

## Introduction of alfalfa in the Southern Ukraine

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The gathering of raw materials from cultivated medicinal herbs has several advantages over compounding wild-growing thickets. In particular, it is possible to use mechanized processing techniques, increase the crop yields by improving agronomy and plant breeding, increase the quality of raw materials at optimal terms of gathering and ensuring rational drying conditions. Correct crop rotation, application of fertilizers, protection of plants from pests, diseases and weeds, and also special activities can contribute to increasing the production of raw material of medicinal herbs. The great importance has the development of agronomic recommendations for cultivated forest plants and essential oil plants, introduction of industrial technologies of cultivating medicinal crops and carrying out works of seed production into the practice of plant growing. As we conduct the introduction of medicinal plants, a special place is given to the most important features of the chemical composition in view of its possible variability at the new conditions of existence. In our work the results of the research of samples of 20 sorts of alfalfa in the area of the Zaporizhzhya region are represented. Seed material was obtained from the Institute of Forage and Agriculture of Podillya of the NAAS, Vinnytsya. We received 5g of every type of seed that was not subjected to preliminary processing, 20 varieties, different countries of origin. And in the future, we plan to research the chemical composition and the content of the derivatives of 4-oxy coumarin of the harvested raw material, because this group of chemical compounds can accumulate and to have the pharmacological action as anticoagulants. The dropping of alfalfa in the experiment were carried out according to the soil readiness for the optimum terms for the culture. The cultivation technology is generally accepted for alfalfa. Observations, accounting and analysis were conducted in accordance with the Methodological Instructions and the Technique of field experiments. It was established that the height of alfalfa was within the range of 48.8 - 74.1 cm. The introduction was carried out on the territory of *Institute of Oilseeds National Academy of Agrarian Sciences of Ukraine* (Zaporizhzhya). We made observations of the average climatic indexes within the researched period. In researching the introduction of alfalfa varieties, we investigated of the conformity of growth of alfalfa varieties towards the climatic conditions of Southern Ukraine. The most suitable indicators had the variety of Ukrainian origin (No. 20) Sinucha; its height was  $53.3 \pm 3.0$  cm and weight of dried plant was  $25.4 \pm 4.3$  g.

**Key words:** Introduction; Alfalfa; Climate Conditions; the South of Ukraine

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The implementation to the domestic medical practice of new types of herbal substances, its derivative products, the expansion of the range of herbal formulations require the improvement of the standardization system and control of their quality. Therefore, medicine remedies derived from plants are of a great importance in the therapy of various types of diseases and are widely used in the medical practice. They are included in more than 30 pharmacotherapeutic groups of medicine remedies and practically do not have equivalent substitutes. This is since some natural compounds are not yet synthesized or their output is very low and the process of obtaining them has only theoretical value.

The introduction (Latin: «introduction» - introduction) of medicinal herbs means the introduction into the culture of plants in new areas where these species have not met until now. The theory of plant introduction was first grounded by A. Decandol (1855), later it was developed by M. Vavilov as a complex biological process, which requires knowledge of the limits of endurance of the introduced and its features - the reaction to temperature, soil and air humidity, light and phylogenetic features, geographical origin. Biological properties are also studied as a result of the constant interaction of the plant with the environment by comparing and analyzing the sum of the active temperature of the areal and the new place of culture, absolute and average thermal indices of different periods of vegetation, light regime, taking into account the sum of precipitation, etc. Only the investigation of the whole complex of factors: thermal, bioecological, geographic and chemical, revealing among them

the integral and functional dependence can give an opportunity to predict the effect of introduction.

At the same time, we remembered that the introduced varieties represented a complex isolated morphological system, which is in close connection with a certain environment and area.

Despite the general tendency of increasing the number of introduced species, these investigations are conducted selectively for:

medicinal herbs that provide a large amount of raw materials (*Valeriana officinalis*, *Matricaria chamomilla*, *Hippophaë rhamnoides*, *Digitalis lanata*);

medicinal herbs with limited area or limited stock of raw materials (*Atropa belladonna*, *Rubia tinctorum*, *Panax ginseng*);

medicinal herbs with a large area, but which grow sporadically and do not form thickets (*Hypericum*, *Helichrysum arenanum*, *Polemonium caeruleum*);

sources of new medicinal herbal phytopreparations and remedies with unsafe raw material base (*Silybum marianum*, *Rhaponticum carthamoides*);

foreign medicinal herbs without analogues in the domestic flora;

medicinal herbs that are not found in the wild nature and are known only in culture (*Mentha piperita*);

rare or endangered species of medicinal herbs.

