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The relationship between frequency of sound and both germination percentage and growth in edible plants

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Abstract

Our goals are to find frequencies of sound which have effects on the growth of plants and the substances in a plant cell which receive the effect. We have found that two frequencies of sound, 1000Hz and 2000Hz, have some effects on plants, and we are doing experiments specifically designed to test their effects.

1. Purpose

We aim to identify the frequencies of sound that affect the growth of plants and contribute to agriculture by applying the result to controlling the growth of agricultural products.

2. Hypothesis

We define the growth of plants as the germination percentage and the length of the plants. According to previous studies, sound affects the growth of plants. In our research, we don't use music, but several single frequencies, and we expect that the influence of sound on growth will differ according to the frequency.

3. Method

Experiment 1: We soaked two kinds of seeds, white radish sprouts and komatsuna, in water for seven hours, put them into soil in a planter, and gave them five kinds of sounds at a constant frequency: 500Hz, 1,000Hz, 1,500Hz, 2,000Hz and 2,500Hz. (Picture 1)

We prepared another planter that we didn't give any sounds so that we could do a blank test at the same time.

To make all the conditions equal, we used a shading curtain and a white LED as a light source device, giving plants light from 8 a.m. to 4 p.m.

We observed each planter for five days.

We counted the number of sprouts, measured their length and the air temperature, and recorded them at 4 p.m. in our experimental notebook.

Moreover, at the last day of each experiment, we measured the length of the stalks and recorded them, too.

Experiment 2: We used agar containing gibberellin in trays instead of soil and

planters.

We soaked the seeds for seven hours, and put them into agar.

However, in this experiment, we gave the plants only two kinds of sounds at a constant frequency: 1,000Hz and 2,000Hz. This was because according to our first experiment, we found that these frequencies had relatively larger effects on the growth of plants than the other three frequencies.

We observed the plants for five days.

On the last day of the experiment, we counted the number of sprouts, measured the length of the stalks and the air temperature, and recorded them in our experimental notebook.

Experiment 3: As a control experiment for Experiment 1, we observed white radish sprouts and komatsuna planted in agar.

The planters were covered with a cardboard attached with sponge so that the sounds would be muffled.

Lastly, we put a small speaker on the top of the cardboard to send the sounds evenly to all the seeds.

4. Result

Experiment 1: Compared with the seeds with no sounds, more of the seeds with 1,000Hz sprouted and fewer of the seeds with 2,000Hz sprouted. (Graph 1 and Graph 2)

The seeds with 500Hz, and those with 1,500Hz didn't have much of a difference. (Graph 3 and Graph 4)

In the experiment with 2,500Hz, most of the seeds in its control experiment, which were not given any sound, didn't sprout. (Graph 5)

With five kinds of frequency, the lengths of the grown stems are almost the same as those in the control experiment.

Experiment 2: There is hardly any difference between plants which we gave gibberellin and those which we didn't give gibberellin. We couldn't see any difference in length of stalk between the plants which were given 1,000Hz and those which were given 2,000Hz. (Graph 6 and Graph 7)

There were some molds in the agar when we performed the experiment of 1,000Hz. So, in the experiment of 2,000Hz, we disinfected container with ethanol, and there was no mold.

Experiment 3: We could observe some differences between the plants which we gave the sound and those which we didn't give any sound, but the result of this Experiment 3 varied in each observation. （Graph8~12）

５．Conclusion

We concluded that sounds of 1,000Hz and 2,000Hz influenced on the growth of the plants.　However, it was not clear whether each frequency of sound promoted or restrained the growth of plants.　Moreover, little was learned about the relationship between plant hormones and the effects which frequency of sounds gave to the plants.

６．Perspective

We think we can discover the effects which each frequency of sound gives to the plants by performing Experiment 4 again and again, or by examining plant hormones other than gibberellin.

７．References

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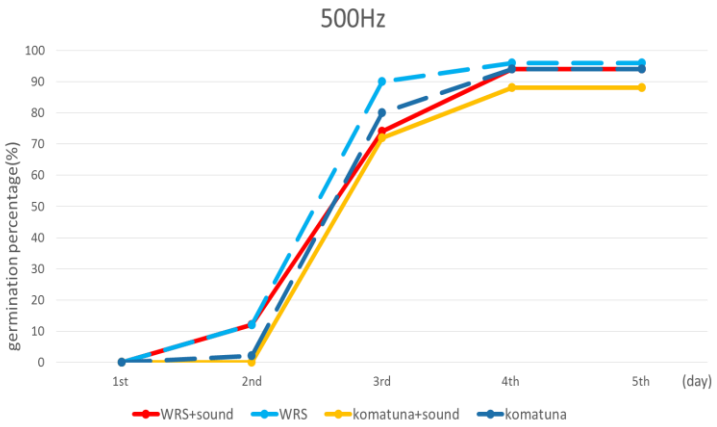
８．Key words

