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HEAT AND LIGHT REQUIREMENTS OF VEGETABLE PLANTS

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Abstract: *This paper addresses to the problem of knowledge requirements of each vegetable species to environmental factors (heat and light), which is of particular importance because the technology used for their control can intervene in closely aligned with requirements of different vegetable species. Although vegetable growing is one of the oldest human occupations, it has developed in modern times, because technological progress, thereby strengthening the independent science that deals with the peculiarities of agricultural plant culture.*
This was the result of vegetable crops in protected areas having the climate controlled, which allows providing appropriate conditions for plant growth in out of vegetables season. The practice of modern technology, low pollution risk and low specific energy consumption, it tries increased productivity, which can benefit from economic point of view.
Keywords: *climatic factors, gardening, heat, light greenhouses*

1. INTRODUCTION

In vegetable production systems for a balanced supply of the market with fresh produce in season that they cannot be obtained under natural conditions in the field, are used greenhouses and solariums [1].
The proper knowledge of vegetation factors and appreciation that the proportion of their participation in plant growth and development processes allows the implementation of ecological systems models, methods of vegetable production models, especially in cultures where it is possible to automate the regulating of greenhouses environmental factors [2].

Table 1: The influence of environmental factors on plant growth
(after Laue, Forkel and Forberg 1968)

Environmental factors	Proportion %
Precipitations	***5,74***
Air relative humidity	***2.03***
The soil tillage	***1.69***
Soil micro-organisms	***5.41***
Nebulosity	***4.28***
The season of the year	***4.28***
Underground water	***2.03***
Irrigation and drainage	***3.72***
Soil	***6.76***
The fertilizers	***3.72***
The air pollution	***7.66***
Soil water available for plant	***12.16***
Soil nutrients available to plants	***10.14***
Physiologically effective electromagnetic radiation	***12.84***
The content of CO2 in the air around the plant	***10.14***
Plant growth	***7.40***

Knowing the plant relationships with the light is important in crop zoning, establishing optimal ages to set up cultures in protected areas to phased production. However it is known that a decisive factor in seed germination, plant growth, chlorophyll formation, flowering, fructification and sweat is the heat [3]. This correlated with a strong intensity makes the process of photosynthesis to be high and during the night stops, while breathing is

intensified. Knowing the vegetable demands has a practical importance, because it is the basis of establishment and conveyance culture technology [4].
Environmental factors such as light and heat are those together along with chlorophyll from plants directly influence the accumulation process in photosynthesis.

2. THE IMPORTANCE OF HEAT TO VEGETABLES PLANTS

Knowing the relationships between the heat as a growth factor and vegetable plants are important theoretical and especially practical. The heat is a factor that affects the whole range of plants vital processes [5].
Some data concerning the temperatures in the climate of our country shows that they records an diurnal, monthly and yearly variation, depending on the amount of solar radiation (Table 2).

Table 2: Annual temperature values in Romania, monthly and annual average, minimum and absolute maximum for a period of 59 years [°C]

Location / Month	București Filaret	Constanța	Craiova	Timișoara	Arad	Cluj-Napoca	Brașov	Iași
January	-2.9	-3.0	-2.5	-1.2	-1.1	-4.4	-3.9	-3.9
February	-0.8	-0.8	0.3	0.4	-0.3	-2.3	-1.8	-1.9
March	5.0	4.4	5.2	6.0	5.8	3.2	3.0	3.2
April	11.3	9.3	11.3	11.3	11.0	9.0	8.5	10.3
May	16.8	151	16.7	16.4	16.1	14.1	13.2	16.1
June	20.5	19.5	20.4	19.6	19.3	17.2	16.0	19.4
July	22.9	22.2	22.7	21.6	21.4	18.9	17.8	21.3
August	22.4	22.0	21.9	20.8	20.8	18.2	17.2	20.6
September	18.1	18.5	17.8	16.9	17.0	14.2	13.5	16.3
October	11.9	13.3	11.7	11.3	11.5	8.8	8.4	10.1
November	5.2	7.5	5.2	5.7	5.7	3.1	2.9	4.1
December	-0.1	2.6	0.1	1.4	1.4	-1.6	-1.6	-0.8
Annual average	10.9	11.2	10.8	10.9	10.8	8.2	7.8	9.6
Absolute minimum	-30.0	-25.0	-30.5	-29.2	-30.1	-32.5	-29.6	-30.0
Absolute maximum	41.1	38.5	41.5	40.0	40.0	36.8	37.1	40.0

Vegetable plants can be grouped according to heat requirements as follows:

- Exigent vegetable plants towards heat - include annual species, which consume fruits: tomatoes, peppers, eggplant, cucumbers, squash, melons, watermelons, beans, okra, etc. The minimum germination temperature is 10…14°C, the optimum germination is 20…25°C, it grows well at 25…32°C, supports a maximum of 35…40°C and a minimum of 10°C.
- Vegetable plants demanding average heat - annual and biennial species include: bulbs, roots, cabbage leaves, peas, beans, potatoes, etc. Minimum germination temperature is 2…5°C, the optimum germination and growth is 14…20°C and 22…25°C. Maximum growth. For a short-term support negative temperature between - 4°C and - 2°C.
- Vegetable plants resistant to cold - include perennial species as: asparagus, rhubarb, cardoon, artichoke, tarragon and sorrel. Generally requires a temperature similar to the previous group, or slightly lower, but over winter breeding organs that are found in soil supports a temperature down to - 20 ° C, and by protecting the right of - 27°C.

