

Analyzing the Difference Between Floral Materials Water Potential When Cut by Ikebana Experts and Inexperienced Persons

Yuki Ikenobo¹(✉), Yuko Hanba², Noriaki Kuwahara³,
and Akihiko Goto⁴

¹ Ikenobo, 248 Donomae-Cho, Nakagyo-ku, Kyoto 604-8134, Japan
hanahana@ikenobo.jp

² Centre for Bioresource Field Science, Kyoto Institute of Technology,
Matsugasaki, Sakyo-ku, Kyoto 606-8585, Japan
hanba@kit.ac.jp

³ Department of Advanced Fibro-Science, Kyoto Institute of Technology,
Matsugasaki, Sakyo-ku, Kyoto 606-8585, Japan
nkuwahar@kit.ac.jp

⁴ Department of Information Systems Engineering,
Faculty of Design Technology, Osaka Sangyo University,
3-1-1 Nakakakiuchi, Daito-shi, Osaka 574-8530, Japan
gotoh@ise.osaka-sandai.ac.jp

Abstract. Ikebana is one of the aspects of Japanese traditional culture. Flowers are used for the creation of ikebana, and keeping a completed arrangement in good condition is important. Ikebana arrangements are used for welcoming guests or displayed for a period of several days at exhibitions.

It is thought that floral material cut by an expert lasts longer but this has not been scientifically verified. Therefore this research aims to scientifically calculate and clarify the difference between floral materials cut by ikebana experts and an inexperienced persons, observing the cross section diagram of cut floral materials and their water potential (water retention).

Two kinds of floral material, one generally considered able to absorb water easily and the other generally considered to absorb water with difficulty, were cut by both the ikebana experts and an inexperienced persons, and these materials' cross sections were observed and their water potential (retention) measured.

As a result, material cut by the Ikebana experts showed a tendency for less damage at the cross section and higher water retention than material cut by the inexperienced persons. This was especially pronounced in floral material considered to be difficult in absorbing water. This thus suggested a correlation between the degree of damage seen in cross section and the water potential of floral material.

Keywords: Scissor · Process analysis · Water potential · Cutting speed

1 Introduction

Ikebana is one of the aspects of Japanese traditional culture. Flowers are used for the creation of ikebana, and keeping a completed arrangement in good condition is important. Ikebana arrangements are used for welcoming guests or displayed for a period of several days at exhibitions. However, most study of ikebana has been in terms of history or aesthetics and no scientific analysis of movement while arranging or of completed arrangements has been done. Thus it is thought that a scientific approach is needed in order to make clear the whole picture of ikebana.

It is thought that floral material cut by an expert lasts longer but this has not been scientifically verified. Therefore this research aims to scientifically measure and clarify the difference between floral materials cut by ikebana experts and inexperienced persons, observing the cross section of cut floral materials and the water potential (water retention) of cut floral materials.

Two kinds of floral material, one generally considered able to absorb water easily and the other generally considered to absorb water with difficulty, were cut by both ikebana experts and inexperienced persons, and these materials' cross sections were observed and their water potential (retention) measured.

Since cutting floral materials is especially important in ikebana, it is assumed that information about the quantitative evaluation of circumstances of different cutting motions between ikebana experts and inexperienced persons, differences in use of scissors, and how such differences affect cut materials and the condition of materials used in an arrangement will be useful for future teaching methods.



Fig. 1. Scissors “Warabite” (scissor handles in the shape of fern shoots)

2 Outline of Experimental Procedure

2.1 Methods, Conditions, and Floral Material Used

This experiment focused on quantitative evaluation of differences between ikebana experts and inexperienced persons with respect to the motion of cutting floral materials, and quantitative evaluation of the effect on floral materials caused by these differences. Circumstances of cutting motion by ikebana experts and inexperienced persons and cutting speed by ikebana experts and inexperienced persons were measured. Common “warabite” ikebana scissors (with handles in the shape of fern shoots) were used. (Fig. 1) These scissors are different from usual stationary scissors in the absence of a ring or oval-shaped portion for the fingers to pass through. When cutting materials with “warabite” one has to hold the scissors in the hand. To move the upper blade the lower handle is supported and moved by the four fingers other than the thumb; to move the lower blade the upper handle is grasped between the thumb and the palm of the hand.

