# THE INFLUENCE OF SEED SIZE ON EMERGENCE OF SEEDLINGS AND PLANT DEVELOPMENT IN GRAIN CROPS WITH SPECIAL REFERENCE TO SEEDING DEPTH

ROLF MANNER

*Agricultural Research Centre, Department of Plant Breeding, Jokioinen*

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The dependence of grain yields on the size of the sown seed has been studied in a number of trials by earlier investigators. Very little or no influence of seed size has been observed in the experiments (3, 4).

Shallow seeding depth (2.5 cm) was best for winter wheat if the soil contained enough moisture in the experiments of STEPHANS, WANSER and BRACHEN (5). The relative grain yield was 8 % smaller with 6.2 cm and 18 % smaller with 10.0 cm seeding depth than with 2.5 cm seeding depth. NIELSEN and OVERGAARD (4) obtained in field trials greater grain yields from oats sown at 5 cm than at 10 cm seeding depth.

Table 1. The quality of sown seed

| Kind of cereal | Variety | Year | Small seeds 1000-seed weight, g | Germination % | Large seeds 1000-seed weight, g | Germination % |
|---|---|---|---|---|---|---|
| Winter rye | Kungs II | 1960 | 20.2 | 82 | 33.6 | 91 |
| | | 1961 | 20.8 | 95 | 33.3 | 95 |
| | | 1962 | 20.7 | 96 | 33.1 | 92 |
| Winter wheat | Odin | 1960 | 25.5 | 92 | 49.5 | 95 |
| | | 1961 | 26.2 | 93 | 49.6 | 96 |
| | | 1962 | 26.0 | 86 | 49.2 | 89 |
| Spring barley | Rika | 1961 | 22.0 | 90 | 50.9 | 96 |
| | | 1962 I | 26.0 | 83 | 56.0 | 83 |
| | | 1962 II | 25.9 | 82 | 55.7 | 81 |
| Spring wheat | Drott | 1961 | 20.1 | 85 | 47.1 | 85 |
| | Ring | 1962 I | 26.0 | 90 | 50.0 | 93 |
| | Ring | 1962 II | 25.9 | 76 | 49.8 | 79 |
| Oats | Sol II | 1961 | 16.6 | 93 | 38.6 | 95 |
| | | 1962 I | 15.4 | 85 | 27.5 | 86 |
| | | 1962 II | 15.3 | 90 | 27.2 | 90 |

## *Material and methods*

Data on the seed batches used in the study are compiled in Table 1. In each pair of small seeds and large seeds both seed batches were obtained from the same cultivation lot by grading. All seed batches were treated with mercury seed dressing preparation Betoxin.

After preliminary cleaning, the seed was graded to effect a division of each seed lot into three parts: (1) about 10 %, small seeds; (2) about 80 %, »medium large» seeds; and (3) about 10 %, large seeds. Differences in germination percentage between the small and large seeds could not be avoided. These differences were compensated so that the experimental results for small and large seeds became mutually comparable. The experiments were conducted in a greenhouse. The water supply and other environmental factors were the same in all tests of different seeding depths, seed sizes and species.

The experiments were conducted in wooden pots 0.16 $m^2$ in size and with 20 cm soil depth. 192 germinating seeds were placed in each pot. Loam soil was used. The number of replications was three. The plants were counted 40 days after sowing. The seeding depths were 1 cm, 6 cm and 11 cm.

The t-values were calculated as presented by FISHER (1) and the significance levels determined according to FISHER and YATES (2) denoting them by asterisks as follows: *** = $P \leq 0.001$, ** $\leq P > 0.01$, but $> 0.001$, and * = $P \leq 0.05$, but $> 0.01$.

## *Percentage of emerging seedlings*

*Rye.* In all comparisons, the large seeds gave a higher percentage of seedlings and plants than the small seeds used in the test (Table 2). The difference, in per cent of seedlings that emerged from small and large seeds was greater with greater seeding depth than with shallow seeding depth (Fig. 1).

Table 2. Emergence of seedlings in per cent, 1960–62

| Seed size and seeding depth | Per cent seedlings emerged | | | | | All crops in total | |
|---|---|---|---|---|---|---|---|
| | Winter rye | Winter wheat | Spring barley | Spring wheat | Oats | Difference between small and large seeds | t value for the difference |
| *Small seeds* | | | | | | | |
| 1 cm | 77.6 | 81.8 | 82.7 | 55.8 | 78.1 | — | — |
| 6 cm | 43.6 | 63.7 | 69.8 | 44.6 | 73.2 | — | — |
| 11 cm | 4.0 | 28.1 | 34.9 | 19.4 | 42.0 | — | — |
| *Large seeds* | | | | | | | |
| 1 cm | 84.0 | 84.7 | 84.7 | 63.7 | 83.8 | + 5.0 | 6.11*** |
| 6 cm | 57.4 | 69.0 | 77.7 | 53.2 | 80.6 | + 8.6 | 4.43*** |
| 11 cm | 17.1 | 41.2 | 45.6 | 32.5 | 56.8 | +13.0 | 7.82*** |
| t value for the difference between small and large seeds | 4.62** | 3.90** | 1.93 | 5.69*** | 4.56** | + 8.9 | 8.88*** |

*Winter wheat.* A higher percentage of seedlings was obtained with large seeds than with small ones (Table 2). The tendencies were consistent with those observed in winter rye, but the influence of seed size and seeding depth seems to have been less with winter wheat.

