밤나무林에 있어서의 꽃 생산에 관하여

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Flower Production in a Chestnut (*Castanea crenata*) Forest.

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ABSTRACT

The flower production in the *Castanea crenata* forest in Gapyong was investigated, by appl ying litter trap and allometric method. Among several variables, DBH is the most reliable one but the estimated value by DBH showed remarkable difference from the value obtained by the litter trap method. Litter trap showed 149.3 kg of flower production per ha in the *Castanea crenata* forest. And the F/L ratro increased with the itme until flowers began to fall. The variation of flower production among trees by allometric method seems to be unreliable.

Introduction

It has been observed by many resechers that litter fall (Alway and zon, 1930; Ando, 1971; Bray and Gorham, 1964; Cormarck and Giming ham, 1964; Duvigneaud and Denaeyer, 1970; Ovington, 1962; Reu Kema, 1965) is responsible for mineral nutrient circulation in a forest ecosystem. Ltter fall means dead parts of plants iwhich fell down on the forest floor and it includes stems, branches, leaves, cones and seeds.

In general amount of the mineral contributed from flower has been regarded as a viol one because of small amount. However, Ovington (1936) mentioned that a source of error in estimating woodland prodiuction, energy flow and mineral cycling is due to flower and seed production.

Flowers are carrier of hereditary materials composed of DNA which is consisted of base (purin and pyrimidin) and phosphorus. So it is natural that flowers are rich in nitrogen and phosphorus compared with vegetative organs.

As flower production takes place during the warm and hot season, it is responsible for higher rate of decomposition, which is accelerated by the abundant presence of nitrogen and phosphorus in litter. Moreover flowers have soft tissues and are rich in water.

In case of the tree species with much flowers, it is necessary to nvestigate the amount of flower in a forest ecosystem quantitatively because of the special chemical composition.

Site description and Methods

The *Castanea crenata* forest was selected for this study in Gapyonggun, Gyeunggido. The study area reaches 6000 square meter (150×40m) and has 450 trees and the tree aged 15 years. The slope of the forest floor ranges from 3° to 5°.

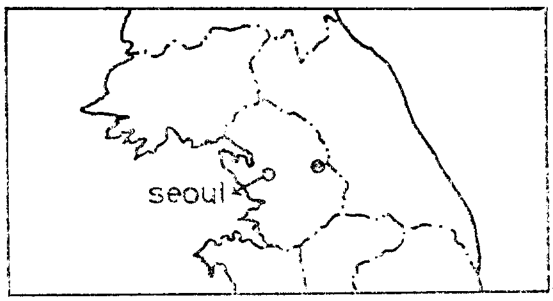

Fig. 1. Map of study site.
● : study area

In undergrowths there are 47 species. The color of surace soil is brown-black and rich in clay. It is a kind of upland sandy soil.

Flower production estimation was carried out by allometric method and litter trap. For the allometric estimation 10 trees were selected at random. The tree inventory for allomation is as flollows.

Table 1. The inventory of sample trees.

No.	1	2	3	4	5	6	7	8	9	10
DBH(cm)	[illegible]	[illegible]	14.0	[illegible]	13.4	11.0	12.5	14.2	14.6	17.4
H (m)	[illegible]	7.3	[illegible]	7.6	6.2	5.6	7.0	7.3	8.1	8.5
CH (m)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	4.1	5.2	[illegible]	6.0	5.9
CW (m)	6.4	5.9	5.8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	7.8	7.9

CH: Crown height, CW: Crown width

Because the size of the male flower of *Castanea crenata* is comaparatively long, litter traps which sized 1×1m were made by wood stakes and polythene bag, Twenty or more litter traps are seemed to be enough to estimate flower production within study area. Mowever, in this study 64 traps were set in parallel. to obtain high prerision of estimation.