For measurement of cutting motion and speed, chrysanthemum was used as a softer material, and red budding salix was used as a material harder to cut. Both materials are commonly used for ikebana. On a desk the materials were placed in a frame to prevent change of position during filming, and subjects were asked to cut at the points indicated. The experiment was recorded by high-speed camera (Photoron FASTCAM SA4) at 500 fps. Three points (points 1-3) were marked on the scissors, and two points (points 4 and 5) were marked at both ends of the stick fixed to the material for measuring its rotation. Video of the cutting action was analyzed by TEMA motion analysis software (Photoron), and the speed at each point was measured. A mark was placed at 800 mm from the upper tips of the material in order to assure as much as possible the uniform thickness of all stalks, and subjects were instructed to cut at that point (Fig. 2).

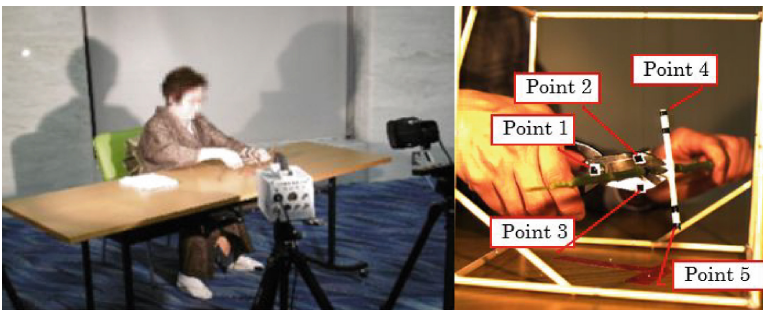


Fig. 2. Conditions for the experiment and the frame used for fixing the cutting position

The general concept of water potential was used for measuring the conditions of a floral material’s water absorption. After observation of cut surfaces with the naked eye photographs were taken, and water retention and transpiration amounts were measured. For floral materials, chocolate cosmos and gerbera were used. Generally chocolate

cosmos is considered to absorb water with difficulty and gerbera is considered to absorb water more easily. Both materials are regarded as relatively softer materials. Measurements were taken on the 1st, 5th and 9th days after cutting by the subjects.

2.2 Details of the Subjects Participating in the Experiment

Thirty subjects were chosen for the experiment: ten Ikebana experts as experienced persons, and twenty undergraduate and graduate students as inexperienced persons. Information on the subjects is as follows:

- Ikebana experts

1. 40 years of experience (69 years old/Female)
2. 33 years of experience (52 years old /Female)
3. 47 years of experience (65 years old /Female)
4. 20 years of experience (37 years old /Female)
5. 40 years of experience (62 years old /Female)
6. 49 years of experience (71 years old /Female)
7. 24 years of experience (44 years old /Female)
8. 40 years of experience (60 years old /Female)
9. 27 years of experience (37 years old /Female)
10. 60 years of experience (84 years old /Female)

- Inexperienced persons

20 subjects (male and female) with no Ikebana arranging experience were chosen, ranging in age from 20 to 49.

3 Results

3.1 Blade Speed When Cutting Flower Materials

Figures 3, 4, 5 and 6 are some instances of blade motion when cutting chrysanthemum and red budding salix by both Ikebana experts and inexperienced persons.

Figures 7 and 8 show average blade speed at the moment when stems of chrysanthemum and red budding salix were cut by both Ikebana experts and inexperienced persons. Figure 3 indicates that when cutting chrysanthemum the velocity of the blade of experts was faster than that of inexperienced persons. With respect to differences among marked points, blade speed for Ikebana experts was faster at point 2 than at point 3, while for inexperienced persons speed was faster at point 3 than at point 2, an opposite result.

