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Phenological and Cultural Studies of Common Dandelion (Taraxacum officinale Weber)

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PHENOLOGICAL AND CULTURAL STUDIES OF COMMON DANDELION (*Taraxacum officinale* Weber)

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PHENOLOGICAL AND CULTURAL STUDIES OF

COMMON DANDELION (Taraxacum officinale Weber)

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ABSTRACT

Phenological and cultural studies of common dandelion (Taraxacum officinale Weber) were conducted from 1969 to 1971 at Bowling Green, Kentucky.

The phenological studies were based upon dandelion plants which were found growing in a Kentucky bluegrass lawn or in open lots. At this location the dandelion flowered throughout the year. Maximum flowering occurred during April and a secondary peak occurred in September and October. The number of flowering stems per square meter was not correlated significantly with precipitation, temperature, or day length. Length of stem was positively correlated with temperature and day length. The plants exhibited diurnal variation in flowering habit. Number of times (or days) the heads opened and closed, length of time in which the heads remained open each day, and length of time heads remained closed before opening into the mature heads (white balls) varied with time of year.

The cultural studies were based upon 400 dandelion plants which were transplanted from their natural environment into an experimental area. The dandelion plants were subjected to a combination of two main-treatments and five sub-treatments. The main-treatments were: 1) hand cultivation to control weed competition, and 2) overseeding with Kentucky bluegrass (Poa pratensis L.). Sub-treatments were: 1) no

clipping, 2) clipping at 4 cm each week, 3) clipping at 4 cm every two weeks, 4) clipping at 8 cm each week, and 5) clipping at 8 cm every two weeks. Sod competition significantly reduced both the number of reproductive stems and the diameter of plants. Dandelion plants which were clipped more frequently and at a lower stubble height exhibited less reproductive and vegetative vigor than plants that were clipped less frequently and at a higher stubble height.

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CHAPTER I

INTRODUCTION

The common dandelion (Taraxacum officinale Weber) is widely distributed throughout the cultivated regions of the world. The dandelion appears to have become established wherever man has settled and cultivated the soil. Although the dandelion reportedly reproduces largely through apomixis, it is characterized by tremendous plasticity. It has the capacity to grow and produce seed under climatic conditions of different geographical areas and under variable weather conditions of different seasons in a given area.

The dandelion appears to be ubiquitous and has a propensity to grow in lawns. The abundance of seeds which are readily disseminated and the growth characteristics of the plants permit dandelion plants to compete effectively in a lawn culture.

Objectives of the present investigations were: 1) to study seasonal variation in the frequency of flowering and in the cycle of flowering of common dandelion plants, and 2) to determine the effect of certain lawn cultural managements on growth and reproduction of common dandelion.

CHAPTER II

REVIEW OF LITERATURE

Common dandelion (Taraxacum officinale Weber) belongs to the Compositae family and the Liguliflorae subfamily. This subfamily which is characterized by plants having only ligulate flowers includes only one tribe and 19 genera. A ligule is a flattened, strap-shaped, marginal or ray flower (3).

Leaves of common dandelion are usually narrow and scarcely winged at the base. The lower and longer lobes are toothed with frequent intermediate small teeth. The orange-yellow inflorescences vary from 2 to 5 cm and are borne on the tip of a reproductive stem (scape). The involucre consists of a ring of phyllaries which are all or nearly all unappendaged and linear. The defining characteristic of the common dandelion is the strongly recurving outer phyllaries. The indehiscent fruit (achene) varies from 2 to 4 mm in length. A slender beak which is attached to the end of the achene elongates during the maturation of the achene and extends the white pappus. Since the dandelion reproduces largely through apomixis, the species is polymorphic and is difficult to classify on a meaningful basis (3).

The common dandelion is a ubiquitous weed in lawns, grasslands, wastelands, and open fields in the United States.

It has had the capacity to adapt to many different natural and man-made ecological situations. The dandelion appears to be well adapted to lawn conditions (3, 7). Solbrig (7) stated that dandelion populations consist of mixtures of genotypes which differ in ability to compete and in their methods of survival. Dandelions use different reproductive patterns in the allocation of energy between reproduction and vegetative growth. Thus, dandelions as a group are adapted to taking advantage of different environmental conditions.

