Pak. j. sci. ind. res., vol. 34, no. 12, December 1991

INFLUENCE OF CULTIVAR, SOWING DEPTH AND SEED SIZE ON THE EMERGENCE OF GROUNDNUT

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(Received April 29, 1991; revised January 12, 1992)

A study was conducted to determine the influence of cultivar, sowing depth and seed size on the emergence of groundnut in controlled environment. The study comprised of four cultivars, *viz.* Kadiri-3, Kadiri 71-1, Gangapuri and TMV-2; four sowing depths, *viz.* 2,4,6 and 8 cm; and three seed sizes, *viz.* large, medium and small. Seeded pots were irrigated as and when necessary for normal plant growth. Results indicated that emergence percentage was significantly influenced by cultivars. Gangapuri had the greatest emergence followed by TMV-2. Although insignificant, emergence percentage was reduced with the increase of sowing depth. Seed size had no significant influence on emergence, but a slightly higher emergence was observed in large seeds. Despite insignificant cultivar differences, TMV-2 emerged faster than all other cultivars. The fastest emergence was recorded at 2 cm sowing depth and then decreased with increasing depths. Small seeds emerged significantly faster than large seeds. None of the interactions between cultivar, sowing depth and seed size was significant. However, a faster emergence was observed for small seeds at all sowing depths.

Key words: Groundnut, Cultivar, Sowing depth, Seed size.

Introduction

Groundnut is an important cash crop for the semi-arid tropics (SAT), but yields are low in comparison to the average yield of the developed countries. A major factor limiting the productivity of many crops including groundnut in the SAT is the poor establishment of seedling. Thus, it is important to obtain the desired crop stand to achieve optimum yield. However, failure of seeds to germinate, emerge and establish leads to a poor crop stand.

Among a number of factors that affect the emergence of seedlings, seed size and sowing depth of seeds are important. Gorbet [1] reported a significant and positive correlation between seed size and seedling vigour. The seedlings obtained from larger seeds had a greater emergence rate than those produced from smaller seeds. Sivasubramanian and Ramakrishnan [2] reported higher germination and more vigorous seedlings from large seeds. Whereas Ponnuswamy and Ramakrishnan [3] reported that the emergence percentage of smaller seeds in groundnut was greater than that of larger seeds. The rate of radicals emergence increased with decrease in seed size and the rate of field emergence decreased with increase of seed size.

Another factor which determine the emergence and growth of crops in the field is sowing depth. Growers in the SAT frequently sow seeds deeply to overcome the adverse effects of a dry soil surface on germination and emergence and to make better use of the moisture at greater depths. But evidence of its usefullness is lacking. Results for various crops including groundnut have shown a reduction in emergence percentage and rate of emergence with increasing depth of sowing [4,5]. Varietal response to seed size and sowing depth on the germination and emergence are important criteria for selecting the right cultivar for large scale production. Therefore, in the study, pot experiments were conducted in controlled environment to find out the effect of cultivar, sowing depth and seed size on the emergence of groundnut.

Materials and Methods

The experiment was carried out in a growth chamber at the Department of Agriculture and Horticulture, University of Nottingham, U.K. during 1987 to study the influence of

Table 1. Datails of the Seed Sizes Used.

Cultivar	Seed size	Range of seed diameters (mm)	Mean seed weight (gm)
Kadiri-3	Large	10.31 - 9.52	0.616 ±0.095
	Medium	9.52 - 7.93	0.448 ±0.038
	Small	<7.93	0.344 ±0.042
Kadiri 71-1	Large	9.52 - 8.72	0.601 ±0.066
	Medium	8.72 - 7.93	0.393 ±0.046
	Small	< 7.93	0.292 ±0.027
Gangapuri	Large	9.52 - 7.93	0.446 ±0.044
	Medium	7.93 - 6.35	0.350 ±0.033
	Small	< 6.35	0.239 ±0.030
TMV-2	Large	9.52 - 7.93	0.398 ±0.028
	Medium	7.93 - 6.35	0.296 ±0.028
	Small	< 6.35	0.237 ±0.024

cultivar, sowing depth and seed size on the emergence of groundnut.

