

THE EFFECTS OF DIFFERENT SHADING OF MULCHING ON YIELD OF ROOT AND QUALITY IN *PANAX GINSENG*

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I. Introduction

Ginseng is one of three treasures in northeast area of China. It has been a valuable medicine since ancient times. Throughout the ages, Chinese people have used it as a medicine of highly nutritious value to cure chronic diseases, such as neurasthenia, decreasing in sexual desire, weakness of body, diabetes, etc.

According to past observations, ginseng adapts to grow in mountainous region about 1500–2000 m. above sea level in Taiwan. We have met many problems in culturing process, such as pests control, shade, mulching, soil property, soil temperature, fertilizers, etc. In shading with mulching materials, we used to shade with straw mulching on lath sheds. Now we find that plastic film is cheaper and more durable than straw.

In this experiment, we have mainly purposed on the study the effects of shading of different mulching materials on yield of root and quality in *Panax ginseng*. Moreover, we have also studied the effects of shading of different mulching materials on yield of root and quality in *Panax ginseng*. Moreover, we have also studied the effects of shading of different mulching materials on the growth of ginseng plant. We hope to be informed which material is the most suitable one so we may increase gains from pro-

duction of ginseng.

II. Material and methods:

2-, 3-, and 4- year-old seedlings of introduced Korean *Panax ginseng* were grown in lath sheds at Mei-Feng Farm which is located in a mountainous region in Taiwan. Three mulching materials: A. straw, B. black plastic cloth, C. grey plastic cloth were used as three mulching treatments to cover the top of lath sheds in this experiment. Ginseng Seedlings were planted row by row in lath sheds. These rows were directed to the side of sun set in the summer time. Each row were planted with 396 Ginseng seedlings. The experiment was under a Randomized Complete Block Design in three replications. After one year, all ginseng plants were harvested and leaf area, leaf number, leaf weight, root diameter, root weight, root length and stem length of ginseng plant were recorded. Every month after treatment during this year, light intensity and soil temperature which can be read separately from Lux meter and Recording Earth Thermometer were recorded too, three times at 11:00 a.m., 1:00 p.m. and 3:00 p.m. each day. The chemical analysis were also made after one year of cultivation. The amount of alkaloids and panacene content were determined in this analysis. This experiment began in March, 1972 and ended in July, 1972.

III. Results and discussions:

1. The effects of different mulching treatments on light intensity.

In general, light intensity at 11:00 a.m. was lower than that at 1:00 p.m. and 3:00 p.m. The light intensity under straw mulching treatment reached the highest point, that is 9,100 lux, at 3:00 p.m. in August and the lowest point, 1,200 lux, reached at 11:00 a.m. in next March. For mulching treatment B (covered with black plastic cloth), the light intensity reached the highest point, 12,400 lux, at 3:00 p.m. in July and reached the lowest point, 2,100 lux in next March. For mulching treatment C (covered with grey plastic cloth), the light intensity reached the highest point, 20,000 lux, at 3:00 p.m. in July and reached the lowest point, 2,700 lux, at 11:00 a.m. in next March. The light intensity differed greatly between mulching treatments. The variation of light intensity through the year may be affected by climate conditions.

2. The effects of different mulching treatments on soil temperature.

In general, the soil temperature reached the highest point in August and then lowered down gradually to the lowest point in February and then risen again gradually till July. The soil temperature of treatment A (straw mulching treatment) reached the lowest point 11:00 a.m. in February and reached the highest point, 24°C, at 3:00 p.m. in September. In treatment B (black plastic cloth treatment), the lowest soil temperature was reached at 11:00 a.m. in October and next February; the lowest soil temperature was reached at 11:00 a.m. in October and next February; the highest soil temperature was 25°C been reached at 3:00 p.m. in August. For mulching treatment C (grey plastic cloth treatment), soil temperature reached the lowest figure 7°C at 11:00 a.m. in December and next February and the highest figure, 25°C, was reached at 3:00 p.m. in August and September. The results have shown that mulching with plastic cloth was more effective in increasing soil temperature than mul-

ching with straw.

3. The effects of different mulching treatments on growth of ginseng plant.

According to the data shown in this experiment, ginseng had the highest stem length (22.5 cm), leaf number (16.4 leaves), and leaf area (74.4 cm²) comparing to the other two treatment. Ginseng had the lowest figure in growth in grey plastic cloth treatment. The growth of ginseng in plastic cloth treatments was less than that in straw treatment perhaps because that rainwater or dew could not penetrate through the plastic cloth as easily as through the straw so that the ginseng plants in plastic cloth film had lacked of much more water or moisture than those in straw treatment.

4. The effects of different mulching treatment on root length of ginseng.

The results had shown that ginseng had the longest root length, 33.8 cm, in straw treatment. Next to it is 31.3 cm in black plastic cloth treatment. The lowest figure of root length is 29.2 cm in grey plastic cloth. The root length of ginseng was affected greatly by different mulching treatments. The differences among all treatments were significant.

5. The effects of different mulching treatment on root diameter of ginseng plant.

Ginseng had the largest root diameter, 2.67 cm, in straw mulching treatment. The root diameter of black plastic cloth treatment was next to it, 2.37 cm. The lowest figure of root diameter is 2.23 cm in grey plastic cloth treatment. Results have shown that root diameter was affected by different mulching treatment. The differences among all treatments were significant, too.

6. The effects of mulching treatments on yield of ginseng root.

The yield of ginseng root in straw treatment reached the highest figure, 92 g/plant. In black plastic cloth treatment there was 78 g/plant of root yield. In grey plastic cloth treatment the yield of ginseng root was the lowest, only 74 g/plant. It is evident

that different mulching treatment had affected the yield of ginseng root significantly. Besides, light intensity, temperature and rainwater may affect the yield of ginseng root, too.