The flowering cycle of the common dandelion was studied by Listowski and Jackowska (2) in Poland. They found that the dandelion plant flowers within a very wide scope of photoperiods and light intensities. Although the duration and intensity of flowering were higher under short days, the authors concluded that the common dandelion could be classified as day neutral. In studies conducted in northern United States, Solbrig (7) observed greater inflorescence in the spring and fall and concluded that the dandelion was a short day plant. Listowski and Jackowska (2) found that seeds which germinated in the spring produced plants which flowered during the following summer. Most of the plants which flowered in the spring flowered again in the autumn.

Free and Nuttall (4) observed that dandelion flowers were open for honeybee visitation between 9:00 AM and 3:00 PM and that most of the pollen was available between 11:00 AM and 1:00 PM. Solbrig (7) observed that dandelion heads

were open one day on the average and then closed for about two days before opening into the white ball stage. Beach (5) found that 10 to 12 days were required for the seeds to mature. In a study of seed production on dandelions, Roberts (6) found that some plants produced an average of 93 heads with an average of 192 seeds per head.

CHAPTER III

MATERIALS AND METHODS

Phenological Studies

Observations on the flowering cycle of common dandelion were made on several hundred plants during 1969, 1970, and 1971 in the vicinity of Bowling Green, Kentucky. In January, 1969, eight 1.9 sq m plots were randomly located in a Kentucky bluegrass (Poa pratensis L.) lawn at Bowling Green, Kentucky. The volunteer common dandelion plants (Taraxacum officinale Weber) in these plots were observed 51 times at approximately weekly intervals during the year. The plants were clipped to approximately 8 cm each week between weeks 12 and 43 to reduce competition from the bluegrass. The number of dandelion heads were counted prior to each clipping. Approximately 20 stems (scapes) were taken at each sampling and used for determining stem length and number of seeds (achenes) per head. Confidence intervals employing the .05 level of probability were calculated for each mean. If the confidence intervals for two means had no common values, the means were considered to be statistically different.

Stems/m^2, stem length, and seeds/head data were used to study the relationship between flowering and temperature,

precipitation, and day length. Daily maximum and minimum temperatures were averaged, then the daily values were averaged for each sampling period. Precipitation data consisted of the total amount of precipitation received during each sampling period. Day length data were obtained by averaging the time from sunrise to sunset for the days in each sampling period.

In 1970, common dandelion plants in an open lot in Bowling Green were used to study the cycle of flowering. Four times during the year the tall-growing weeds were clipped above the dandelion plants to reduce competition. Buds were identified on 100 or more dandelion plants at six different times during the year. These buds were observed at approximately hourly intervals during the daylight portion of each day until the heads matured. Date of head opening, number of times the heads opened and closed, number of days heads remained closed before opening into mature heads, seeds per head, and stem length were determined.

Cultural Studies

In early November, 1970, an experiment was established to study the effect of various lawn cultural practices on growth and reproduction of common dandelion. The experiment consisted of a split-plot arrangement of two main-treatments and five sub-treatments. The main-treatments were: 1) hand cultivation to control competition, and 2) overseeding with Kentucky bluegrass (Poa pratensis L.). Sub-treatments were:

1) no clipping, 2) clipping at 4 cm each week, 3) clipping at 4 cm every two weeks, 4) clipping at 8 cm each week, and 5) clipping at 8 cm every two weeks. Main-treatments were replicated eight times. Each sub-treatment consisted of a single row of five dandelion plants. The plants were spaced approximately 30 cm apart within rows that were spaced approximately 60 cm apart.

The experimental area was located on a Huntington silt loam soil on the Western Kentucky University Farm. The soil was plowed, disked, and smoothed before the dandelions were transplanted. The 400 dandelion plants used in the study were taken at random from areas in the vicinity of the experimental site. The plants were transplanted between November 6 and 20, and the designated plots were overseeded on November 21 with common Kentucky bluegrass at the rate of 0.91 kg/92.9 m^2 (2 lb/1000 ft^2). The entire experimental area was fertilized at the time of transplanting as follows: nitrogen - 1.14 kg/92.9m^2 (2.5 lb/1000 ft^2), phosphorus - 0.50 kg/92.9 m^2 (1.1 lb/1000 ft^2), and potassium - 0.95 kg/92.9 m^2 (2.1 lb/1000 ft^2). In the spring of 1971, the area received additional nitrogen in the amounts of 1.14 kg/92.9 m^2 (2.5 lb/1000 ft^2) on March 15, and 0.34 kg/92.9 m^2 (0.75 lb/1000 ft^2) on April 14. In mid October of 1971 the area again received complete fertilizer at the same rate that was applied at the time of transplanting. The times and rates of fertilizer application and the rate of seeding are based upon recommendations for good Kentucky bluegrass lawn management (9).

