Korean Jour. Botany
Vol. 18, No. 3, 87-91(1975)

Dry Matter Production and Leaf Area Index of Herb Community in the Central Korea

Yim, Yang-Jai
(Dept. of Biology, College of Liberal Arts & Sciences, Chungang University, Seoul)

中部地方에 있어서 草本群集의 葉面積指數와 乾物生産

任 良 宰
(中央大學校 文理科大學 生物學科)

ABSTRACT

Dry matter production of herb community in the Central Korea was studied. Generally, the maximum standing crop in the Central Korea can be observed during the period from July through September with somewhat differences between the herb communities of different floristic composition. Differences in standing crop between the communities of similar floristic composition in different regions were insignificant while those between different floristitc community were relatively great, ranging from 308.7 d.w.g/m^2 in *Phragmites prosturatus* community. It seems that regional difference in standing crop of herb community of the same floristic composition in the Central Korea is greatly influenced by grazing effect rather than any other conditions. The maximum leaf area index (LAI) of different herb communities was observed during the period from July through September, ranging from 3.0 in *Plantago asiatica* community to 16.0 in *Phragmites longivalvis* community.

INTRODUCTION

Standing crop of herb community can be used as an indicator of annual plant productivity in certain land, since standing crop, in a sense, is equal to net plant production in terms of dry matter production during growing season. From this point of view, a series of investigations on dry matter production of herb vegetation in the Central Korea was performed from 1969 through 1974. The Central Korea in vegetation distribution is divided into two parts of western region and eastern region, cultivated plain and mountaineous land covered with forest vegetation. Naturally, it is difficult to find out native grassland in these regions except that in artificial or topographical condition.

In the present study plant matter production is discussed with the results obtained from the surveys suggested above and other data reported by some investigators up to the present for the evaluation of plant productivity in the Central Korea(Kim *et al.* 1969, 1972, 1973; Park, 1962, 1966, 1971a, 1971b).

MATERIALS AND METHODS

Various herbaceous stands were selected for the measurement of dry matter production in maximum productivity period or study of seasonal changes in productivity during growing season in different regions in the Central Korea from 1969 through 1974.

Selected stands are almost pure or monodominant

Table 1. Standing crop in the different herbaceous vegetation in the Central Korea

Herb community (Dominant species)	Standing crop gd.w./m²					Sampling date	Locality	Author
	Leaf	Stem	Top	Root	Total			
Natural								
Phragmites longivalvis Steudel	499.2	1322.5	1821.7	—	—	Sept. 3, '72	Gunja	Yim, Yang-Jai
P. prostruatus Makino	—	—	1987.2	—	—	Jul. 8, '74	Baegam-san, 350m alt.	〃
Zijania caduciflora(Turczaninow) Nakai	456.4	384.8	841.2	—	—	Aug. 10, '74	Suweon	〃
Miscanthus sinensis Andersson	232.2	324.6	556.8	142.3	699.1	Aug. 19, '72	Seoul	〃
Miscanthus sinensis Andersson	548.4	700.4	1248.8	—	—	Jul. 11, '73	Daeam-san, 130malt.	〃
M. sacchuriflorum B. et H.	1070.4	1788.4	2958.8	—	—	Aug. 10, '73	Hyangno-bong, 700m alt.	Yim, 1973
Zoysia japonica Steudel	223.3	574.4	847.4	57.0	904.4	Aug. 22, '72	Yeongzong-do	Yim, Yang-Jai
Alopeculus amurensis Komarov	195.8	428.9 (stem) 162.1 (flower)	786.8	385.0	1171.8	May 23, '70	Jemulpo	〃
Chenopodium album Linne var. *centrorubrum* Mikino	187.9	403.1	591.0	110.1	701.1	Aug. 25, '72	Euizeongbu	〃
Plantago asiatica Decaisne	86.7	88.0	174.7	142.5	317.2	Aug. 25, '72	〃	〃
Erigeron canadensis Linne	115.5	521.7	637.2	189.8	827.0	Aug. 25, '72	〃	〃
Ligularia fischeri Turczaninow	442.0	688.8	1207.6	—	—	Aug. 10, '73	Hyangno-bong, 1000m alt.	Yim, 1973
Artemisia asiatica Nakai	263.8	548.8	812.6	—	—	Jul. 11, '73	Daeam-san, 1300m alt.	〃
Artemisia asiatica Nakai	—	—	813.6	—	—	Jul. 8, '74	Baegam-san, 600m alt.	Yim, Yang-Jai
A. gigantea Kitamura	—	—	904.6	—	—	Jul. 8, '74	Baegam-san, 500m alt.	〃
Sanguisorba hakusanensis Makino	258.0	265.6	545.6	—	—	Jul. 11, '73	Daeam-san, 1300m alt.	Yim, 1973
Suaeda glauca Bunge	176.3	174.4	350.7	37.9	288.6	Aug. 22, '72	Yeongjong-do,	Yim, Yang-Jai
Persicaria japonica (Meissner) Gross et Nakai	—	—	659.2	—	—	Jul. 8, '74	Baegam-san, 500m alt.	Yim, 1974
Trifolium repens Linne	90.4	218.3	308.7	79.7	388.4	Aug. 11, '72	Incheon	Yim, Yang-Jai
Humulus japonicus S. et Z.	91.6	163.6	255.2	19.3	274.5	Aug. 17, '72	Incheon	Yim, Yang-Jai
Cultivated								
Helianthus annuus Linne	406.7	1331.6	2003.3	150.3	2153.6	Aug. 8, '73	Chuncheun	Kang, S.J.
Helianthus annuus Linne	926.0	89.4	1291.0	150.6	1441.6	Aug. 22, '73	Seoul	Kim *et al.*
Glycine max (holding soil water content 17—20%)	—	—	2008.5	156.3	2164.8	Aug. 30, '70	Incheon	Yim & Rim
Mixed Herb Community								
Arundinella hirta, Miscanthus sinensis	—	—	576.1	—	—	Aug. 17, '69	Chunseung	Kim *et al.*, 1969
Miscanthus sinensis Arundinlla hirta,	—	—	687.7	—	—	Oct. 22, '69	〃	〃
Veronica sp.	143.2	332.2	475.4	—	—	Jul. 11, '73	Hyangno-bong,1200m alt.	Yim, 1973