7. The effects of different mulching treatments on leaf weight of ginseng plant.

The average leaf weight of each ginseng plant was highest in straw mulching treatment (52.3%). Next to it was 48 g in black plastic cloth treatment. The lowest figure was 44.7g in grey plastic cloth treatment. The differences among treatments were all great and significant.

8. The effect of different mulching treatment on the amount of plant alkaloids and panacene content.

The market value of the cured ginseng root is leased on color, maturity, size and form, content of plant alkaloids and panacene in root. According to results of chemical analysis in this experiment, the amount of plant alkaloids in straw mulching treatment was the highest, 0.53%. Next to it was 0.37% in black plastic cloth treatment. It was lowest in grey plastic film, only 0.23%. The differences among replications were not significant, but those among treatments were significant.

The panacene content obtained from various mulching treatment were very different. We had obtained the highest panacene content 0.053%, from roots in straw treatment. The panacene content obtained from black plastic cloth treatment was next to it, 0.037%. And the grey plastic cloth treatment had the lowest panacene content, it was only 0.02%. According to statistic analysis of variance, the differences between replications were not significant. But the differences among treatments were significant. The standard content of panacene is 0.05%. In straw treatment we obtained a little more than that level. From the viewpoint of yield, straw was the best mulching material. On the other hand, the black plastic cloth will be fairly good mulching material from the viewpoint of economical principle because plastic cloth is more durable than straw. The grey plastic cloth allowed too much penetration of light so that increased soil temperature and

resulted in bad growth of ginseng root.

In short, under straw mulching treatment the ginseng plant had a suitable light intensity and soil temperature for growth in this experiment. The yield of ginseng root, the amount of plant alkaloids and panacene content were the highest in straw mulching treatment. The results in black plastic cloth treatment was fairly good though it was less than that in straw treatment. The results in grey plastic cloth was worst. Data obtained from this experiment were quite complete. It seems that climatal circumstances, degrees of latitude, fertilizers used and nutrients in original soil have an effect on the yield and quality of ginseng roots. We need further studies and investigations on these respects.

Summary

This experiment was on the purpose to study the effects of different shading of Mulching treatments on the quality and yield of ginseng root. This experiment were conducted at Mei-Feng for one year, from July, 1972 to July, 1973. The variety been used was introduced Korea *Panax ginsyng*. Three different Shading of Mulching treatments have been studied. The results were summerized as follows:

1. The growth of ginseng plant is good under around 4,300 Lux of light intensity. Fig. 1. showed the shadow treatment of straw had a better effect than that of black or grey plastic film. The differences between treatments were significant.
2. The adequate soil temperature for ginseng culture was in the range of 16-18°C. Fig 2. showed that there were significant differences among treatments, of which the straw shadow treatment had the best effect.
3. The growth of ginseng plant was greatly affected with various shadow treatments. Fig. 1. showed both straw and black plastic film treatments had a better effects on growth of stem, leaf area and leaf numbers.
4. Fig. 2. 3. 4. 5 indicated there were distingished differences among all treatments. The straw and black plastic film mulching treatments had a better effects on root length, root diameter,

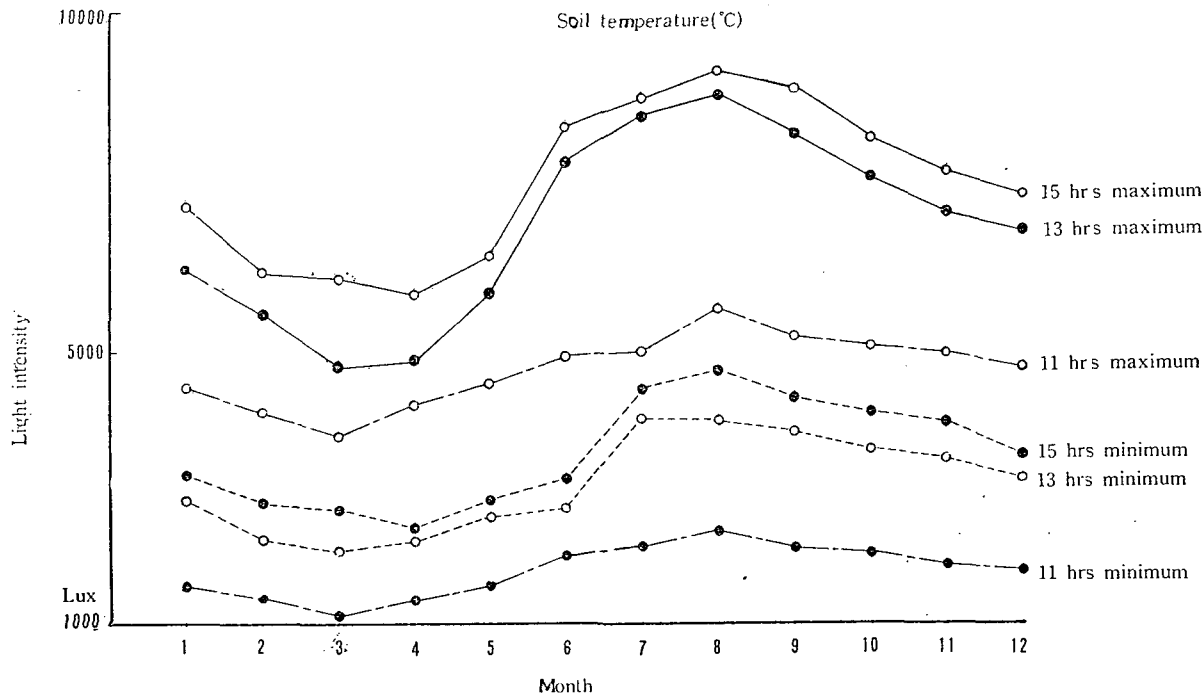
root weight and leaf weight than the grey plastic film.