A hand hoe was used to effect weed control without disturbing the soil in the plots which were not overseeded. Clipping treatments were initiated April 22 and continued through November 8, 1972. Each week the reproductive dandelion stems were removed from plants of all treatments before any plants were clipped. In order to determine the influence of the grass competition and the clipping treatments on vegetative growth of dandelions, diameters of the dandelion plants were measured at bi-weekly intervals during most of the growing season. All dandelion plants were measured immediately prior to clipping of the designated plants.

The inclusion of observation dates resulted in a split-split-plot arrangement of treatments. The analysis of variance procedure was used to analyze the variation in the data for numbers of reproductive stems and for measurements of plant size. Duncan's Multiple Range Test was used to separate means (8).

CHAPTER IV

RESULTS AND DISCUSSION

Phenological Studies

The phenology (relationship between climate or season and periodic biological phenomena) of the dandelions was studied throughout the three-year period, but was studied more intensively during 1969 and 1970.

Beginning the second week in January, the dandelion plants in the bluegrass lawn were observed 51 times at approximately weekly intervals during 1969. Dandelion flowers were found throughout the year, except when the ground was covered with snow. Seeds/head, stems/m^2, and stem length data are presented in Figure 1.

No flowers were found in any of the eight plots (a total of 15.2 m^2 of the area) at sampling periods 7, 10, 24, 33, 34, 40, and 41; however, flowers were found during these periods in other areas of the lawn. The number of heads or flowering stems was less than $1/m^2$ during the first 13 weeks, and there were no significant differences in number of stems/m^2 during these periods. The primary flowering peak began during week 14 (April 4-10) when the number of flowering stems increased to an average of $68/m^2$. During weeks 14 and 15 the numbers of stems/m^2 did not differ significantly,

