THE EFFECT OF PHYTOHORMONES ON FLOWERING AND PHYSICO-CHEMICAL PROPIERTIES OF SHOOT APEX DURING GENERATIVE DEVELOPMENT OF WINTER WHEAT

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The aim of the present work was to study co-operation of hormones with short vernalization on flowering of winter wheat. Moreover, the effect of studied substances on the metabolism rate (heat production, electric potential, composition of lipids and sterols of shoot apex) was also determined. Isolated embryos of *cv*. Grana were placed on Murashige Skoog medium with addition of indole–3-acetic acid (IAA), kinetine (KIN), spermidine (Spd), gibberelic acid (Ga_3) and zearalenone (ZEN) and then subjected to 14-day vernalization.

All used substances stimulated generative development of winter wheat increasing the percentage of plants heading in comparison with the controls. Changes in the heat production, electric potential, lipids and sterols composition were observed after 5-weeks growth at 20 °C. The most effective among examined substances were Spd and ZEN.

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PHYSIOLOGICAL CHANGES IN STEVIA REBAUDIANA (BERTONI) LEAVES CAUSED BY ROOT SPHERE CONDITIONS

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The leaves of *Stevia rebaudiana* (Bertoni) contain several natural, heat-stable ent-kaurene glycosides. Their intensities of sweetness and flavour profiles differ from each other and vary according to conditions and environment. Collectively they give Stevia 100 to 300 times the sweetness of sucrose (PHILLIPS, 1987) and are calories free. The crude Stevia leaves and herbal powder (green) are reported to be 10 – 15 times sweeter than table sugar (RICHARD, 1996). Acclimation of Stevia in Slovakia gives the possibility of its utilisation as a source of natural light sweetener suitable for obese and diabetics, too (ČERNÁ, 1998). Stevia originated in South American gene centre, and usually occurs on locations with high level of underground water or with continually moistened soil. Therefore to secure optimum water relations for Stevia plants seems to be one of the main tasks closely connected with its cultivation in our soil/climatic conditions.

Our experiments were focused on determination of transpiration rate (TR) diurnal course based on intact leaves diffusion resistance for water vapour measured by portable porometer DELTA – T, on leaves chlorophyll content measured by portable chlorophyll-meter and on number of stomata on leaves adaxial and abaxial side during vegetative period in the field conditions. In 1997 - 1999 there were 3 treatments of *Stevia rebaudiana* plants cultivation in field experiments: on the soil mulched with white PVC sheet (W), mulched with black PVC sheet (B) and non-mulched as a control (C) in conditions of South Slovakia. In 1998 when irrigation was interrupted for 5 days, water saturation deficit (WSD) of various aged Stevia leaves was determined in greenhouse pot experiment.

The highest values of TR and the highest yields of dried leaves (58.15 g per plant) were obtained in the treatment (W). In spite of 4-times higher number of stomata on abaxial leaf side compared with adaxial side, TR of abaxial side was higher in morning hours only by 18,44 % and this difference was gradually lowered with increased air temperature and radiation intensity even to total equalisation. Chlorophyll content in Stevia photosynthetic active leaves increased by their ontogenetic age. Interrupted irrigation proved on control plants by lethal WSD (24,25-33,99 %) whereas plants of mulched treatments had low WSD values (6,76-10,73 %) did not endangering their life functions. On the basis of obtained results we can presume that for obtaining optimum water relations and maximum yields of Stevia plants cultivated in Slovakian field conditions the most convenient soil treatment is soil mulched by white PVC sheet.

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THE INFLUENCE OF LOW TEMPERATURE OSCILLATIONS ON THE TIME TO HEADING IN WINTER WHEAT

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Under controlled conditions vernalization is usually performed at constant low temperature. On the other hand if the process is taking place in natural environment, temperature oscillations are strong and frequent. In earlier our studies we shown that short warm breaks that separating cold periods exhibited weaker devernalizing action as compared to only one but long warm break. The aim of our studies was the comparison of effectivity of 4-week-long vernalization of winter wheat seedlings under non-optimal temperature +9 ^{o}C but with two values of the temperature oscillations: 2 ^{o}C and 6 ^{o}C from the average value. In the first variant of vernalization the temperature oscillated in the range 7 - 11^{o}C, while in the other case the oscillation range was wider from 3 to 15 ^{o}C. The time of full oscillation amounted ca. 1,5 h. The vernalization was performed in the refrigerator equipped with the temperature sensor which was earlier covered with rubber foam to increase its thermic inertion. On that way the high temperature oscillation was obtained inside the refrigerator and also in the vessel containing vernalized wheat seedlings. However inside the same refrigerator local low temperature oscillation was formed. It was done on such a way that the second vessel with vernalized seedlings was closed additionally in the container made from porous, highly thermically isolating material (polystyrene foam). For both the vernalization variants were realized inside the same refrigerator the mean temperature of vernalization was at both variants right the same. After the end of vernalization seedlings were sown in pots, put in glasshouse and cultured under 16-h photoperiod and temperature 18/14 ^{o}C. In everyday observations the date of heading of particular plants was noted. Each of the both treatments under study was consisted of 50 plants. In the both treatments practically all plants headed. However the mean period of plants growth to heading in the group of plants vernalized under high oscillations of temperature amounted 74 days while the other plants vernalized under small temperature oscillations headed 5 days later. The result supports the hypothesis that if vernalization is performed in conditions where temperature changes are similar to natural ones the process is more efficient. It means that in the case of vernalization less favourable conditions were when plants were grown for prolonged period under low temperature oscillations (conditions close to the thermic homeostazy). The disturbance of such metabolic equilibrium facilitates full perception of the stress stimulus and maks possible the effective perception of the thermioinduction of flowering (vernalization).