5. The amount of plant alkaloids and panacene content had related to the shadow treatment, as showed in Fig. 6 and 7 that straw shadow

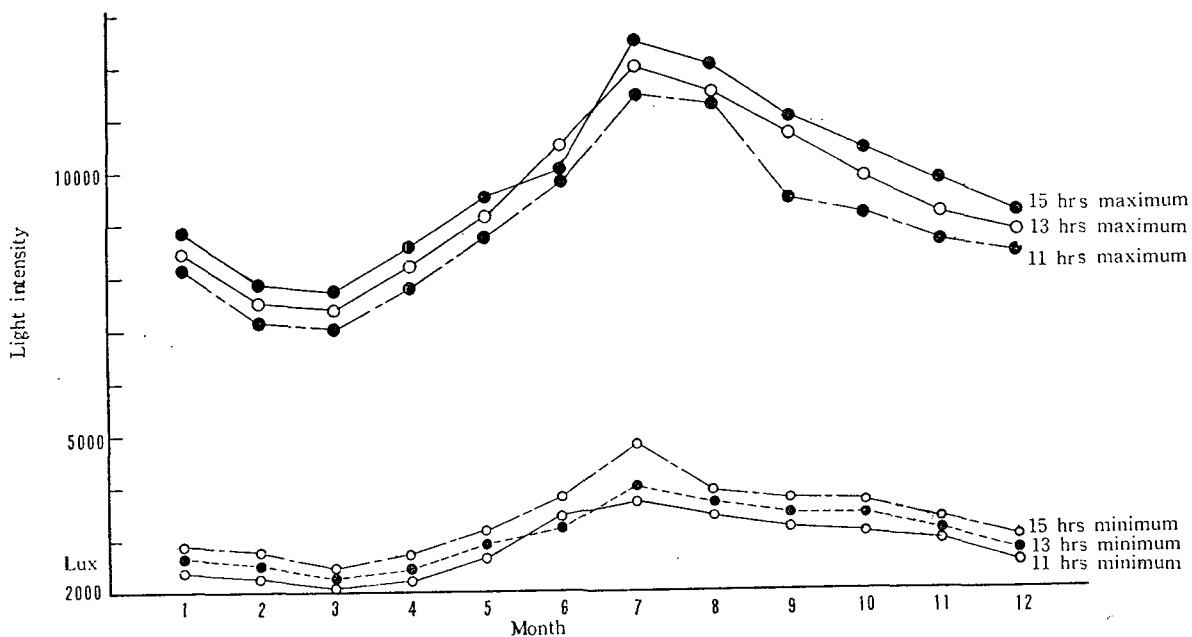
treatment had greatly increased the proccution of plant alkaloids and panacene content.

6. The quality and yield of roots of ginseng greatly affected by different shading of mulching treatments.

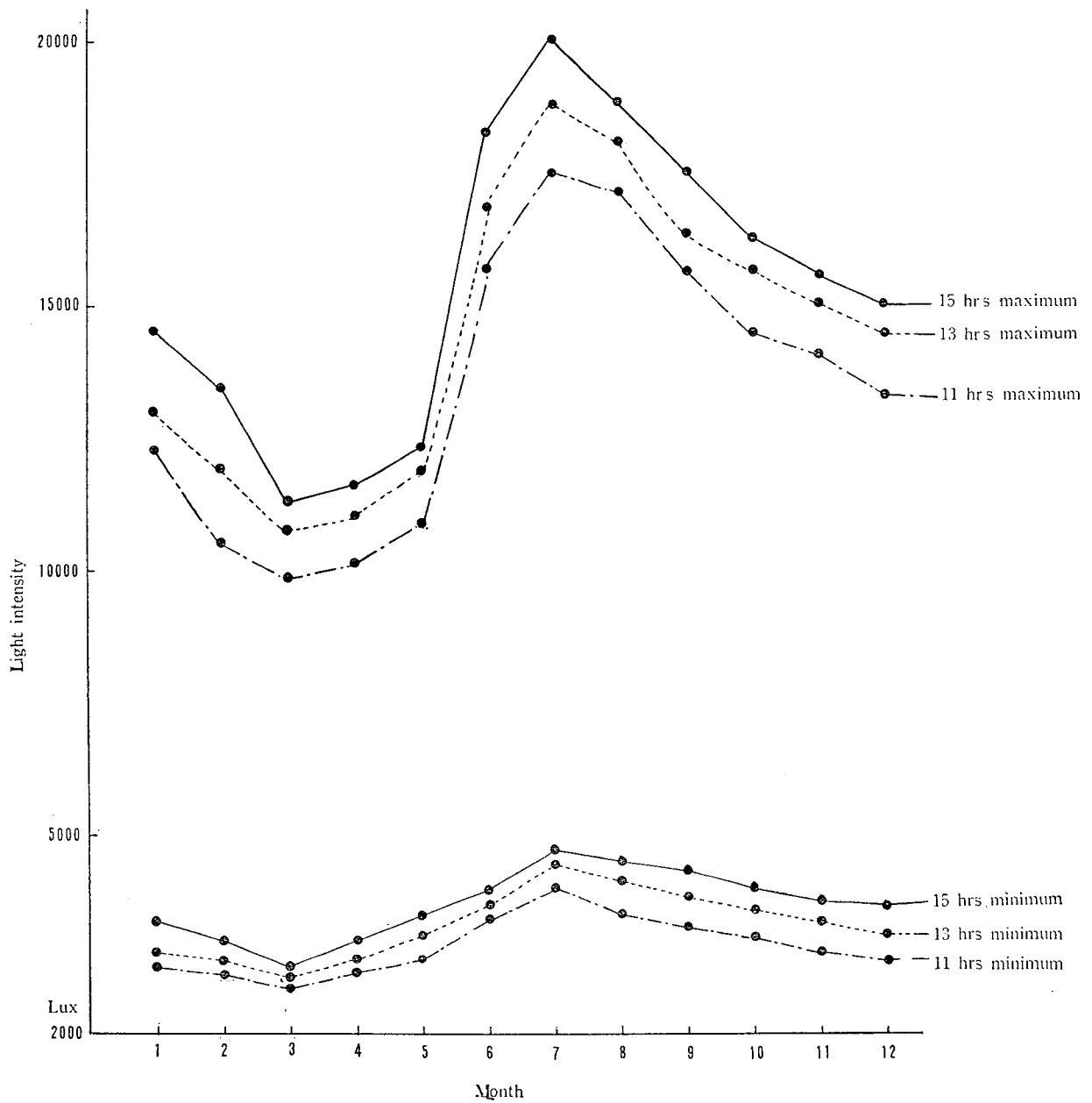
Fig. 1. The effects of different shading of mulching on light intensity