*Spring barley.* The percentage of emerging seedlings was higher for large seeds than for small seeds. It was higher in all individual experiments at 11 cm seeding

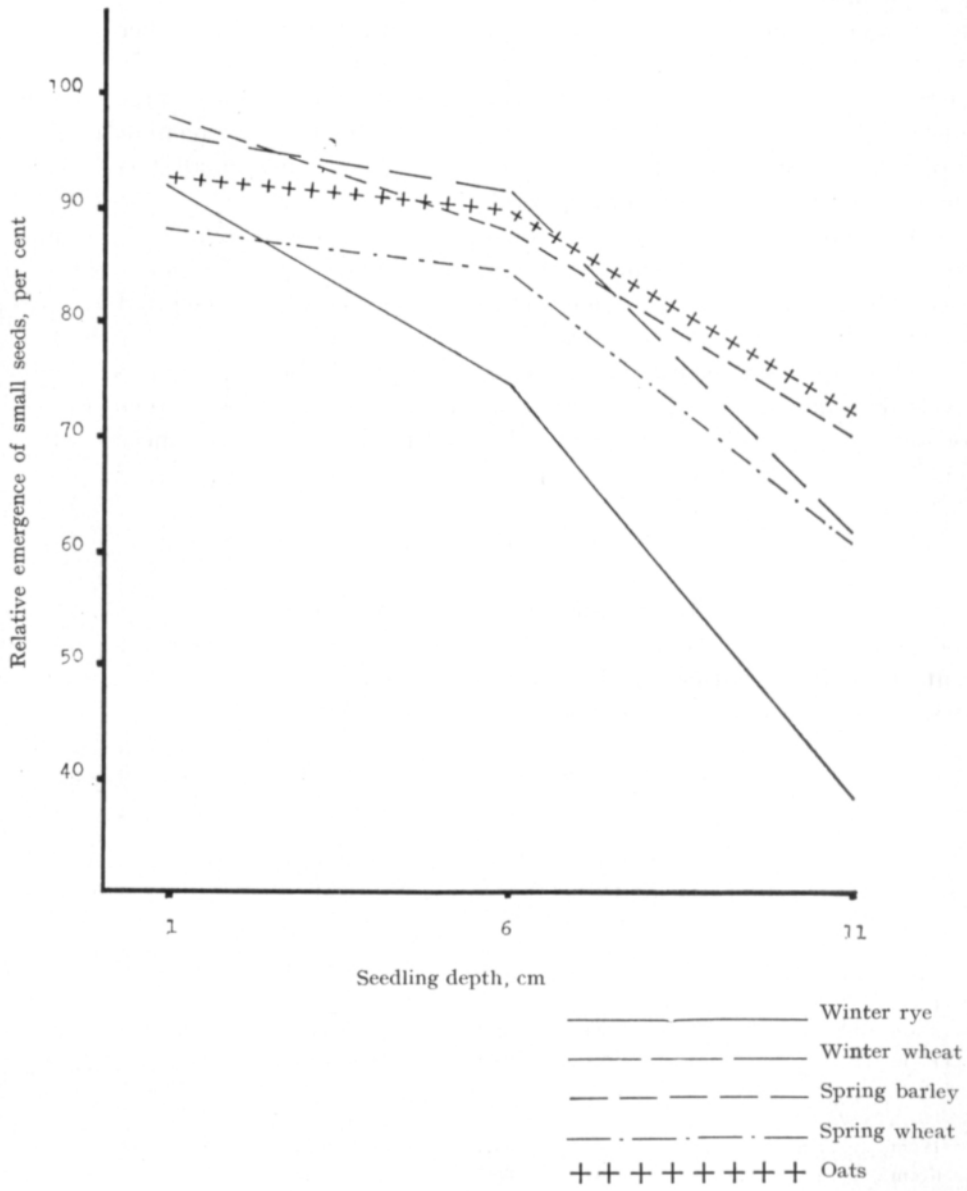


Fig. 1. The relative emergence of seedling from small seeds in comparison with the emergence from large seeds (= 100.0).

depth for large seeds than for small seeds (Table 2). The influence of seed size and seeding depth seems to have been less in spring barley than in winter rye.

*Spring wheat.* In all comparisons, seedlings were obtained in smaller numbers with small seeds than with large seeds (Table 2). Greater seeding depth produced a lower percentage of emerging seedlings in all experiments. The greater the seeding depth, the bigger the difference established in the number of seedlings emerging from small and from large seeds.