In the experiment, there were four cultivars, *viz.* Kadiri-3(V_1), Kadiri 71-1 (V_2), Gangapuri (V_3) and TMV-2 (V_4); three seed size, *viz.* large (L), medium (M) and small (S) and four sowing depths, *viz.* 2,4,6 and 8 cm. The seeds were graded by hand sieving with round hole screens (Table 1). The experiment was laid out in a split-split plot design with cultivars in main plots, sowing depths in sub plots and seed size in sub plots. There were two replications. Seeds were sown in plastic containers and soil was used as a growth medium for the plants. The soil belongs to the Banbury series, reddish brown in colour and loamy in texture with favourable drainage capacity. It was acidic in reaction (pH 6.5). The soil was air-dried, ground and passed through a 4 mm sieve. The moisture content of air-dried soil was about 4%. Each pot was filled with a total of 4.7 kg soil maintaning a bulk density of 1.5 cm^{-3}. The soil in each pot was initially irrigated with 1200 ml of water and left for three days in the glass house to drain any excess water. Nine seeds, not visibly damaged were selected from each size in each cultivar for sowing at different depths. Glass rods of different lengths and diameter were marked and used for making holes of desired depths. One seed was sown in each hole. The seeds were then covered with dry soil and gently pressed. To ensure seed contact with the soil, 100 ml of water was applied to the surface. Pots within each replicate were randomly re-arranged at four day intervals in order to equalize temperature and light differences. Light was provided by mercury vapour lamps supplying a radiation of about 70 watts m^{-2}. The day length was set to a photo-period of 12 hrs from 08 : 00 to 20 : 00 hrs at a constant temperature of 28°. Seeded pots were irrigated as needed to prevent drying.

Data on emergence percentage and rate of emergence were collected. A seedling was considered to have emerged when the cotyledon was visible at the soil surface and the rate of emergence was calculated as the reciprocal of time (d) to 50% emergence (E = 0.5). In this study, the E = 0.5 criterion for emergence was calculated on the basis of the number of seedling that had emerged.

Data were statistically analysed with a computer using the "Genstat" programme and the mean differences were adjudged by using SED (standard error of differences of means). Tests of significance were made at the 0.01 and 0.05 levels of probability.

Results and Discussion

Emergence percentage. Emergence percentage showed a significant difference between cultivars ($P<0.01$). Cultivar Gangapuri had the greatest emergence and cultivar Kadiri-3 and Kadiri 71-1 had similar emergence but sifnificantly lower than that for Gangapuri (Fig. 1a). Results of emergence percentage showed that differences exists in cultivars in the same growing conditions irrespective of sowing depth and seed size. The differences in emergence may be associated with the genetic potential of cultivars and differential mechanical resistance offered by the soil to the emerging seedlings of different cotyledonary areas. Sowing depth had a major influence on emergence percentage for all cultivars but the effect was not significant at 2,4 and 6 cm

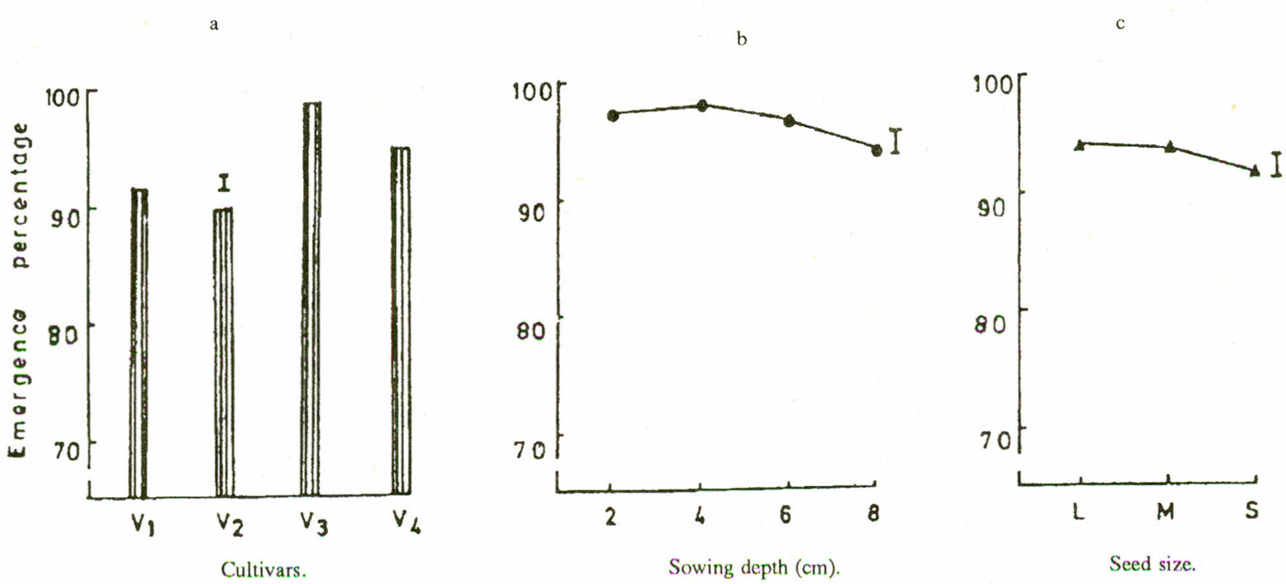

Fig. 1. Emergence percentage as influenced by (a) cultivars (b) sowing depths and (c) seed sizes. Bars represent SED.