A. Straw shadow treatment

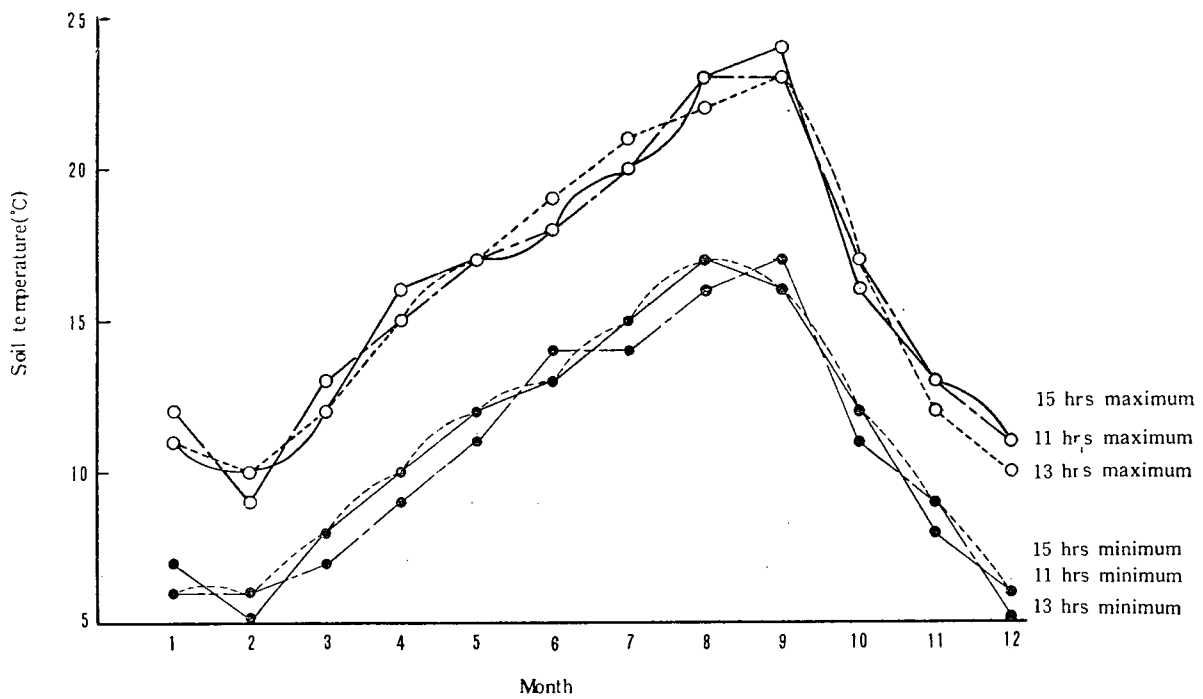


B. Black plastic film shadow treatment

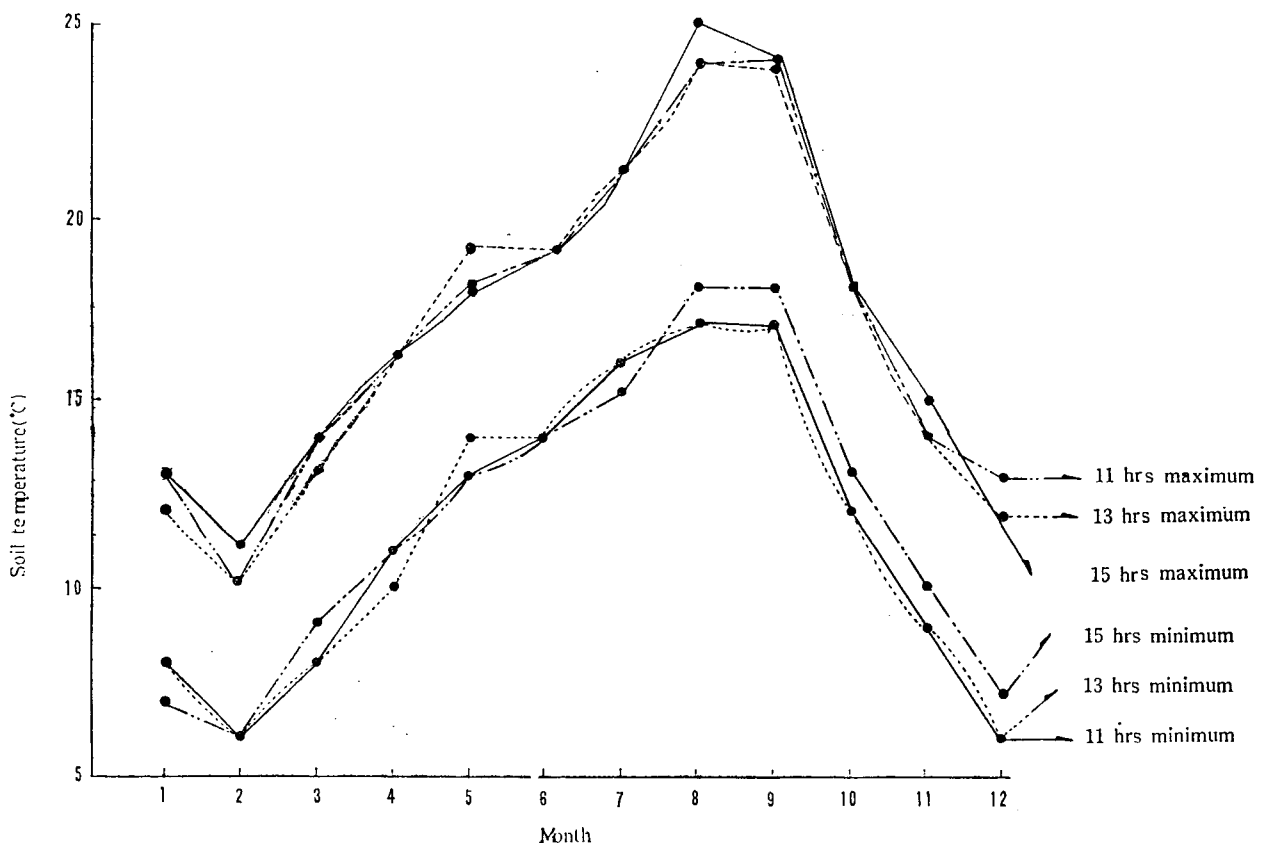


C. Grey plastic film shadow treatment

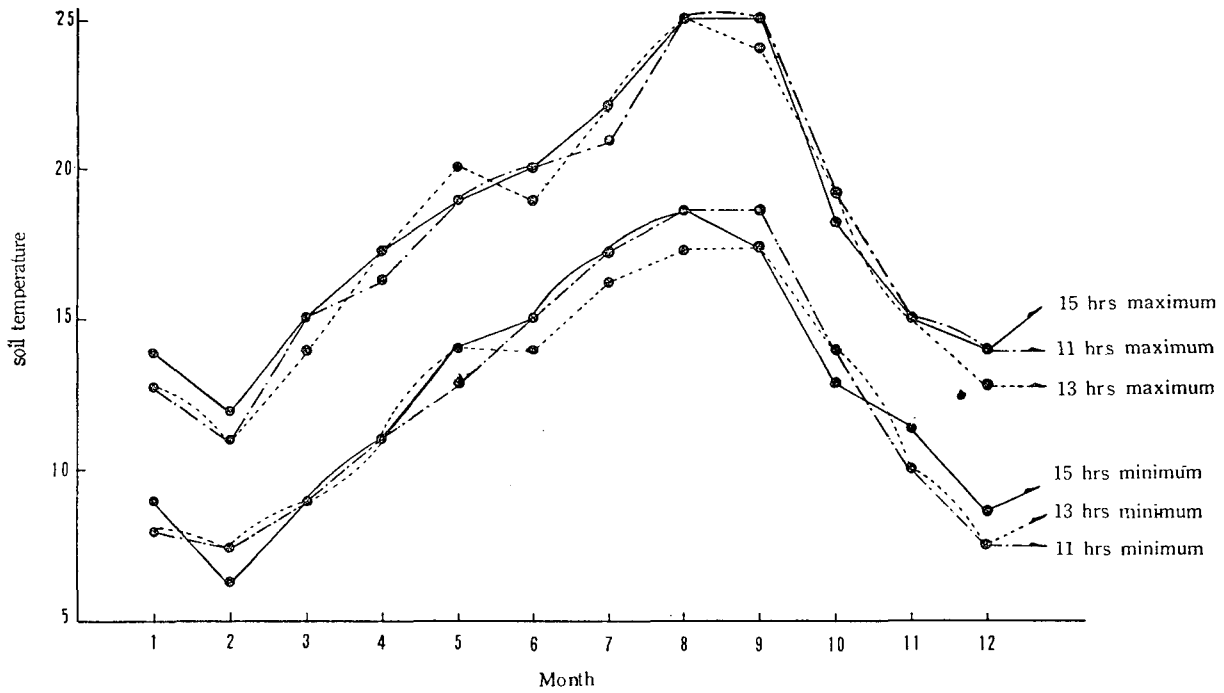
Fig 2. The effects of different shading of mulching on soil temperature



