

*Short communication:*

## **Comparative studies on germination media for four agricultural seeds**

(Kajian perbandingan tentang media percambahan untuk empat jenis biji benih pertanian)

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Key words: germination, media, shoot, root, normal seedling

### **Abstrak**

Kajian ini menggunakan tujuh jenis medium percambahan (kertas gulung khas untuk percambahan biji benih, kertas tisu gulung kegunaan di dapur, kertas sap biru, kertas kegunaan di makmal, kertas sap, kertas sap dengan span dan pasir) serta empat jenis biji benih (timun, padi, cili dan sawi). Bagi biji timun, tiada perbezaan yang ketara antara kesemua jenis medium yang digunakan, kecuali pasir yang memberikan kadar percambahan yang terendah. Bagaimanapun, pasir memberikan kadar percambahan yang tertinggi bagi padi. Pada amnya, percambahan dalam pasir, kertas gulung, kertas tisu gulung dan kertas sap lebih baik daripada kertas sap dengan span. Bagi cili, medium pasir memberikan percambahan yang sangat ketara tetapi tiada perbezaan yang ketara antara medium lain yang digunakan. Kertas sap biru memberikan kadar percambahan yang tertinggi bagi sawi, sementara tiada perbezaan antara kertas sap dengan span, kertas makmal dan kertas tisu gulung. Secara amnya, pucuk anak benih di medium gantian lebih pendek daripada pucuk anak benih di medium standard (pasir, kertas gulung dan kertas sap biru).

### **Abstract**

The study involved seven types of germination media (roll towel, kitchen roll towel, blue blotter, hygienic paper, blotting paper, blotting paper on sponge and sand) and four types of seeds (cucumber, rice, chilli and Chinese mustard). With cucumber, there was no significant difference in germination among all the media used, except sand which gave the lowest germination. With rice, sand gave the highest germination. In general, germination with sand, roll towel, kitchen roll towel and blotters was significantly better than on blotter + sponge. In the case of chilli, germination in sand was highly significant. However, there was no significant difference in germination among other media tested. Highest germination in Chinese mustard was obtained with blue blotter, while there was no significant difference in germination on blotter + sponge, hygienic paper and kitchen roll towel. The shoot length was generally shorter when using substitute media as compared with standard media (sand, roll towel and blue blotter).

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## Introduction

Information on seed viability is always useful before sowing the seeds. Planting of non-viable seeds increases cost and disrupts schedules. The most common and universally accepted method to determine seed viability is the germination test. A standard germination test is conducted under standardized conditions as outlined by International Seed Testing Association (Anon. 1985). The official recommended media of germination are sand, soil and paper. The types of paper used are filter paper, paper towel and blotting paper. Rolled paper towel held horizontally in 3 cm deep water was found to be the best medium for rice seed (Nihei and Takahashi 1991). On the other hand, germination of soyabean seed was better on vermiculite and sponge as compared with blotting paper and sand (Sun and Chen 1991).

The standard paper media for germination tests are rather costly and sometime not easily available locally. As such, seed laboratories at MARDI, Department of Agriculture (DOA) and Asean Plant Quarantine & Training Institute (Asean Planti) use substitute paper media for germination tests. These types of paper have never been tested before for such purpose. A study was thus conducted to determine the efficiency of various substitute media used by the local seed laboratories in testing for germination.

## Materials and methods

Four types of seeds used in this study were those of rice (*O. sativa* L.), cucumber (*Cucumis sativa* L.), chilli (*Capsicum annum* L.) and Chinese mustard (*Brassica chinensis*). The rice seeds were obtained from MARDI Station in Parit, the cucumber and chilli seeds were obtained from DOA, while the Chinese mustard seeds were bought from a seed dealer. All the seeds showed initial germination of above 80%.

Seven types of germination media were tested: roll towel, kitchen roll towel, blue blotter, hygienic paper, blotting paper,

blotting paper on plastic sponge and sand. Roll towel which is non-toxic to seedlings as well as having good water holding capacity, is paper specially made for germination test. Kitchen roll towel is the normal roll tissue paper used in the kitchen and does not have special quality for seed germination. Blue blotter is the square blue blotting paper used for seed germination. The sand used was river sand that had been sieved, washed and oven sterilized. The hygienic paper is absorbent, embossed quality hand towel normally used in pathological laboratory. Three of the media, sand, roll towel and blue blotter, are standard media for germination tests.

All the media were tested with all the crop seeds except roll towel which was not used for Chinese mustard due to its small seed size. Seeds were germinated on top of all the paper media except roll towel. For roll towel, seeds were placed on the paper which was then rolled over. In the case of sand, seeds were covered with a thin layer of sand. Three layers of kitchen roll towel and blotters were used in each case. The germination media were kept damp by spraying with tap water when necessary. The germination tests were conducted under room temperature. Four hundred seeds were used in four replicates in a randomized complete block design. Germination evaluation was done according to ISTA (1985) rules. Shoot and root lengths of 10 sample seedlings from each treatment were also measured during germination count.