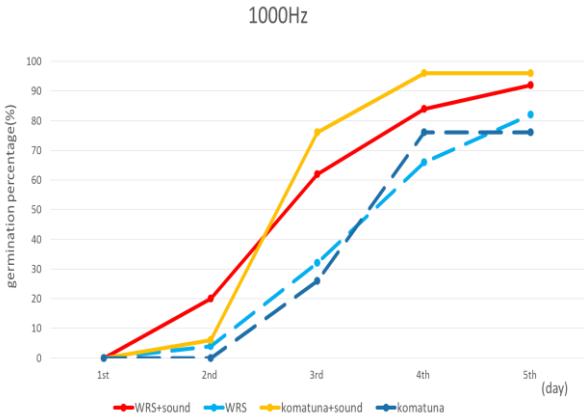
frequency of sound,　edible plants,　control of growth,　gibberellin

Picture1

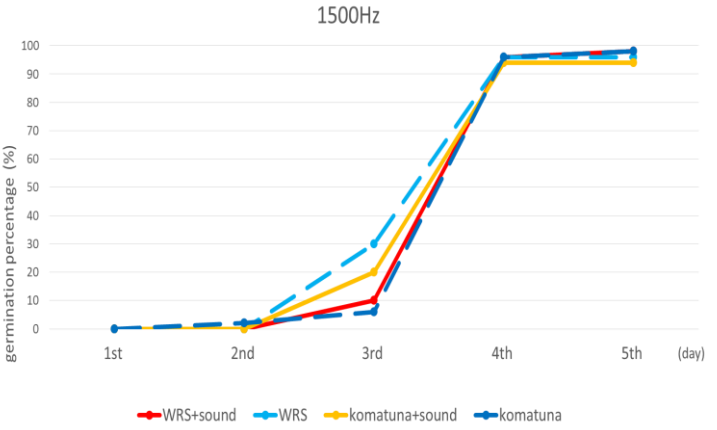
Graph 1



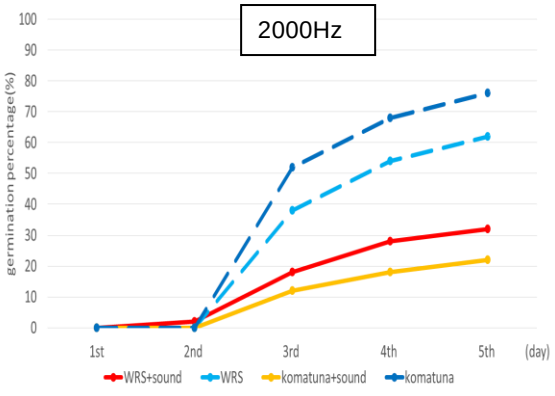
Graph 2



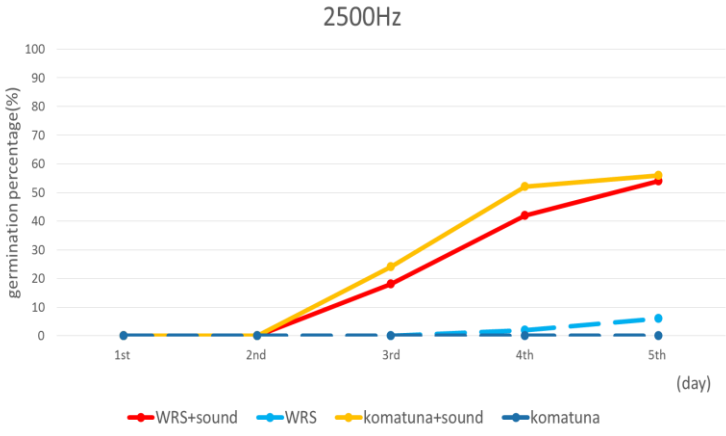
Graph 3



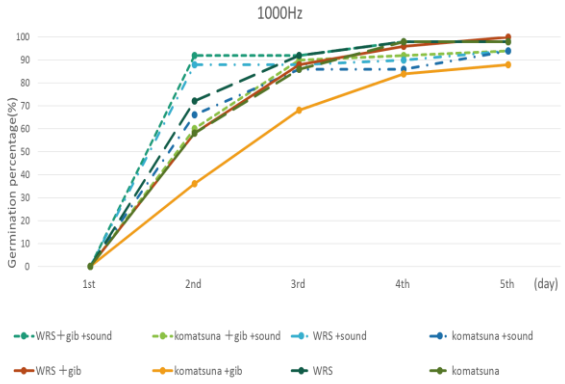