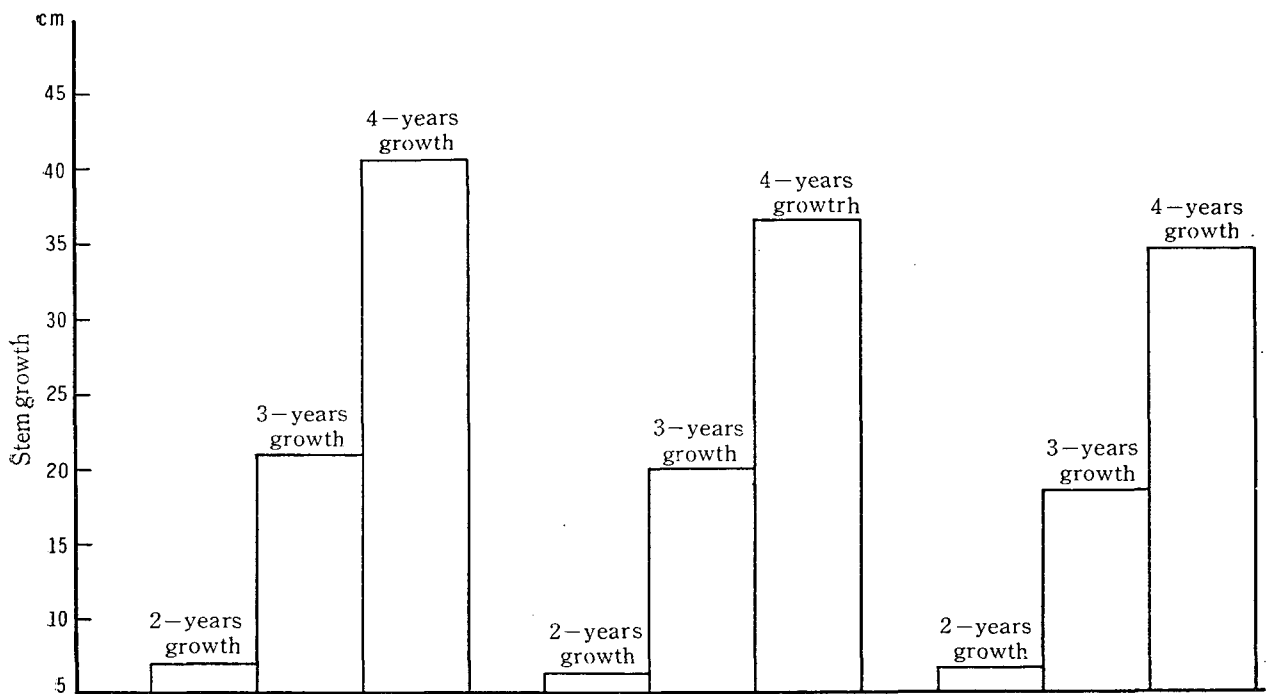
A. Straw shadow treatment



B. Black plastic film shadow treatment



C. Grey plastic film shadow treatment



A. Straw shadow treatment B. Black plastic film shadow treatment C. Grey plastic film shadow treatment
 Fig 3. The effects of different shading of mulching on growth in ginseng (A)

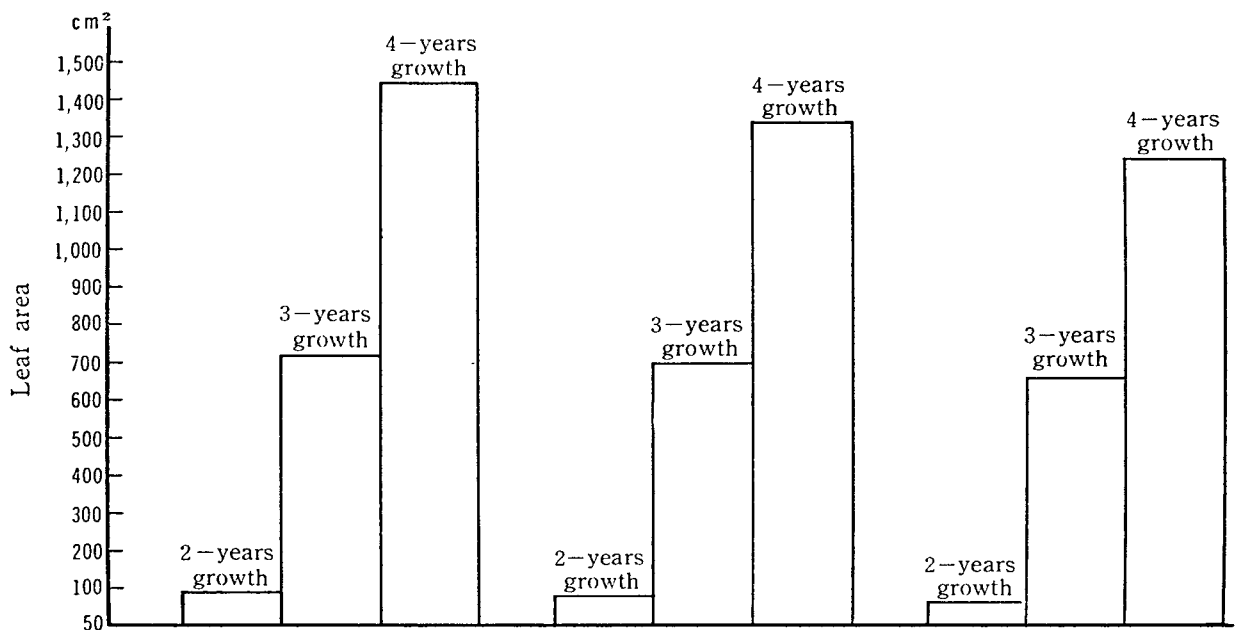


Fig 3. The effects of different shading of mulching on growth in ginseng (B)

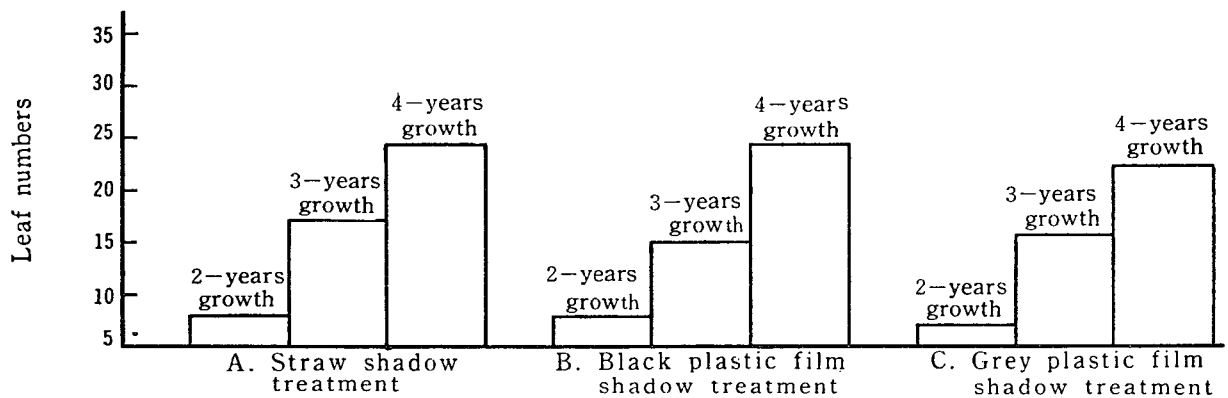


Fig 3. The effects of different Shading of mulching on growing in ginseng (C)