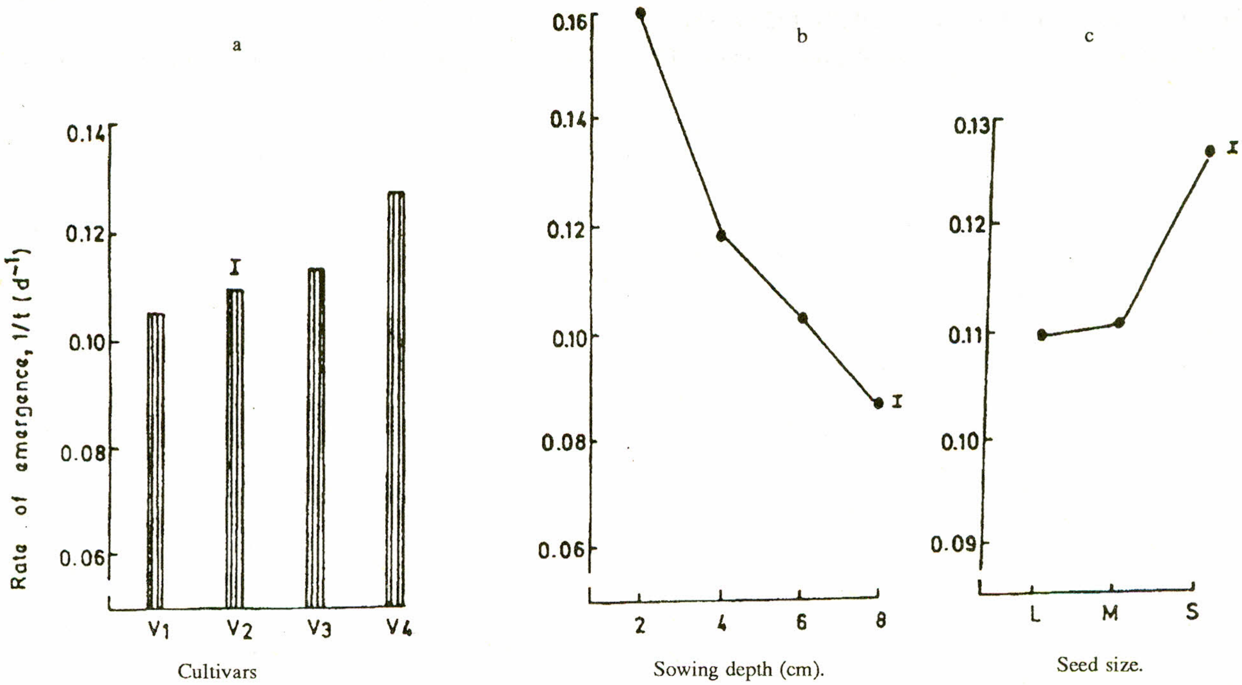

Fig. 2. Rate of emergence as influenced by (a) cultivars (b) sowing depths and (c) seed sizes. Bars represent SED.

sowing depths but there was a significant effect when seeds were sowing at 8cm depth (Fig. 1b). Reduction in emergence was also reported in soybean with increasing sowing depth [5,6].

The effect of seed size was found to be insignifocamt (Fig. 1c). However, large seeds appeared to have a better emergence than small seeds. Singh and Gill [7] and Johnson and Luedders [8] also reported no significant effect of seed size on emergence in pea and soybean respectively. On the contrary, some reported better emergence from small seeds of soybean and groundnut [3,9].

None of the interactions between cultivar, sowing depth and seed size was found to be significant. Thus, for optimum soil moisture content, effects of sowing depth and seed size on emergence were similar regardless of the cultivars used.

Rate of emergence. No significant cultivar differences in the emergence rate were observed (Fig. 2a). Cultivar TMV-2 showed the fastest and Kadiri-3 showed the slowest rate of emergence. The decreased emergence rate of Kadiri-3 might be partially explained by the increased mechanical resistance encountered by seeds during emergence. As expected, the rate of emergence decreased significantly with the increase in sowing depth ($P<0.01$). The fastest emergence rate was recorded at 2 cm depth and then decreased with increasing depths (Fig. 2b). Dejong and Best [10] reported an increased number of days required to attain 50% emergence in wheat when planting depths were increased from 5 to 10 cm. The effet of seed size on emergence rate was marked ($P<0.05$). Small seeds emerged faster than medium and large seeds (Fig. 2c). The reasons for faster emergence of small seeds might be due to the rapid activation of the physiological processes and reduced soil mechanical resistance encountered during emergence of seeds. Similar results were also reported by Ponnuswamy and Ramakrishnan [3] and Hoper *et al.* [9].

None of the interactions between cultivar, sowing depth and seed size was found to be significant. However, a faster emergence rate was observed for small seeds at all sowing depths than medium and large seeds.

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