Graph 4



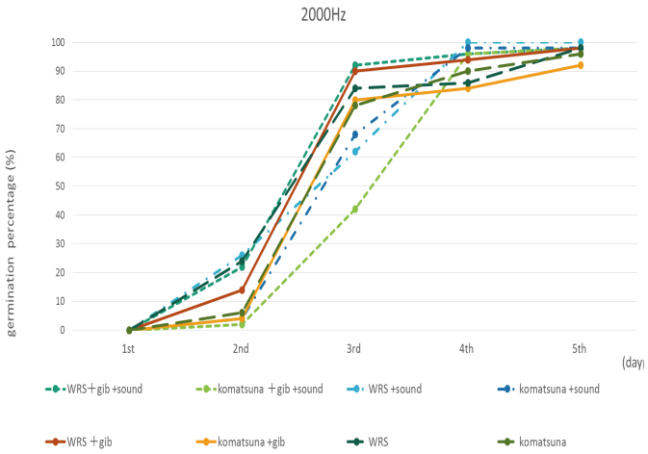
Graph 5



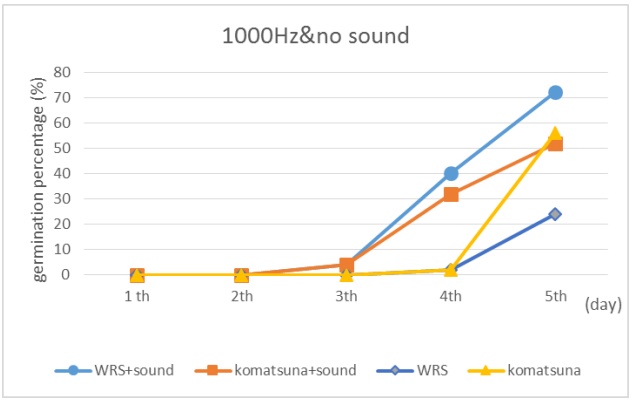
Graph6



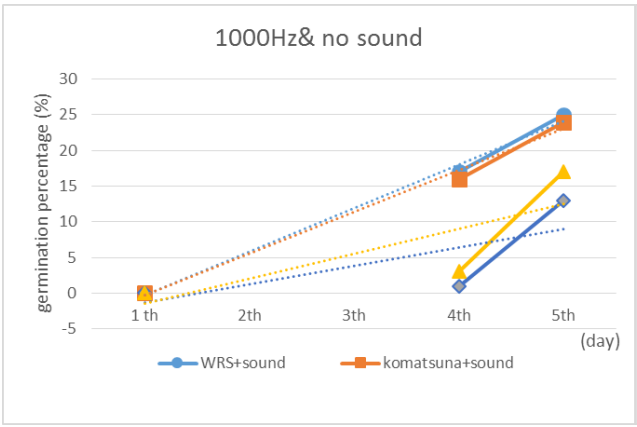
Graph7



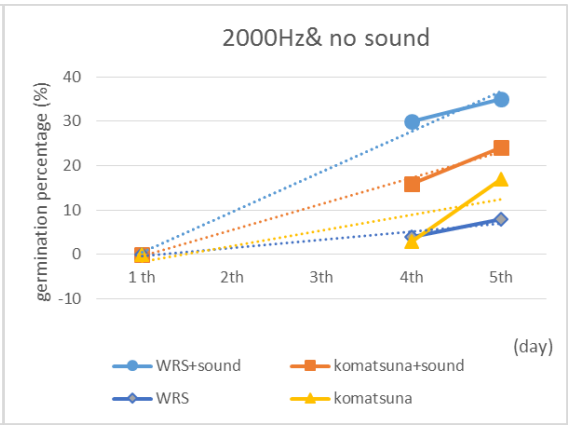
Graph 8



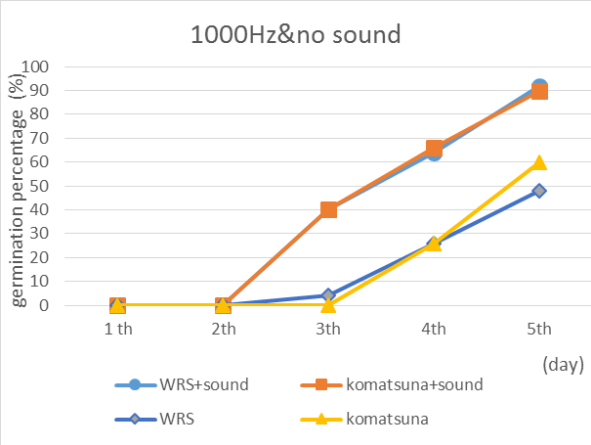
Graph 9



Graph 10



Graph11



Graph 12