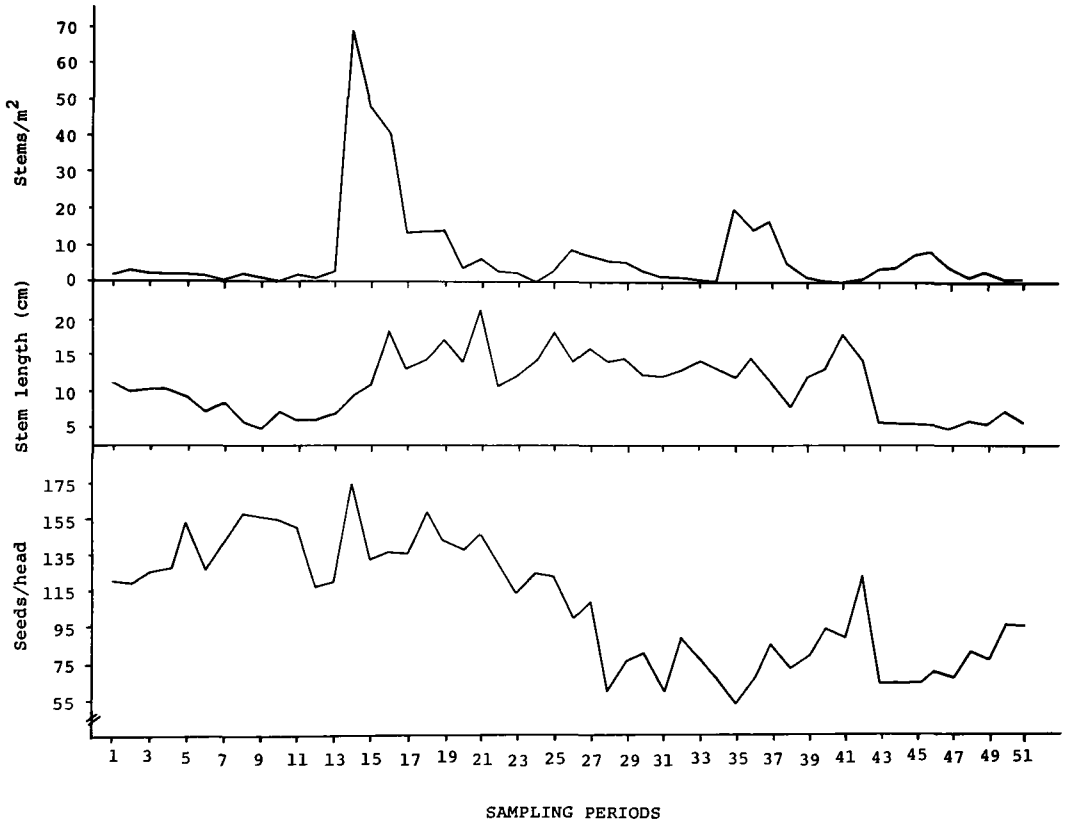

Figure 1. Seeds per head, stem length, and stems/m^2 of common dandelion at approximately weekly intervals during 1969 at Bowling Green, Kentucky.

but the number of stems/m^2 was significantly lower in week 16 than in week 14. The numbers of stems per unit area in periods 14, 15, and 16 were significantly greater than in any other periods during the year. During weeks 17, 18, and 19 there was an average of about 14 stems/m^2. From weeks 20 to 34 (mid-May to early September) there were fewer than 10 stems/m^2 each week. A secondary peak in flowering occurred during September and early October with more than 10 stems/m^2 being produced in each of three successive weeks (periods 35, 36, and 37). Although no new stems were observed in the plots during the middle part of October (periods 40 and 41), approximately seven stems/m^2 were counted during each of the last two weeks in November. The number of stems per unit area in December, January, February, and March did not differ significantly.

Stem length varied from 5 to 21 cm and was significantly longer at most sampling periods during late spring, summer, and early autumn than during the winter (Figure 1).

Seeds/head ranged from 54 to 172 (Figure 1). Although seasonal effects were not consistent, there were significantly more seeds/head at several sampling periods during the spring than during summer, autumn, or winter. Seeds/head in this study were lower than the average of 192 seeds/head reported by Roberts (6).

During the study in 1969, a total of 114 cm of precipitation was recorded (2). Average temperatures and day lengths for the sampling periods ranged from -3 to 28C and

9.57 to 14.76 hours, respectively. Linear correlation coefficients between these weather data and the flowering measurements were calculated (Table 1).

Variability in numbers of flowering stems per unit area was not significantly associated with variability in the measurements of precipitation, temperature, or day length. The coefficient of determination (r^2 or $.227^2$) indicated that approximately 5 percent of the variability in number of stems was associated with variability in day length. This low association between flowering and day length supports the day neutral classification of the common dandelion by Listowski and Jackowska (5).

Correlations for length of stems with temperature and day length were positive and highly significant indicating that stems were longer in the summer when temperatures were higher and day lengths were longer. Variability in stem length was not highly correlated with variability in precipitation.

Variability in seeds/head was not significantly correlated with variability in the measurements of precipitation, temperature, or day length. However, the correlation between seeds/head and temperature was negative (-.266) and approached significance ($r_{(.05,\ 49\ df)} = .276$). The coefficient of determination for seeds/head and temperature indicated that about 7 percent of the variability in seeds/head was associated with variation in temperature.

Table 1. Linear correlation coefficients for temperature, precipitation, and day length with number of flowering stems, stem length, and seeds per head in common dandelion at Bowling Green, Kentucky in 1969.

	Number of stems	Length of stems	Seeds per head
		r values	
Temperature	+.183	+.694**	-.266
Precipitation	+.051	+.009	+.142
Day length	+.227	+.692**	+.076

**Indicates significance at the .01 level of probability.

Although the number of dandelion heads per unit area was not highly associated with precipitation, temperature, or day length when considered individually, flowering may be influenced by interactions among these variables. The peak flowering period occurred in the spring when the average temperature was about 16C and day length was about 13 hours (Figure 1). The secondary peak in flowering occurred in the autumn when the average temperature was about 21C and day length was 12 to 13 hours. The amount of precipitation during these periods should have been sufficient to prevent soil moisture from being limiting. Although certain advantages are derived from studying the flowering of plants growing under natural conditions, elucidation of the interactions among these variables could likely be enhanced through controlled environmental studies.