Seed germination, plant growth, flowering, fructification, duration of the resting phase, assimilation, respiration, transpiration and other physiological processes take place in the presence of a certain temperature.
Regarding the temperature level of each biological species has three layers:

- a minimum when metabolic processes are slowed down and no accumulation occurs (F / R = 1);
- optimum when metabolic processes are intense and balanced, and perform the most intense growth rate and accumulation of reserve substances in consumer bodies (F / R> 1);
- a maximum when the intensity of metabolic processes is maximal, but F / R = 1, and by exceeding this threshold the plants are exhausted and dying (F / R <1);

Conducting mode of temperature for different vegetation stages vegetable plants can be seen in Table 3.

Table 3: The optimum temperature vegetable plantson growth period and phase [°C] by Stan, N. 1992

The species	The optimum temperature for vegetative growth	Periods					
		Seed	Vegetative growth		General growth		
		Phases					
		Germination	Appearance of the cotyledons	Seedling growth	Accumulation of reserve substances	Flowering	Fruiting and maturation of fruits
Cucumbers, melons, watermelons	25°C	32°C	18°C	25°C	25°C	23°C	32°C
Tomatoes, peppers, eggplant, beans and pumpkin	22°C	29°C	15°C	22°C	22°C	20°C	29°C
Beets, asparagus, onions, garlic, celery	19°C	26°C	12°C	19°C	19°C	17°C	26°C
Potatoes, salads, peas, carrots, parsley, parsnips, chicory, spinach, dill, sorrel	16°C	23°C	9°C	16°C	16°C	14°C	23°C
Cabbage, radish, horseradish	13°C	20°C	6°C	13°C	13°C	11°C	20°C

3. THE IMPORTANCE OF LIGHT TO VEGETABLES PLANTS

Light is the determining factor in the normal course of photosynthesis, acting through specific parameters such as intensity, duration, spectral composition, and determining the optimal value of other factors by species and stage of vegetation. Taking into account that the variations of these parameters cannot be directed only in small measure, the light is considered to be a limiting factor for crop production.

After Somos and collaborators, 1966 sowing in December when light conditions are poor, prolongs the period to harvest compared to sowing in February, with 19 to 48 days in different species (Table 4).

Table 4: The period until harvest, depending on the lighting conditions determined during the period of culture (Somos et al., 1966)

Culture	The period until harvest (days) on crops sowed on:		Diference (days)
	15 december	15 february	
Pepper	134	113	21
Tomatoes	168	134	34
Cauliflower	155	113	42
Early okra	133	85	48
Salad	100	71	29
Radishes	76	57	19

Depending on the light intensity vegetable plants are grouped in:

- Demanding plants (8000…12000 lx): solanaceous, cucurbits, beans, okra, are cultivated in the most favorable areas.
- Less demanding plants (4000…7000 lx): root, bulb, cabbage, leafy peas.
- Plants with small claims (1000…3000 lx) are grown for consumption extra-early and late (green onions, perennial onions, beet leaves).
- Plants that do not need light during growing of edible parts: cauliflower, chicory, asparagus, mushrooms.

Depending on Day length (photoperiod) vegetable species are classified as follows:

- long day plants - originating in northern areas requiring between 15…18 hours of daily illumination, but in lower intensity (3000…7000 lux).): Root, bulb, cabbage leaves, peas, green onions, perennial onions, beet leaves;
- short-day plants - originating in southern areas, requires between 10 to 14 hours of daily illumination, but with high intensity (8000…12000 lx.) Solanaceous, cucurbits, beans, okra,
- indifferent plants - adapted to different culture conditions (tomato, salad);
- in order to obtain large and quality productions, especially in plants which consume fruit and seed crops, it must be provided the lighting conditions required by plants.

Light intensity strongly influences the duration and progress rate of physiological processes and plant growth. As the light is more intense, speed up chemical reactions in cells and plant physiological processes take place faster. Vegetable plants grow and develop themselves best at a light intensity of 20…30 thousand lux. In most species, as light intensity increases to the level of 50000 lux, the photosynthesis curve has an upward allure, and then remains constant up to 100000 lux and decreases sharply above this value called light saturation.

4. CONCLUSION

1. Knowing the vegetable plants requirements has a practical importance because it is the basis of establishment and conveyance of culture technology.
2. Environmental factors such as light and heat are those along with the chlorophyll from plants directly influence the accumulation process in photosynthesis.
3. The heat is a key factor that affects the whole range of plants vital processes.
4. Light is the determining factor in the normal course of the photosynthesis, acting through specific parameters such as intensity, duration, spectral composition.
5. The heat coupled with a strong intensity makes the process of photosynthesis to be high during the day and stops over the night, while breathing is intensified.

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