*Oats.* Large seeds produced greater numbers of emerging seedlings than small seeds in all experiments (Table 2).

## *Formation of shoots*

The number of shoots developed from 100 seeds was in every experiment smaller with small seeds than with large seeds (Fig. 1). The greatest difference in this respect between small and large seeds was observed in barley.

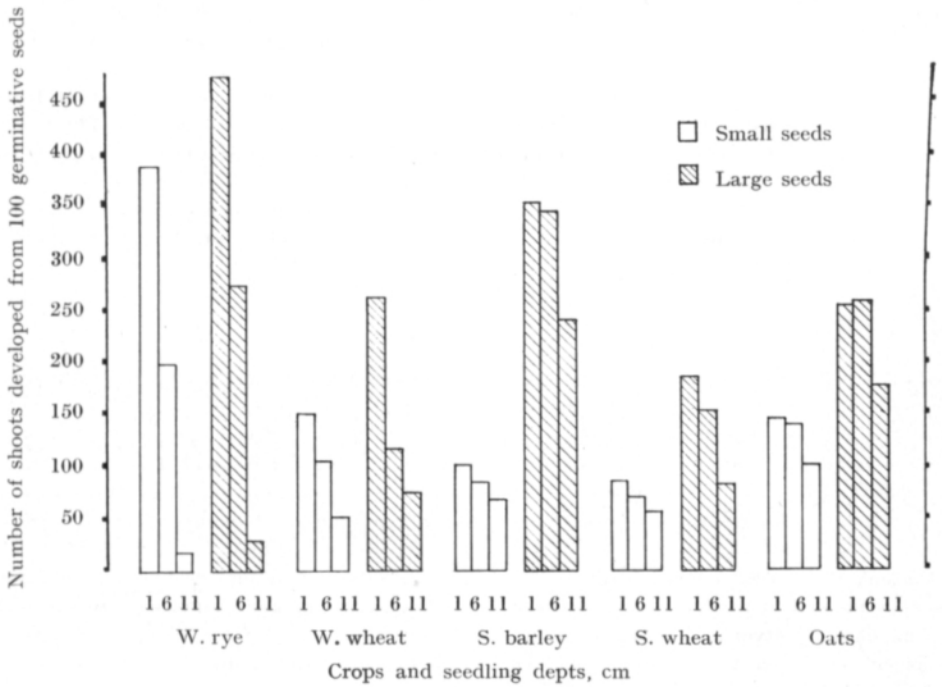


Fig. 2. The number of shoots developed from 100 germinative seeds sown at different depths.

## *Summary*

The influence of seed size on emergence of seedlings and plant development was studied in a number of trials with special reference to seeding depth. The results of the study lead to the following conclusions:

The number of emerging seedlings and the number of developing shoots per 100 sown germinative seeds were smaller with small seeds than with large seeds.

The influence of seeding depth on the percentage of emerging seedlings was more marked with small seeds than with large seeds.

Differences were found between different crops. The strongest dependence of the observed quantities on seed size was displayed by winter rye at a great seeding depth. The differences between the studied crops could not be explained on the basis of differences in 1000-seed weights.

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## SELOSTUS:

### KORSIVILJOJEN ORASTUMISEN JA TAIMIEN KEHITYKSEN RIIPPUVUUS KYLVÖSIEMENEN KOOSTA

Rolf Manner

*Kasvinjalostuslaitos, Maatalouden tutkimuskeskus, Jokioinen*

Vuosina 1959—1962 suoritti tekijä sarjan vertailevia tutkimuksia siitä, miten korsiviljan orastuminen ja taimien kehitys riippuu kylvösiemenen koosta. Tutkimuksen kohteena olivat syysruis, syysvehnä, ohra, kevätvehnä ja kaura. Tutkimuksen tarkoituksena oli selvittää, onko pienien ja suurien kylvösiemenien arvossa todettavissa eroja. Tutkimuksessa vertailtiin kahta eri siemenkokoa sekä kolmea eri kylvösyvyyttä.

Pieni- ja suurikokoisen siemenen arvossa todettiin eroja. Pienien jyvien orastumisprosentti oli alhaisempi kuin suurien jyvien. Tämän lisäksi oli pienistä jyvistä kehittyneiden taimien versojen lukumäärä 100 kylvettyä itävää jyvää kohti alhaisempi.

Pienistä jyvistä kehittyneiden taimien orastuminen oli enemmän kuin suurista jyvistä kehittyneiden tainten riippuvainen kylvösyvyydestä.

Viljelykasvien välillä voitiin osoittaa olevan eroavuuksia sekä orastumisprosenttiin että taimien versoutumiseen nähden. Syysrukiissa on todettu suurin ero pieni- ja suurikokoisen kylvösiemenen orastumisprosenttien välillä. Syysruis osoittautui tutkituista viljakasveista myös eniten riippuvaiseksi kylvösyvyydestä.

Tutkittujen viljelykasvien välillä todetut eroavuudet eivät ole selitettävissä tuhannen jyvän painon perusteella.