Figure 4 shows that the speed of the blade of experts was faster than that of inexperienced persons when cutting red budding salix. Blade speed for cutting red budding salix was faster than for cutting chrysanthemum for both experts and

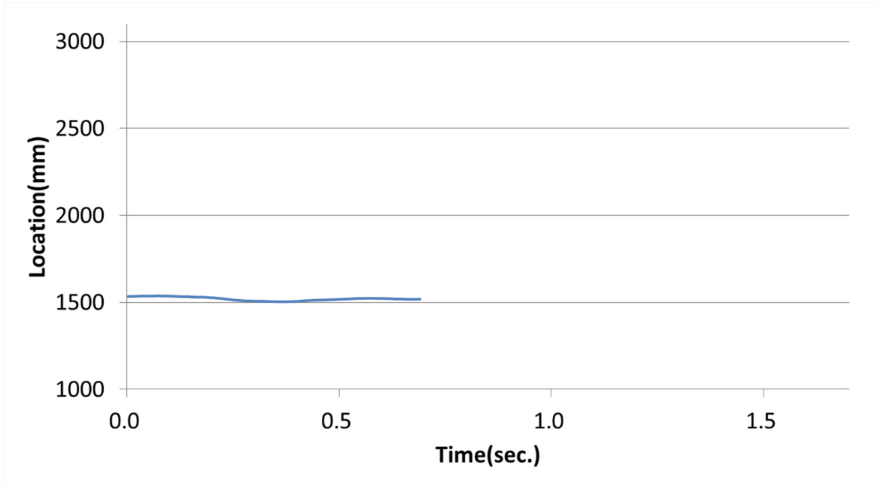


Fig. 3. Blade motion by one of experts (point 1 /chrysanthemum)

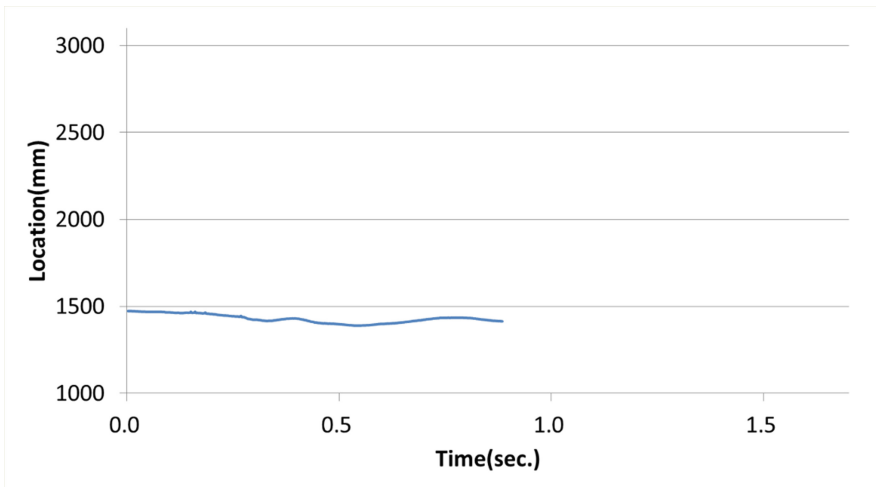


Fig. 4. Blade motion by one of beginners (point 1 /chrysanthemum)

inexperienced persons. However for red budding salix the speed was higher at point 3 than point 2 for both experts and inexperienced persons, a result different from that of chrysanthemum. There was a tendency toward large variation among the blade speeds of the experts.

The results suggest that experts not only cut materials with faster blade speed than inexperienced persons but also that their way of using scissors is different.

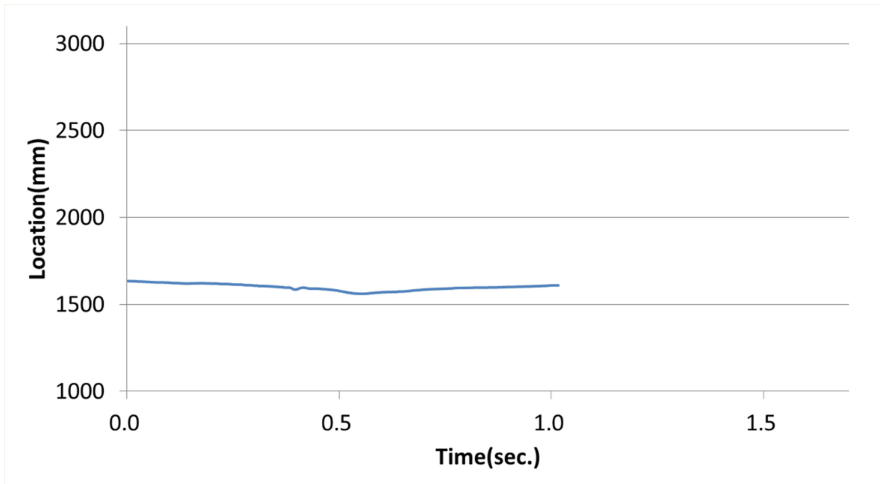


Fig. 5. Blade motion by one of experts (red budding salix) (Color figure online)