## Results and discussion

In cucumber, there was no significant difference in germination among the six media (roll towel, kitchen roll towel, blue blotter, hygienic paper, blotting paper and blotter + sponge). The sand medium gave the lowest germination (*Table 1*). However, there was great difference in results between replicates in the sand medium. Seedlings in the sand medium had significantly long shoot lengths while root length was longest in those on roll towel.

Table 1. Germination of cucumber, rice, chilli and Chinese mustard seeds on seven types of media

Medium	Germination (%) (normal seedling)	Shoot length (cm)	Root length (cm)
<b>Cucumber</b>			
Roll towel	94.7a	8.9b	13.2a
Kitchen roll towel	95.0a	6.9c	6.4d
Blue blotter	87.0a	8.0c	9.0b
Hygienic paper	92.0a	6.2c	6.7cd
Blotter	89.0a	6.8c	9.9b
Blotter + sponge	93.7a	6.6c	9.7b
Sand	73.0b	13.3a	8.4bc
<b>Rice</b>			
Roll towel	87.2ab	10.1b	19.6a
Kitchen roll towel	86.7ab	7.9c	4.6d
Blue blotter	82.7bc	8.3c	8.5c
Hygienic paper	81.7bc	8.3c	6.3d
Blotter	86.7ab	8.1c	8.9c
Blotter + sponge	79.7c	8.3c	13.4b
Sand	90.2a	20.3a	6.5d
<b>Chilli</b>			
Roll towel	63.0c	4.7b	7.4a
Kitchen roll towel	76.3b	3.8c	3.7cd
Blue blotter	75.5b	4.5b	4.9b
Hygienic paper	77.5b	3.6c	3.1d
Blotter	70.3b	3.6c	4.1bc
Blotter + sponge	75.8b	3.7c	4.1bc
Sand	91.8a	7.4a	4.3bc
<b>Chinese mustard</b>			
Roll towel	nd	–	–
Kitchen roll towel	82.7b	3.6cd	4.5c
Blue blotter	88.7a	5.0b	6.2a
Hygienic paper	82.7b	3.8c	4.3c
Blotter	86.5ab	3.9c	5.2b
Blotter + sponge	82.7b	3.3d	4.4c
Sand	76.7c	6.4a	4.2c

Mean values in each column with the same letter are not significantly different at  $p = 0.05$  according to DMRT

nd = not done

Unlike cucumber, germination of rice seeds was highest in sand although not significantly higher than those on roll towel, kitchen roll towel and blotter (*Table 1*). Germination in these four media (sand, roll towel, kitchen roll towel and blotter) was higher compared with using blotter + sponge. The sand medium also gave the longest shoot length (20.3 cm). There was no significant difference in shoot length of

seedlings on hygienic paper, blotter + sponge, blotter, blue blotter and kitchen roll towel. Root length was longest using roll towel.

Similar to rice, sand gave the highest germination of chilli (*Table 1*). There was no significant difference in germination among the seeds on hygienic paper, kitchen roll towel, roll towel, blotter, blotter + sponge or blue blotter. Root growth of chilli

seedlings was longest on roll towel. The seedlings had the longest shoots when grown on sand. However, shoot length did not differ significantly between seedlings on blotter, kitchen roll towel, blotter + sponge and hygienic paper.

In the case of Chinese mustard, highest germination was observed on blue blotter and blotter. There was no significant difference in germination on blotter + sponge, hygienic paper and kitchen roll towel. Although germination on sand was the lowest (*Table 1*), it resulted in the longest shoot. The longest root was produced by seedlings on blue blotter.

Results from this study showed that for the same medium, germination rates differed for all the seeds tested. Sand was the best medium for rice and chilli seeds, but least suitable for Chinese mustard seeds. The result for cucumber in sand was doubtful. There could have been some error probably related to water availability that resulted in inconsistency between replicates. In the case of Chinese mustard, the seeds are small and round so that they have restricted contact area for imbibition, thus there was better water absorption with paper media than with sand. Generally for all the four crops, all the substitute media were relatively suitable for use as germination media as reflected by the number of normal seedlings.

However, based on seedling growth, the substitute media seemed to be inferior to some of the standard media (sand, blue blotter and roll towel). The shoot lengths of the seedlings on the substitute media were significantly shorter than those on sand, roll towel or blue blotter. This trend was not apparent in root length but the roots of the seedlings on kitchen roll towel and hygienic paper tended to be shorter than those on the other media. Even though the seedlings on the substitute media seemed less superior (shorter shoots), they could still be considered as normal seedlings and thus be included in the calculation for percentage germination. In conclusion, based on the

results obtained in the four crops used, all the media could be used as substitutes to standard media.

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