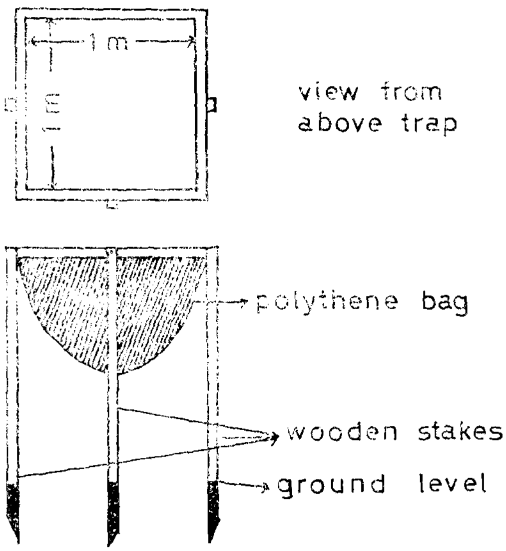

Fig. 2. Litter trap for collecting fallen flowers.

Samplings were carried out five times (Jun. 4, Jun. 11, Jun. 18, Jun. 25 and Jul. 2) and F/L (flower/leaf) ratio was obtained by the samples.

The chestnut stand is comparatively most. The average diameter of the chestnuts at breast height is 13.7 cm and the average height is 7.3m. The chestnut stand is an artificial plantation but no thinning and prunning have been carried out since they were planted. The trees belong to late blossomed species.

Results and Discussion

To know the characteristics of the individual trees composed of *Castanea crenata* forest, diameter at breast height (DBH), tree height (H), crown width (CW), crown height (CH) were measured for each sample tree.

Figure 3, 4 and 5 show the relationship between DBH and H, DBH and CW, CH and CW.

Among variables such as DBH, CW, CH, H, allometric relationship was not seemed to be obvious compareing with that of *Pinus densiflora*

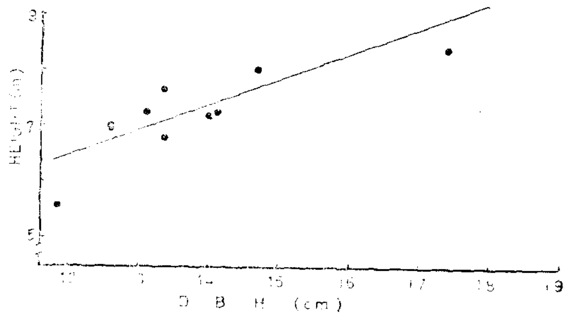

Fig. 3 Relationship between DBH and tree height.

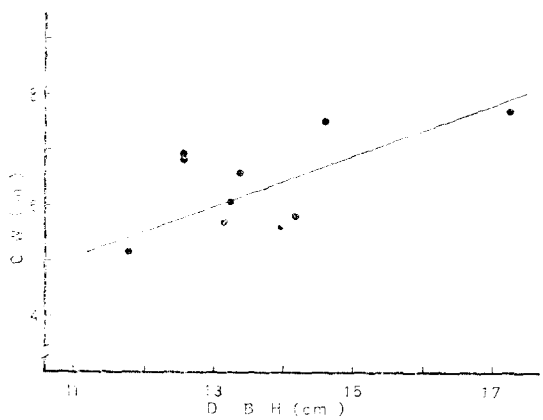

Fig. 4. Relationship between DBH and crown width.

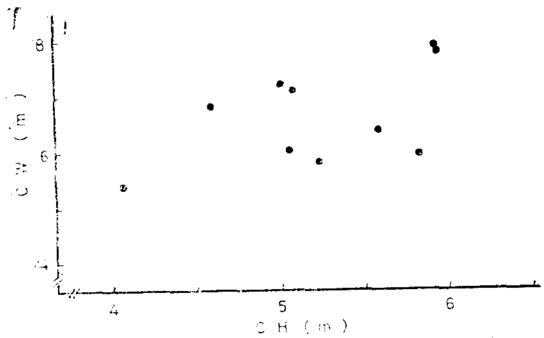

Fig 5. Relationship between crown height and crown width.

(Rim, 1974). Among above variables the relationship between DBH and tree height showed linear tendeny compared with other factors such as CH and CW (Fig. 3). And allometric relationship between DBH and CW showed reasonably linear one (Fig. 4) but CH-CW showed no linear relationship (Fig. 5).

