractor is pulled at the speed as in the case of (c).
- e) Obtain the draft of the drill by deducting the draft of tractor [as obtained in (d)] from the draft of drill and tractor [as obtained in (c)].
- f) Calculate the power in accordance with the procedure as given in 6.3.1(d).
- g) Repeat the procedure (a) to (f) a minimum of three times to arrive average power requirement.

#### 6.3.2.1 Record the data according to Annex H.

### 6.4 Field Efficiency and the Labour Requirement

The theoretical field capacity in hectare per hour may be taken from the power requirement tests. It is the rate of field coverage that would be obtained if the drill was operating continuously without interruptions (turning at the ends, filling of hoppers, etc). The effective field capacity is the actual average rate of coverage. It includes the time lost in filling hoppers, turning at the end of the rows, unclogging of openers, making adjustments, etc. The labour required for operating the drill is measured at the same time that the field capacity is determined. It is the number of the manhours used to cover one hectare of effective field area.

#### 6.4.1 Record the data in accordance with Annex J.

### 6.5 Assessing the Ease of Operation and Adjustments

The observations regarding the ease of operation and adjustments shall be recorded in accordance with Annex K.

### 6.6 Suitability and Soundness of Construction

The drill shall be operated in continuous field work for at least 4 hours. It is preferred if at least 20 hours test is performed.

## 7 REPORTING RESULTS

7.1 For reducing the data to a usable form prepare a summary report in accordance with Annex L. The performance conformity in relation to the performance requirements specified in IS 6813 : 1993 shall also be mentioned in detail against item 5 of the summary report.