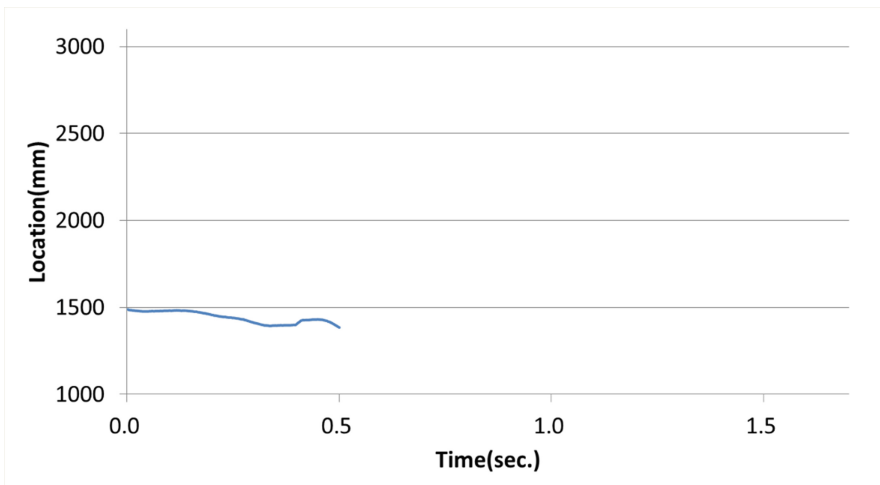


Fig. 6. Blade motion by one of beginner (red budding salix) (Color figure online)

3.2 Condition of the Floral Materials After Cutting

The results of water retention for chocolate cosmos and gerbera are shown in Figs. 9 and 10. Pressure Chamber 600 (PMS Instrument Company) was used for water retention measurement. Water potential is utilized to describe water retention status. Water potential is thermodynamic potential energy, the result of the division of chemical potential by partial molar volume of the water. Water potential, Ψ_w [Pa] is described in the following equation:

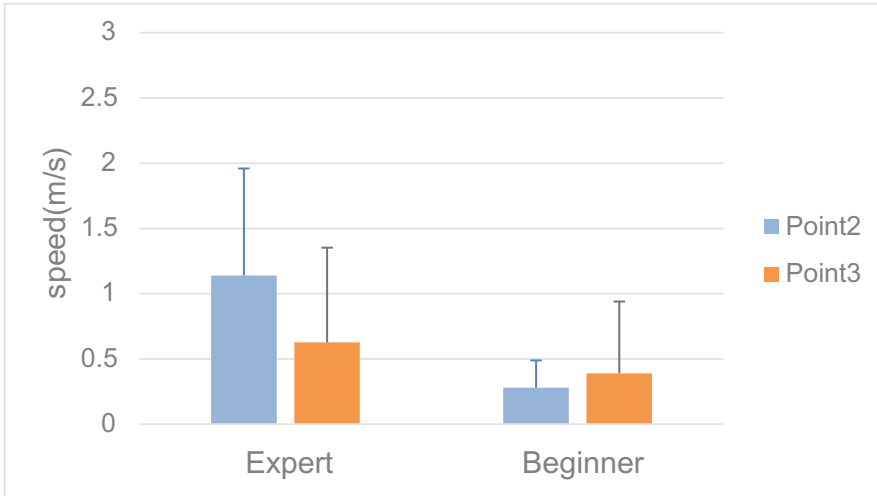


Fig. 7. Blade speed when cutting chrysanthemum

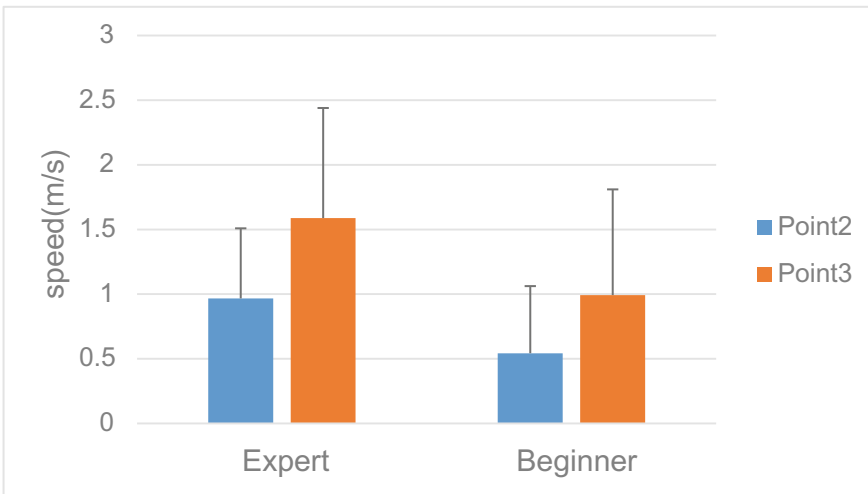


Fig. 8. Blade speed when cutting red budding salix (Color figure online)

$$\Psi_w = \Psi_o + \Psi_m + \Psi_p + \Psi_g$$

Ψ_o : Osmotic potential

Ψ_m : Matrix potential

Ψ_p : Pressure potential

Ψ_g : Gravitational potential

Water Potential

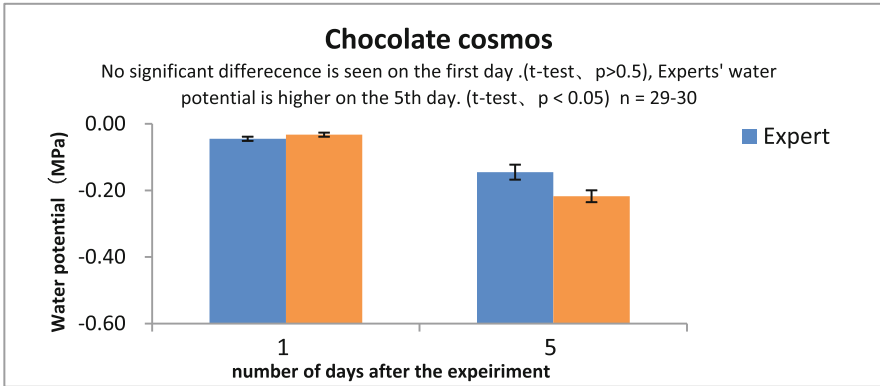


Fig. 9. Water potential of chocolate cosmos

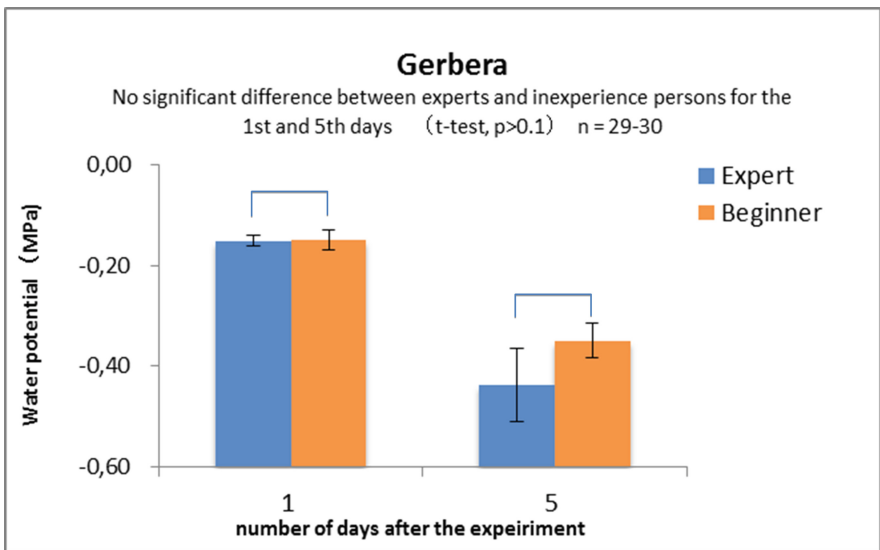


Fig. 10. Water potential of gerbera

- Chocolate cosmos

First day after the experiment: No difference between experts and inexperienced persons

Fifth day after the experiment: Experts' water potential was higher than that of inexperienced persons.

Ninth day after the experiment: No difference between experts and inexperienced persons.

- Gerbera

No difference between experts and inexperienced persons on the first, fifth and ninth days after the experiment.