F/L ratio ranges from 0.12 to 0.71. The peak value showed in Jul. 18 as 0.71, while the lowest was 0.12 when most of flowers fell down. The ratio incresed in the course of time until male flower begin to fall.

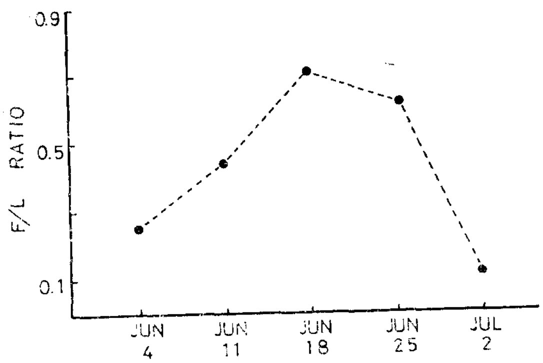

Fig 6. F/L ratio in the course of time.

The flower production of most trees is considerafly irregular. Very young plants do not blossom. Flower production begins at no fixed age, and during the life of the plant it varies considerably from year to year with most species and finally, as the plant becomes overmature and moribund, it decreases and may cease. The chestnut trees begin to blossom after three years when planted, and flowers are supposed to increase gradually in the course of time. while several attempts have been made to frame a general theory to account for these pecularities, no throughly satisfactory explanation has been advanced. The most stimulating theory, however, is the C/N theory originally proposed by Klebs (1910).

Kraus and Kraybill (1918) have suggested that when either the available nitrogen or the amount of carbohydrate is very low the plant will be unfruiful because it is starved. If, however, the levels of both nitrogen and carbohydrate are reasonably high, a high ratio of carbohydrate to nitrogen leads to abundant fruit formation: a low ratio leads to strong vegetative growth coupled with relatively poor fruit production.

Flower production is likewise heavy in isolated or dominant trees and in woodland type where the trees are well separated. One of the reasons is supposed that a high rate of photosynthesis and rapid accumulation of cabohydrates is favored by high temperature and plenty of light, and it is true that flower production begins earlier and is heavier and more consistent in the south part of the range of trees as well as on warm south exposures.

It is notorious that on poor soils flower production starts at an early age and is often heavy per unit of crown, although the trees are often small and stunted.

Chestnut trees, like all other tree species, show an early period of sexual immaturity. The length of the period depends in a great measure on the conditions under which the tree develops. Isolated trees in warm situations may develop flowers and fruits at remarkably early ages, while suppressed trees in the forest may persist for more than 10 years without ever producing flowers.

Flower bud formation is governed by a complex set of factors mainly within the tree in which genetic patterns of behaviour appear to bevery important. It is difficult to modify these patterns at all effectively.

The tendency of trees to produce flowers at a very early age upon poor sites, especially when they have shallow soils and are warm and dry, has already been noted. But once they come into flower production, the trees on the better sites appear to produce the largest amount of flower and the crops are more dependable. And it is supposed that the flower production is merely a reflection of crown development of the tree. But in fact there is very little definite information upon this points in either orientatal or occidental literature.

This study showed that crown development is of no importance to flower production (Fig. 7, Fig. 8). But in other species such as ponderosa pine, flower production is greatly affected by crown class (Dunning, 1928).

Somewhat more useful than the per cent of bearing trees is the estimate of seed crop in relative terms like "good," "average," "poor" for trees of different sizes. For many scientific purposes it is necessary to know the actual production of flower per tree, but as already noted, such information is obtainable only through long and intensive studies. Furthermore, the practical value of the results at any specific place and season premises to be low. A few studies of this type have been made inwestern white pine and the shouthern pines (Kapper, 1930; Little, 1939).

Several workers (Adams, 1928; Allen, 1945; Alway, 1913; Anonymous, 1912; 1944) have found a relationship between fruitfulness and diameter at breast height of the tree. It has been suggested that height may be a valuable figure in flower production studies: it measures the degree of association between two variables, such as DBH and amount of flowers, produced (Fig. 9).