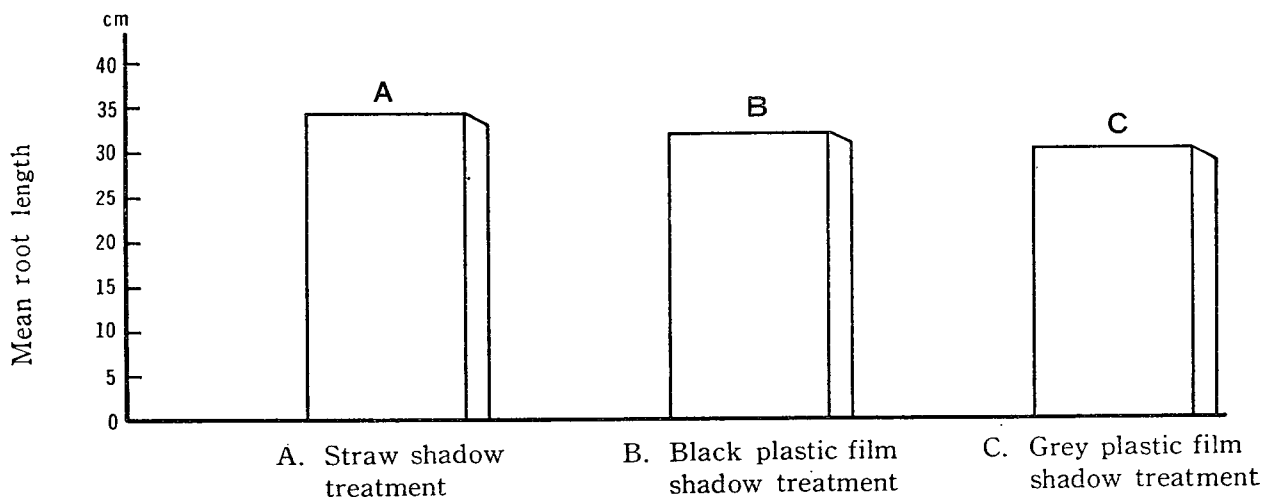


Fig 4. The effects of different shading of mulching on root length in ginseng (4-years growth)