The gathering of raw materials from cultivated medicinal herbs has several advantages over compounding wild-growing thickets. It is possible to use mechanized processing techniques, increase the crop yields by improving agronomy and plant breeding, increase the quality of raw materials at optimal terms of gathering and ensuring rational drying conditions. Correct crop rotation, application of fertilizers, protection of plants from pests, diseases and weeds, and activities can contribute to increasing the production of raw material of medicinal herbs. The great importance has the development of agronomic recommendations for cultivated forest plants and essential oil plants, introduction of industrial technologies of cultivating medicinal crops and carrying out works of seed production into the practice of plant growing. As we conduct the introduction of medicinal plants, a special place is given to the most important features of the chemical composition in view of its possible variability at the new conditions of existence.

And in the future, we plan to research the chemical composition and the content of the derivatives of 4-oxycoumarin of the harvested raw material, because this group of chemical compounds can accumulate and to have the pharmacological action as anticoagulants.

## Methods

In our work we presented the results of our research of samples of 20 sorts of alfalfa in the area of the Zaporizhzhya oblast. Seed material was obtained from the *Institute of forages and agriculture of Podillya of National Academy of Agrarian Science of Ukraine*, Vinnytsya. We received 5 g of every type of seed that was not subjected to preliminary processing, 20 varieties, different countries of origin (Table 1).

**Table 1.** Seed material from *Institute of forages and agriculture of Podillya, National Academy of Agrarian Science of Ukraine*, Vinnytsya

	Name of the variety	Country of origin
1	Commercial 2-52-75	United Kingdom
2	Sevany-1	Russia
3	Kisvardai	Hungary
4	Vertibenda	Germany
5	Mega	Sweden
6	JJ Paso	Argentina
7	Peruvian pubescent	Peru
8	Boreale	France
9	Saladinasinteticala Banda	Argentina
10	Fergana 700	Uzbekistan
11	Vakhsh 233	Tajikistan
12	Krasnovodopadska 8	Kazakhstan
13	Nizona	Cuba
14	WL 50	USA
15	Moremmona	Italy
16	Liguen	Chile
17	Tanhuato	Mexico
18	Mesopotamian	Iraq
19	Mongolian colorful hybrid	Mongolia
20	Sinucha	Ukraine

The dropping of alfalfa in the experiment were carried out according to the soil readiness for the optimum terms for the culture. The cultivation technology is generally accepted for alfalfa. Observations, accounting and analysis were conducted in accordance with the Methodological Instructions and the Technique of field experiments.

Weather and climatic conditions have a great influence on the growth and development of plants. During the research they were different, therefore the obtained data allowed to assess the peculiarities of the development of the cultivars of alfalfa accurately and objectively. Growth is an irreversible increase of the volume and mass of herbs, accompanied by forming of new elements of the organism structure (organs, tissues, cells, as well as individual cellular organelles).

Growth criteria:

1. Height;
2. Thickness (for caulis);
3. Mass (raw and dry);
4. Leaf-area duration;
5. Number of cells;
6. Protein content;
7. DNA content.

A characteristic feature of plant growth processes is the localization of the process in certain tissues - meristems. The meristem cells, located at the apex of the caulis or root, do not stop the disconnection during the entire period of growth. This zone of meristem cells is called the meristem of waiting.

Stages of growth:

1. Hidden (primary);
2. Visible (secondary).

The height of plants in modern breeding is one of the most important features, because it relates to resistance to lodging and thus indirectly affects the crop. Development - is a process of structural and functional differentiation of individual parts and the organism, which leads to a gradual change of its qualitative states. Growth and development are closely interconnected and interdependent and are only different aspects of ontogenesis, which is also called the individual development of an organism. While conditions are usual for the organism, its growth and development are balanced. However, if the conditions are significantly deviating from normal, this balance is violated. For example, when there are an intensive lighting, high temperatures and insufficient humidity, the development outruns the growth. In such cases herbs as a rule, are small, but never the less, give off spring. In adequate lighting, excessive moisture or excessive nitrogen, on the contrary, accelerates growth, while the development is slowed down. Consequently, even though growth and development are closely interconnected, their speeds are relatively independent from each other. It was established that the height of alfalfa was within the range of 48.8 - 74.1 cm (Table 2).