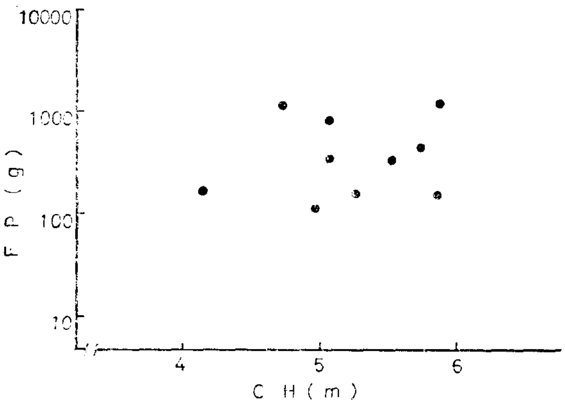

Fig. 7. Relationship between crown height and flower production.

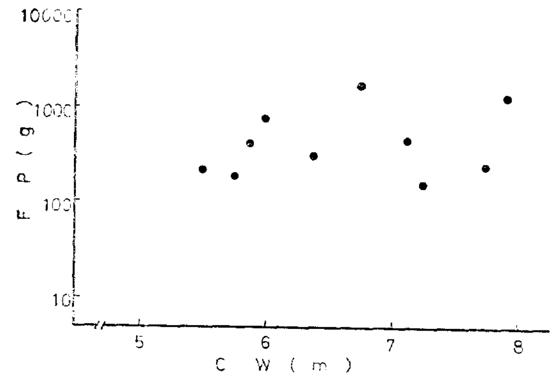

Fig. 8. Relationship between crown width and flower production.

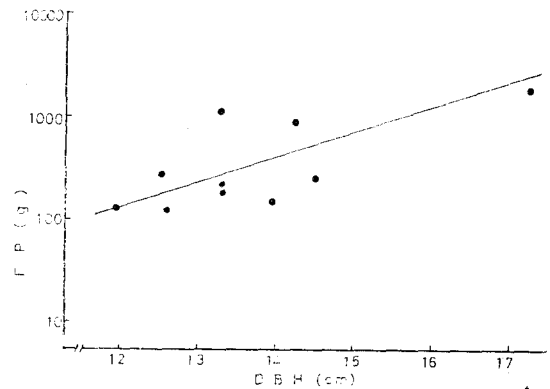

Fig. 9. Relationship between DBH and flower production (FP)

Most tree species show marked variation in the production of fowers from year to year. This variation is presumably attributable to variation in environmental influences acting upon an endegenous component of flower induction, and the variable losses of unknown factors. Variation in reproductive potential is commonly measured in terms of the amount of flowers.

A basic distinction needs to be made the formation of flower buds. But even the annual crop of flower buds is by no means equal and regular. Close observation often reveals the presence of fairly regular cycles with years of excellent producticn alternating with off years. This cyclic pericdicity has been rather carefully studied and ranges all the way from a remarkable Chinese bamboo which flowers at intervals of about 33 years to such trees as the willows, whose crops seem to have little or no natural annual fluctuation (Baker, 1950). But the cyclic periodicity in Castanea crenata has not been studied in Detail.

A number of environmental factors may cause the large annual variation in cone production as clearly evident in tree species. Evidently, flower production must be observed for more than one year to be evaluated with much accuracy. Among several variations such as DBH, H, CH and CW, DBH showed the strongest relationship with flower production. The allometric method by using DBH-FP showed that this forest produced 232.8 kg of flower crop, namely 388kg/ha, while litter trap showed 149.3 kg/ha only. Comparing with Aspen stand in America (Ovington, 1963...0.64 ton of female catkins/ha), this value seemed very low.

In this study allometric methcd revealed different value from litter trap method. One of the reasons is seemed that flower production of individual tree varies from tree to tree even though same DBH, H, and Crown class.

In a *Castanea crenata* forest allcmetric methcd seemed very rough and not available. To utilize the allometric one, further study shculd be made. Litter trap method for estimasion of flower production is seemed to be reasonable.

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