EMERGENCE FORCE OF CROP SEEDLINGS

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Key words
Cotton  Cowpea  Maize  Seedling emergence  Rice  Temperature

Summary
In a laboratory experiment median seedling emergence forces of cowpea, maize, cotton and paddy at 25°C and of wheat at 20°C were worked out to be 1431, 1029, 803, 686 and 931.5 millibars respectively. Changes in temperature brought about variation in the median emergence forces.

Introduction
Crop production is largely affected by its initial stand which, in turn, is directly dependent on the successful seedling emergence. Germination and seedling emergence of many crops are restricted by high crust strength. The mechanism of emergence of seedling involves two opposing forces, namely the crop seedling emergence force and the crust strength. Different crops have different potential forces to overcome the resistance offered by overlying soil in course of emergence. The seedling emergence forces varied with seed weights also.

In view of the facts described, it is very imperative to determine the emergence forces of different crop seedlings in order to know the critical crust strength values which can limit the emergence of seedlings.

Materials and methods
The seedling emergence forces of paddy, wheat, cotton, cowpea and maize were measured using a simple technique which consisted of a pair of glass tube open at both ends and a graduated glass tube piston having a cup at the upper end and the blunt bottom as shown in Fig. 1. The height of the glass tube ranged between 10 to 15 cm and its internal diameter equalled the external diameter of the seed. The piston was so chosen that it just closely fitted inside tube with free movement and without any friction. A set of one hundred such units was arranged in a compact plane with the help of a specially constructed stand. One healthy seed treated with fungicide was placed in each tube and the glass tube piston was allowed to rest on the seed after little initial pressing in order to provide a firm base for seedling. The loads on the emerging seedling were varied by putting different number of steel balls.

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over and above the weight of glass tube piston itself. Periodical observations for displacement of weights were taken. The results obtained from one hundred replication of each load were analysed by the methods of probits after Bliss. The probit analysis facilitated the calculation of the least square regression equation which indicated the percentage of population of seedlings able to exert various levels of forces. From this function the median emergence force, a population parameter, could be calculated. The median emergence force is the force under which fifty per cent of seedlings are too weak to emerge.

Results and discussion

The data in Table 1 exhibit the seed and emerging plumule dimensions of the crops selected for studies of their emergence forces. The seeds of cowpea weighed heaviest (257 mg) followed by maize (104 mg), cotton (85 mg), wheat (52 mg) and paddy (24 mg). The average plumule diameter of paddy was as small as $88 \times 10^{-2}$ mm, the largest being $240 \times 10^{-2}$ of cowpea gave maximum cross-sectional area ($450 \times 10^{-2} \text{ mm}^2$) available for emergence force application. The average plumule cross-sectional area for maize, cotton, wheat and paddy were calculated to be $250 \times 10^{-2} \text{ mm}^2$, $180 \times 10^{-2} \text{ mm}^2$, $110 \times 10^{-2} \text{ mm}^2$ and $60 \times 10^{-2} \text{ mm}^2$ respectively.

The median emergence forces of the crops are presented in Table 2. The emergence forces were observed to be different at varying temperature. The maximum values of median emergence forces of cowpea (1626 millibars), maize (1245 millibars), cotton (1012 millibars) were at 35°C. The emergence forces decreased as temperature decreased. The