**Table 2.** The main morphological characters and productivity indexes in the samples of Alfalfa

Breed, country of origin	Features	Results
Sinucha, Ukraine	Plant height, cm	53.3±3.0
	Mass of dry plant, g	25.4±4.3
	Amount of seeds from the plant, pcs	51.1±7.1
	Seed productivity, m	12.2±2.0

The perspective of introduction was estimated by several indicators, the most important of which are information about the peculiarities of their phenological development, the intensity and quality of seeds production, which is a characteristic of selection possibilities among introduced individuals with high generative ability, which are well adapted to the new conditions and individuals with the smallest quantities representatives of the chemical class of true coumarins. Climatic factors have the greatest impact on the growth and development of herbs.

Features of growth processes, organ formation and physiological processes in plant organisms are closely related with the thermal conditions, humidity of the environment, light regime, amount of precipitation. Disclosure of ecological and biological features of herbs is impossible without researching their seasonal growth and development. Therefore, all manifestations of seasonal rhythmic (phytoenotic, geographic, ontogenetic and annual) are an integral expression of the complex process of interaction between the endogenous rhythms, which is determined by the genetically defined program, and its ecological modifications.

Numerous publications indicate that the features of seasonal development of woody plants to a certain extent reflect the phylogeny of the species, ecological and adaptive capacity of plants. It was found that at a stage of the seasonal development the different physiological and morphological differences occur in the herb. Changes of the phenophases which are observed in this case are in a certain sequence, which is directed by the system of self-regulation. Natural selection fixes in the genotype some progressive changes of biorhythms. Thus, plant organisms are characterized by conservatism of the specificity of biorhythms, and the lability of adaptive properties.

## Results

The inter-relations between them are largely associated with the affiliation of species. The features of these inter-relations are one of the main reasons for the success or failure of the introduction. It is convincingly shown that the peculiarities of different types of plants are due to their uneven demands of ecological factors. Therefore, we can determine the degree of adaptation of the species to the conditions of area, by defining the range of tolerance of phenophases to environmental factors. According to the literary sources, alfalfa pass through twelve stages of organogenesis (Table 3, Figs 1-3).

**Table 3.** Stages of organogenesis of alfalfa

Stage number	Organogenesis
1	Sprouts (consist of a cone of growth of the apical bud and two primordial leaves). The main bulk of sprouts are sprouts of the second and subsequent orders.
2	Differentiation of the cone of growth.
3,4	Tillering, the formation of inflorescences
5	Extended differentiation of flower.
6	Creation of inflorescence.
7	Occurring of the covering organs of the flower, androphores, pistil, peduncle and flower-bearing stem.
8	Budding
9	Blooming
10	Formation of the corcule of the seed
11	Deferment of nutrients to cotyledons of seeds
12	Ripening of fruitery and seeds

The introduction was carried out on the territory of *Institute of Oilseeds National Academy of Agrarian Sciences of Ukraine* (Zaporizhzhya). Were noticed the calendar terms of the beginning and the mass passage of the main phases of development for 20 varieties.



**Fig. 1.** The first stage is the sprouts (02.05.2016)



**Fig. 2.** The second stage is the differentiation of the growth cone (15.05.2016)



**Fig. 3.** Stages 3 and 4 - the tillering, the formation of inflorescences (05.06.2016)

Temperature is the main factor that directly affects releasers that regulate growth processes. The growth of sprouts is also related to the temperature of the air. As a rule, at a significant increase of temperature there was a more intensive growth of sprouts.

The optimum air humidity is 60-70%, providing that other vital factors of the environment are within the optimum. Precipitation is the main source of the accumulation of soil moisture reserves.

Sunlight is a source of energy for photosynthesis, whose effectiveness is largely determined by the intensity of solar radiation, which can enhance or slow down this process. The duration and intensity of sunlight affect the development of plants, by changing the rate of producing of assimilates / photosynthesis, and the temperature regime. We made observations of the average climatic indexes within the researched period (Table 4).

**Table 4.** Climate conditions of cultivating alfalfa varieties (May-August 2016)

Date	Average temperature, °C	Average rainfall, %	Relative air humidity, %
02.05.2016	17 °C	4%	41%
09.05.2016	20°C	5%	60%
15.05.2016	20 °C	26%	68%
22.05.2016	21°C	4%	45%
29.05.2016	21°C	66%	82%
05.06.2016	23°C	0%	43%

## Conclusions

During the introduction of alfalfa varieties, we conducted investigation of the conformity concerning the growth of alfalfa varieties towards the climate conditions in Southern Ukraine. The most suitable indicators had the variety of Ukrainian origin (No. 20) Sinucha; it height was  $53.3 \pm 3.0$  cm and weight of dried plant was  $25.4 \pm 4.3$  g.

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