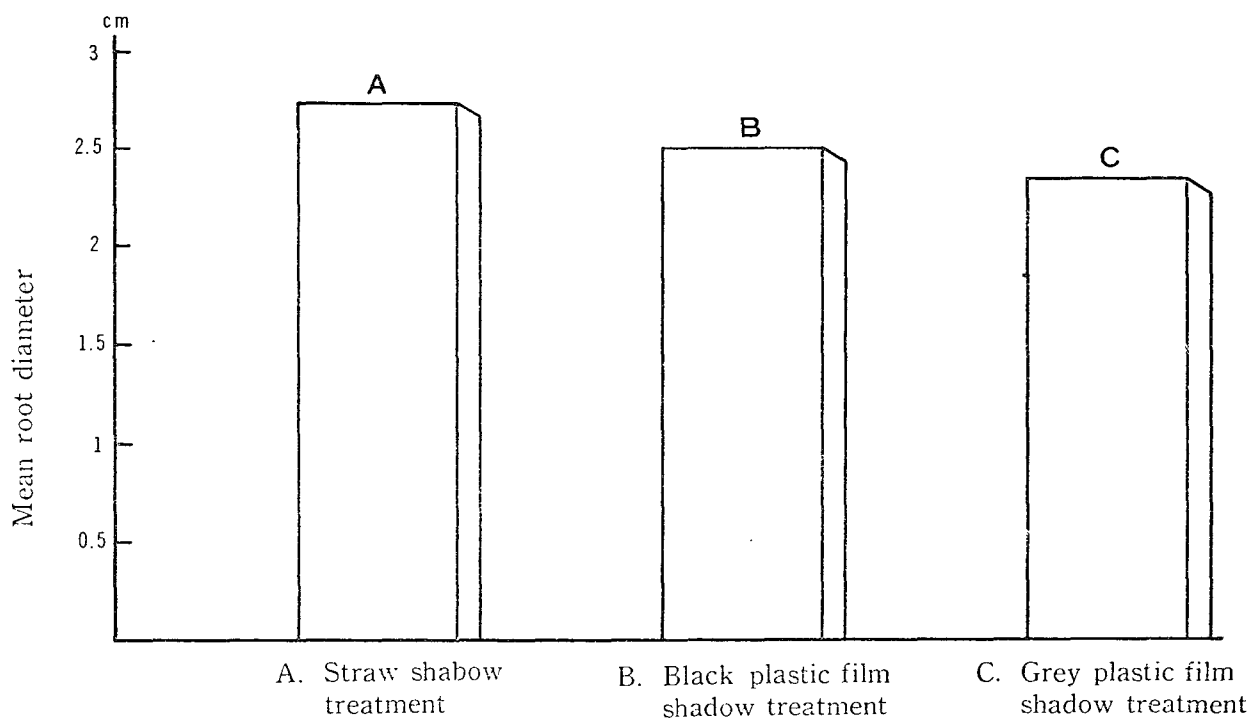


Fig 5. The effects of different shading of mulching on root diameter in ginseng

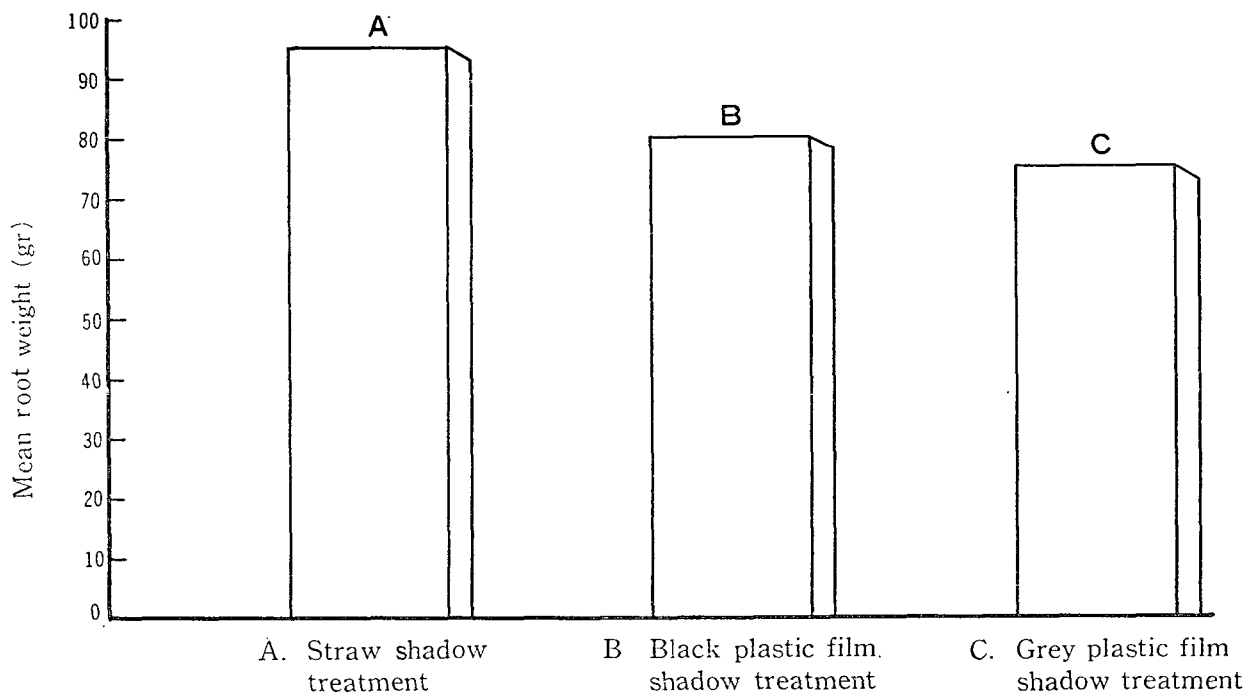