The flowering cycle of common dandelion was studied during six periods in 1970. The plants exhibited diurnal variation in flowering habit (Table 2). Heads opened earlier in the morning and remained open for shorter periods during summer than during spring or autumn. During the peak flowering period which occurred in April, heads were open during most of the time between sunrise and sunset. However, in June, July, and August the heads closed before noon. Heads were open significantly fewer days during summer than during spring or autumn. The average number of days or times the heads opened ranged from 1.6 in August to 3.2 in November. Although no data were presented, Solbrig

Table 2. Flowering cycle of the common dandelion at Bowling Green, Kentucky in 1970.

Date	Heads Studied	Hours Opened (CDST)	Days Open	Days Closed	Days Total[a]
April 2	274	8:30-9:30 a.m. to 6:00-7:00 p.m.	2.5±0.1[b]	10.3±0.2[b]	12.8±0.1[b]
June 2	123	7:00-8:00 a.m. to 10:30-11:30 a.m.	1.9±0.1	6.8±0.3	8.7±0.3
July 10	100	6:30-7:30 a.m. to 10:00-11:00 a.m.	1.9±0.1	7.2±0.3	9.1±0.3
August 19	147	6:30-7:30 a.m. to 10:00-11:00 a.m.	1.6±0.1	6.4±0.2	8.0±0.1
October 2	172	8:00-9:00 a.m. to 2:30-3:30 p.m.	2.1±0.1	11.3±0.2	13.4±0.2
November 8	141	10:00-11:00 a.m. to 4:00-5:00 p.m.	3.2±0.2	20.0±5.0[c]	23.2±5.2[c]

[a]Total days between the first opening of the heads and the formation of white balls.

[b]Confidence interval, $\bar{X} \pm t_{(.05)} S_{\bar{x}}$. Within a column if the confidence intervals of two means do not overlap, the means are considered to be different at the .05 level of probability.

[c]Only 10 heads opened into the white ball.

stated that dandelion heads are open an average of one day (7).

The number of days that the heads remained closed was significantly lower in summer than in spring or autumn (Table 2). Average number of days closed ranged from 6.4 in August to 20.0 or longer in November. From the 141 heads in the study initiated November 8, 1970, only 10 white balls (mature heads) were produced. Only few white balls have been observed from late November through February at this location. During this period, the heads fail to open into the typical white ball stage.

Total number of days from the first opening of the heads to maturation (white balls) ranged from about 8 in the summer to more than 23 in the winter (Table 2). Excluding the winter period, the range of 8.0 to 13.4 days is similar to the range of 10 to 12 days reported by Beach (1).

Several times during the study, heads opened later in the morning or closed earlier in the afternoon, or did not open during the day when sudden drops in temperature and/or heavy overcast conditions occurred. Heads which were in the opening and closing stage when weather conditions prevented opening for one or two days appeared to open and close the usual number of times after conditions became favorable.

Seasonal variation in stem length and seeds/head was studied in 1970. Stem length was greater in late spring, summer, and early autumn than in early spring and late

autumn (Table 3). These results support the positive correlations of stem length with temperature and day length from the 1969 study. Seeds/head ranged from about 125 to 200 as compared to the range in seeds/head of 54 to 172 in the 1969 study and the average of 192 seeds/head reported by Roberts (6). There was no consistent relationship between seeds/head and time of flowering in 1970.

Cultural Studies

The dandelion plants which were transplanted during the fall of 1970 survived well. The 17 plants which did not survive were replaced in late February, 1971. Observations on the number of flowering stems were made 33 times at approximately weekly intervals between April 15 and November 29, 1971.

Seasonal distribution of flower stem production in 1971 was similar to the distribution described earlier for the phenology studies conducted in 1969. The differences between the distributions include: 1) peak stem production occurred between April 15 and 22 in 1971 which was about 10 days later than the period of peak stem production in 1969; 2) stem production during the summer period was relatively higher in 1971 than in 1969; and 3) the secondary peak which occurred in the autumn was less pronounced in 1971 than in 1969.

Dandelion stem production was influenced significantly by the presence and absence of grass competition, by the frequency of clipping, and by the height of clipping (Table 4).

Table 3. Effect of time of flowering of common dandelion on stem length and seeds per head at Bowling Green, Kentucky in 1970.