Concerning material generally considered able to absorb water easily, no difference was seen between experts and inexperienced persons. With respect to material considered to absorb water with difficulty, stems cut by experts lasted longer than those cut by inexperienced persons.

3.3 Transpiration Amount

Figure 11 indicates the measurement of transpiration amount related to water absorption. In case of chocolate cosmos, transpiration amount for stems cut by experts was larger than that of inexperienced persons. With respect to gerbera, no difference was seen.

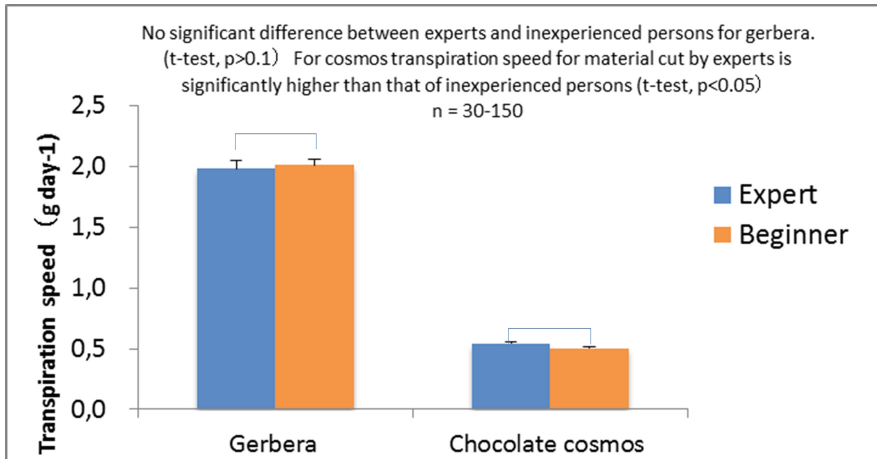


Fig. 11. Transpiration speed for chocolate cosmos and gerbera

3.4 Condition of Floral Materials

In case of chocolate cosmos, material cut by experts was longer lasting. Discoloration and shrinkage of petals were seen in chocolate cosmos cut by experts on the 7th day of measurement. For inexperienced persons the same changes were seen on the 5th day. Also, most of the petals of chocolate cosmos cut by experts had not fallen by the 9th day of the measurement. However for stems cut by inexperienced persons, petals started to fall on the 6th day and petals of many of the sample materials had fallen on the 9th day.

In case of gerbera, no significant change in appearance of the material such as color was observed for materials cut by experts or by inexperienced persons. For gerbera cut by some of the experts stem breakage was noted from the 5th day.

4 Conclusion

Differences in cutting speed and use of scissors were found between experts and inexperienced persons. The cutting speed of experts tends to be faster than that of inexperienced persons. It is possible that when cutting less hard material experts adjust the cutting force with four fingers, while when cutting so-called harder material they use more force applied with the thumb. Therefore this use of two different ways can be considered as a “skill” that experts have. In measurements of water potential, water retention for material cut by experts tends to be longer for chocolate cosmos, a material generally considered to absorb water with difficulty. With respect to gerbera no significant difference was seen between materials cut by experts and inexperienced persons. Internal structure of the materials is not identical; for example, cross section area and configuration or dispersion of vascular tissue are possible factors that might affect water absorption. However, it can be considered that materials considered able to absorb water easily such as gerbera are less likely to be affected by the cutting, while materials considered to absorb water with difficulty such as chocolate cosmos are more likely to be affected.

These results show that by cutting materials quickly in the manner of experts, less damage is done to vascular tissue or other parts of the material, and it can be expected that when a material considered to absorb water with difficulty is placed in water after having been cut quickly, the faster cutting speed will help the material to absorb water more easily and to keep good water retention and good condition of the flower.

From this experiment it was not possible to clarify whether or not differences of cutting speed and use of scissors bring significant difference in water potential. In the case of softer material, however, there seems to be correlation to some extent. I will try to conduct further research with the same materials in the future. The cutting of so-called woody materials (hard materials) will also be a topic for further research. Research will help to clarify the cutting motion and its effects for both experts and inexperienced persons. Based on the results of research, it is expected that an effective way of using scissors will be standardized in teaching manuals, so that beginners can quickly become familiar with use of scissors designed specifically for ikebana and more easily master ikebana skills.