Fig 6. The effects of different shading of mulching on root weight in ginseng

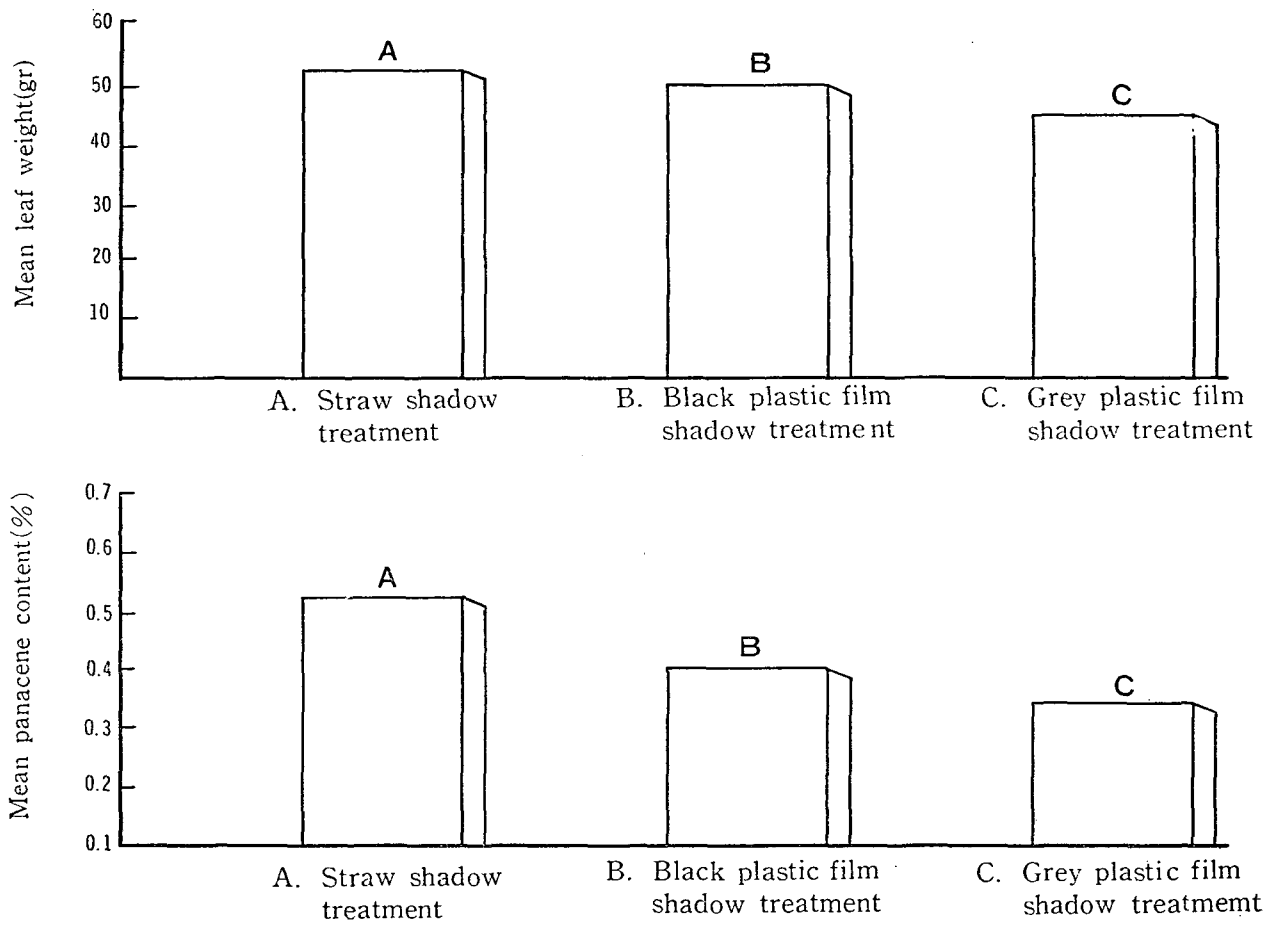


Fig 7. The effects of different shading of mulching on panacene content in ginseng