Table 2. Leaf area index (LAI) in different plant community

Plant Community	LAI(m^2/m^2)	Sampling date	Locality	Author
Wild				
Phragmites longivalvis	16.0	Sept. 3, '72	Gunja	Yim, Yang-Jai
Zijania caduciflora	7.0	*Aug.* 10, '74	Suweon	〃
Chenopodium album	6.1	Aug. 25, '72	Euijeungbu	〃
Miscanthus sinensis	5.8	Aug. 19, '72	Seoul	〃
Humulus japonicus	3.7	Aug. 17, '72	Incheon	〃
Trifolium repens	3.3	Aug. 11, '72	Incheon	〃
Erigeron canadensis	3.3	Aug. 25, '72	Euijeongbu	〃
Zijania caduciflora	6.9	Aug. 10, '74	Suweon	〃
Plantago asiatica	3.0	Aug. 25, '72	Euijongbu	〃
Cultivated				
Helianthus annuus Linne	8.0	Jul. 19, '73	Chuncheon	Kang, S.J.
〃	6.2	Jul. 25, '73	Seoul	Kim, et al.
Glyicine max (soil water holding 17-20%)	14.5	Aug. 20, '70	Incheon	Yim & Rim

community in order to avoid complexity resulted by differences in floristic composition, except some mixed communities to compare with that of pure community.

50cm×50cm size of several quadrats were settled at random in sample stand and its mean value measured was recorded as their standing crop. Plant body within quadrat was divided into top (T) and root system(R), or photosynthetic organ (F) and nophotosynthetic organ(C) and measured after dried during three or four days in 80—85°C drying oven.

Leaf area index (LAI) was expressed as a summed leaf area per unit land area m^2/m^2 obtained from summation of one side area of all leaves measured in quadrat by point counting method.

RESULTS AND DISUSSION

Ground standing crops of pure herb community vary from 255.2 d.w.g/m^2 to 1987.2 d.w.g/m^2, and standing crop of mixed herb community showed lower value than that of pure herb community. Cultivated pure herb communities showed, in general, higher standing crop than that of natural community.

In ground standing crops of herb communities dominated by *Miscanthus sinensis*, our data of 556.8—1248.8 d.w.g/m^2 are not much different from the value reported by Iwaki *et al.* (1969) ranging from 433 to 2,180 d.w.g/m^2. Leaf area index (LAI), though not much examined, varied in range of 3.0—16.0 with the characters of floristic composition.

The growth of leaf area index in almost herb community reached in asymptote in around the middle of July, whereas that of standing crop reached in asymptote in around the late of August or early September (Table 4 and Kim *et al.*, 1972, 1973).

Standing crops in pure communities showed generally higher value than that of mixed community, and also standing crops of herb communities in eastern region conservated in good condition showed higher value than those of herb communities in western region which was heavily destroyed by human activities as shown in the data on *Miscanthus sinensis* community in Daeam-san and the suburbs of Seoul (Table 1). Even in the same western region, the difference in standing crops between the same species community was depended on the grazing degree data shown in the present study and Kim et al. (1972) on the *Phragmites longivalvis* community at Gunja.

Considering the data on plenty water supplied

Table 3. Dry matter distribution in maximum standing crop of herb community

Plant Community	T/R	C/F	% of dry matter		
			Leaf	Stem	Root
Erigeron canadensis	4.2	6.2	11	39	50
Phragmies longivalvis	1.2	5.9	—	—	—
Plantago asiatica	1.1	3.4	28	27	45
Trifolium repens	0.9	3.3	23	57	20
Chenopodium album	5.2	2.8	25	57	18
Zoysia japonica	3.7	2.6	32	53	5
Miscanthus sinensis	3.9	2.0	34	46	20
Humulus japonicus	13.2	1.5	40	52	8
Suaeda gluca	9.3	1.2	45	45	10
Alopeculus amurensis	2.0	5.0	16.7	50.4	32.9
Helianthus annuus	0.08	4.3	—	—	—
〃	0.12	15.1	—	—	—

Ratios of shoot(T) and root system(R), photosynthetic organ (F) and non-photosynthetic organ(C) during maximum standing crop of plant community.