Date	Plants Studied	Stem Length (cm)	Seeds per head
April 2	10	16.1±2.5[a]	144.3±13.3[a]
June 2	20	34.0±3.3	162.4±20.1
July 10	20	36.4±3.3	199.5±26.2
August 19	20	34.9±3.2	125.1±15.9
October 2	20	36.1±2.9	135.6± 9.5
November 8	20	16.7±1.7	139.8±11.2

[a]Confidence interval, $\bar{X} \pm t_{(.05)} S_{\bar{x}}$. Within a column if the confidence intervals of two means do not overlap, the means are considered to be different at the .05 level of probability.

Table 4. Effect of different cultural practices on the number of reproductive stems produced per dandelion plant at Bowling Green, Kentucky in 1971.

Clipping treatment	Sod	Cultivated	Clipping treatment average[a]
		Average number of stems	
1. No clipping	53	113	83[a]
2. Clipped at 4 cm each week	46	71	58[c]
3. Clipped at 4 cm bi-weekly	58	89	74[b]
4. Clipped at 8 cm each week	58	105	82[a]
5. Clipped at 8 cm bi-weekly	54	104	79[a]
Main-treatment average[b]	54	96	75

[a]Clipping treatment averages followed by the same letter are not significantly different at the .05 level of probability.

[b]The difference between the main-treatment averages was significant at the .01 level of probability.

During the growing season the plants which were hand cultivated produced nearly twice as many stem buds as the plants which were overseeded with bluegrass. This highly significant difference indicates that dandelion stem production was reduced by the bluegrass competition. Solbrig (7) reported that dandelions are adversely affected by competition.

The greatest number of dandelion stem buds was produced by plants which were not clipped (Table 4). However, this average was not significantly greater than the average number of stem buds produced by plants that were clipped at 8 cm weekly or bi-weekly. Dandelion plants that were clipped at 4 cm bi-weekly produced significantly fewer buds than plants that were clipped at 8 cm or plants that were not clipped. The lowest average number of buds was produced by plants that were clipped weekly at 4 cm.

The main-treatment X sub-treatment interaction was significant. Stem bud production was greater for plants of all sub-treatments under cultivation than under sod competition (Table 4). Dandelion plants which were not clipped produced more than twice as many buds in plots which were cultivated as in plots which were seeded with bluegrass. The unclipped bluegrass provided strong competition for the dandelion plants. Plants which were clipped weekly at 4 cm produced an average of 46 and 71 buds in the cultivated and overseeded plots, respectively. The 4 cm clipping treatment limited stem bud formation regardless of the competition conditions.

The dandelion stem production data were analyzed for each weekly sampling. Although the differences in stem

production between the cultivated and overseed treatments were not always significant, the observed number of stems was consistently greater in the cultivated than in the overseeded plots. The grass competition effect did not become statistically significant until the sixth sampling period (May 13). Stem production differences between the two treatments were greater during the summer than during early spring or late fall.

Differences in stem production among the five clipping treatments did not become statistically significant until the fifth sampling period (May 6). For those sampling periods in which the differences were significant, fewer stem buds were produced in the treatments where the plants were clipped at 4 cm either weekly or bi-weekly than in other treatments. Differences among the treatments in which the plants were not clipped or were clipped at 8 cm either weekly or bi-weekly were not consistent over the weekly sampling periods.

Stem production per plant averaged 75 for all plants and ranged from a low of 46 for plants which were grown in the sod and clipped at 4 cm each week to a high of 113 for plants which were cultivated and not clipped (Table 4). The plants which Roberts (6) studied produced an average of 93 stems per plant

Diameter of the dandelion plants was measured 15 times during the growing season. Average plant diameter was 37 cm at the first observation in the spring and decreased

consistently until the end of the season when the average diameter was 15 cm. The amount of vegetative growth, as indicated by plant diameter measurements, was influenced by the various combinations of cultural practices (Table 5). Average diameter for plants grown in competition with the bluegrass sod was significantly less than that for plants which were cultivated. Vegetative growth, as well as stem production, was adversely affected by competition.

All of the clipping treatments differed significantly from one another for average plant diameter. Plants which were not clipped had the largest diameter. The height (4 vs 8 cm) of clipping had a greater effect on plant diameter than frequency (1 vs 2 weeks) of clipping. Plants which were clipped at a 4 cm height each week had the smallest diameters.