Table 4. Seasonal changes in dry matter production and leaf area index of some herb communities

Phragmites longivalvis 1972 Gunja

Sampling date	Leaf	Stem	Flower	Total	LAI
May 6	87.9	299.4	—	387.3	6.7
May 20	116.2	353.8	—	470.0	11.1
May 27	201.8	436.5	—	683.3	12.7
June 3	203.4	496.6	—	700.0	12.9
June 17	221.3	503.0	—	727.3	13.4
June 24	242.5	581.9	—	824.4	14.0
July 1	269.9	671.7	—	941.6	14.3
July 16	272.8	677.0	—	949.8	15.0
July 27	296.4	768.7	—	1,035.1	15.4
Sept. 3	499.2	1.322.5	18.4	1,821.7	16.0

to herb community and that in natural condition, it seems that water supply is necessary, above all, to promote only the growth of dry matter production of leaf area index (Yim and Rim, 1971). It seems to interprete that the Walter's conclusion in S.W. Africa, linear relationship of dry matter productivity and amount of rainfall(Walter, 1971) is true even in the Central Korea where the annual mean rainfall is over 1,000mm.

約 要

中部地方에서 主로 草本純群落의 乾物生産量을 調査하였다. 이地方에서는 草本群落의 特性에 따라 多少差異가 있으나 大體로 7~9月 사이에 最高現存量을 나타낸다.

中部地方의 各 地域別 現存量의 差는 群落의 種組成의 差異에서 오는 것보다 작았다. 最高現存量은 *Trifolium repens* 群落에서는 303.7d.w.g/m², *Phragmites prosturatus* 群落에서는 1987.2d.w.g/m²를 나타 냈다 그리고 組成이 같은 群落의 中部地方內 地域別 最高現

存量의 差異를 나타내는 原因은 다른 어느 要因 보다도 grazing에 基因하는듯 하다.

葉面積指數는 亦是 7~9月 사이에 最高値를 나타내는데, *Plantago asiatica* 群落에서 LAI=3.0, *Phragmites longivalvis* 群落에서 LAI=16.0에 達했다. 乾物生産이나 葉面指數의 增加를 爲해서는 水分供給이 무엇보다도 必要하다. 이것은 任·林(1971)의 結果와 草地의 乾物量生産量, 面積指數를 比較하여 알수 있으며, 이는 Walter(1971)의 結論이 年平均 降水量 1000 mm인 우리나라 中部地方에서도 마찬가지라는 것을 立證해 준다.

REGERENCES

Ivins, J.D. 1959. The Measuremcnt of Grassland Productivity. Academic Press Inc. New York.

Iwaki. H., M. Monsi, and B. Midorikawa. 1966. Dry Matter Production of Some Herb Communities in Japan. The Eleventh Pacific Science Congress, Tokyo, August-September 1-15.

Kim, C. M., I,K. Lee, B. K. Park, and N.K. Chang. 1969. The composion and productivity of a grassland in Korea. *Journal of Graduate School of Education*, Seoul National University. 6:178-183.

Kim, C. M., Y.J. Yim, and Y.D. Rim. 1972. Studies on the Primary Prodoction of the *Phragmites longivalvis* community in Korea. The Report for the IBP No. 6. Korean National Committee for the IBB. 1-7.

Kim, J. H. et al. 1973. Studies on the Primary Productivity of the Terrestrial Plants grown at Different Localities in Korea. Ministry of Science & Technology. R-73-87. Seoul National University.

Numata, M. 1967. "Sochichosaho" (Survey on Grassland) Handbook. JIBP-PT(G), CT. In Japanese.

_____. 1968. Analysis in Grassland Ecosystem Designated by Ministry of Education.

Park, B.K. 1966. The Grassland Type in Korea. *Kor. Jour. Bot.* 9: 7-12.

_____. 1962. An Ecological Study of Several Grazing Grassland in the Branch Station of the Taigwanryong Livestock Experiment Center. *Kor. Jour. Bot.* 5:1-4.

_____. 1971a. A study of the relationship between grassland vegetation and soil-pH in Korea. *Journal of Koreanl Research Institute for Betier-Living* Ewha Women's University. 7:33-39.

_____. 1971b. A study on the grassland vegetation of severalpasture in Korea. ibid 7:55-65.

Walter, H. 1971. Ecology of Tropical and Subtropical Vegetation. Oliver & Boyd. Edinburgh.

Yim, Y.J. 1973. Ecological Survey on the Southern Regions of the Demilitarized Zone in Korea (I). I. Vegetation. Theses collection 18 (Natural Science.) Chungang University. p.33-71. In Korean.

_____and Y.D. Rim. 1971. On the Growth and Total Nitrogen Changes of *G ycinemax* Artificial Plant Communities. Grown in sandy loam soil with a controlled moisture content. *Kor. Jour. Bot.* 14:21-23.

(Received May 21, 1975)