The main-treatment X sub-treatment interaction for plant diameter was significant. For example, average diameters of plants clipped at a 4 cm height each week were 13 cm for the sod plots and 15 cm for the cultivated plots; whereas, average diameters of plants which were not clipped were 30 cm for the sod plots and 38 cm for the cultivated plots. The effect of the sod competition on plant diameter was less for dandelion plants clipped lower and more frequently than for plants clipped higher and less frequently.

Plant diameter data were analyzed at each of the biweekly sampling periods during the season. Diameters of plants grown under cultivation were consistently greater

Table 5. Effect of different cultural practices on diameter of dandelion plants at Bowling Green, Kentucky in 1971.

Clipping treatment	Sod	Cultivated	Clipping treatment average[a]
		Average plant diameter (cm)	
1. No clipping	30	38	34[a]
2. Clipped at 4 cm each week	13	15	14[e]
3. Clipped at 4 cm bi-weekly	18	20	19[d]
4. Clipped at 8 cm each week	24	32	28[c]
5. Clipped at 8 cm bi-weekly	27	33	30[b]
Main-treatment average[b]	22	28	25

[a]Clipping treatment averages followed by the same letter are not significantly different at the .05 level of probability.

[b]The difference between the main-treatment averages was significant at the .01 level of probability.

than diameters of plants grown under sod competition. The differences among the five sub-treatments, as were reflected in the season averages (Table 5), were rather consistent throughout the season.

Discussion of Results

The common dandelion has been described as being ubiquitous and as having a propensity to grow in lawns (3, 7). Results of the present study add factual support for this description. An abundant production of seeds is conducive to the natural spreading of a plant. In the cultural studies plants of some of the treatments average more than 100 heads/plant during the growing season. Data from the phenological studies indicated that some dandelion heads contained an average of about 200 seeds/head.

Unlike most flowering plants which produce the entire seed crop in a short period, the dandelion plants flowered and produced seed throughout the year at the Bowling Green location. The opening and closing of heads was found to vary with seasonal weather conditions. This capacity to produce seed throughout the year appears to be an adaptive mechanism which reduces the chances that all of the seed would be produced when conditions are unfavorable for germination and growth.

Although common dandelion is characterized by a large amount of plasticity, both the reproductive capacity and vegetative development are adversely affected by intensive

lawn cultural practices. Findings of this study indicate that good lawn management practices (9), such as maintaining a thick sod, clipping frequently, and leaving a 4 to 5 cm stubble height for Kentucky bluegrass, have an adverse effect on the number of reproductive stems and on the amount of vegetative growth produced by dandelion plants. The dandelion would be more difficult to control in the lawn which has a weak sod, which has been clipped infrequently, and which has been left with a taller stubble height after clipping.

CHAPTER V

SUMMARY

Phenological and cultural studies of common dandelion (Taraxacum officinale Weber) were conducted from 1969 to 1971 at Bowling Green, Kentucky.

The phenological studies were based upon dandelion plants which were found growing in a Kentucky bluegrass lawn or in open lots. At this location the dandelion flowered throughout the year. Maximum flowering occurred during April and a secondary peak occurred in September and October. The number of flowering stems per square meter was not correlated significantly with precipitation, temperature, or day length. Length of stem was positively correlated with temperature and day length. The plants exhibited diurnal variation in flowering habit. Number of times (or days) the heads opened and closed, length of time in which the heads remained open each day, and length of time heads remained closed before opening into the mature heads (white balls) varied with time of year.

The cultural studies were based upon 400 dandelion plants which were transplanted from their natural environment into an experimental area. The dandelion plants were subjected to a combination of two main-treatments and five sub-treatments. The main-treatments were: 1) hand cultivation to

control weed competition, and 2) overseeding with Kentucky bluegrass (Poa pratensis L.). Sub-treatments were; 1) no clipping, 2) clipping at 4 cm each week, 3) clipping at 4 cm every two weeks, 4) clipping at 8 cm each week, and 5) clipping at 8 cm every two weeks. Sod competition significantly reduced both the number of reproductive stems and the diameter of plants. Dandelion plants which were clipped more frequently and at a lower stubble height exhibited less reproductive and vegetative vigor than plants that were clipped less frequently and at a higher stubble height.

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