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PLANT PRODUCTION IN ONTOGENESIS OF OVERWINTERED WHEAT

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The effect of Fusaria-especially *F. nivale* (Fr.) Ces. on plant production overwintered wheat during ontogenesis was examined. Evaluated were crop of wheat cv. Viginta and Roxana, grown at Horná Súča situated in middle Slovakia (650 m above sea level). Analyses of wheat production were done at the second node, at the state of formation af ear-heads and the ripening. Shoot and root biomass of plants was lower at the first stage of sampling. At the stage of ear-head formation and ripening, the balance of production occurred. It is presumed that high potassium content (240-330 $mg.kg^{-1}$) and a level of other minerals had a positive effect for elimination of infection and recovery of wheat plants from a biotic stress. Thousand kernels weight of infected plants was 23,72 % lower than it was at uninfected plants.

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THE CHANGES IN ETHYLENE PRODUCTION, ABSCISIC ACID AND INDOLYL-3-ACETIC ACID CONTENTS AS MARKERS OF BIRCH STRESS AND DAMAGE UNDER THE INFLUENCE OF CEPA AND H_2SO_4 TREATMENTS

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In the present work the changes in endogenous ABA (abscisic acid), IAA (indolyl-3-acetic acid) contents and in ethylene production were observed after stress simulation by treatment of birch with CEPA (2-chloroethylphosphonic acid) – 1 % solution of Flordimex and/or 0.1 N solution of H_2SO_4. At the same time the interactions between the changes in the phytohormone contents evoked by stress and endogenous bud dormancy of birch were described.The content of ABA and IAA was studied in leaves and nodes (or buds) of birch, 1, 24 and 48 hours and 3 and 6 weeks after CEPA and H_2SO_4 treatments, and at the same time the production of ethylene by the intact plant. A higher content of ABA in leaves and nodes was observed 1 hour after treatment both CEPA and H_2SO_4. The content of IAA was low in leaves, in nodes the content of IAA was low after CEPA treatment, higher after H_2SO_4 treatment. Ethylene production was significantly higher after CEPA treatment, while after H_2SO_4 treatment this increase was not significant.The content of ABA increased in leaves and nodes of the stressed birch before the beginning of dormancy. The IAA content in nodes decreased after CEPA treatment and the abscission of leaves and budding was 100 %. At the time of the onset of dormancy, the application of H_2SO_4 insignificantly increased the ABA content in leaves, increased the IAA content in nodes, while CEPA decreased the content of both phytohormones. After CEPA application the abscission of leaves was 70 % and budding stopped. After H_2SO_4 application the abscission of leaves was 20 % and budding was 30 %. During domancy of birch treatment with H_2SO_4 decreased and CEPA treatment increased the content of IAA in buds. In this period the control variant shed 70 % of the leaves and the buds did not grow.

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EFFECT OF MACHINERY DURING POTATO HARVEST AND STORAGE ON THE LOSESS REDUCTION AND PRODUCT QUALITY INCREASING

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Potatoes require very strict technical and technological management within all production cycle starting from soil preparation, through the planting, interrow cultivation, harvest up to storage.

In equal soil and climatic conditions the quality of the harvesting machinery was compared. The following parameters were evaluated: degree of damage caused by individual machine mechanisms, potato losses due to the harvest (non-dig-up tubers and tubers lost on field surface).

From the point of potato tubers damage and losses evaluation the potato harvester GRIMME was found out as the best one. The configuration of its sieving webs allows to decrease the level of potato losses. The quality of machine work allows to reduce storage losses as the potato tubers proceed to the storage without damage and surface disturbance.

For the general purpose the methodology of potato cropping system was developed covering all operations from the soil tillage up to storage of product harvested. The aim of the system is to decrease energy requirements and potato damage during harvest.

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THE IMPACT OF LIMITED SOIL MOISTURE AND WATERLOGGING STRESS CONDITIONS ON MORPHOLOGICAL ROOT TRAITS IN MAIZE HYBRIDS

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Effects of soil drought or waterlogging on the morphological traits of the root system and internal root anatomy were studied in maize hybrids of different drought tolerance. The investigations comprised quantitative and qualitative analyses of a developed plant root system through determining the number, length and dry matter of the particular components of the root system and some traits of the anatomical structure of the seminal root. Obtained results have demonstrated a relatively broad variation in the habit of the root system. This mainly refers, to the number, length and dry matter of lateral roots, developed by seminal root, seminal adventitious and nodal roots, as well as to some anatomical properties of the stele, cortex and metaxylem elements. Plants grown under waterlogging or drought conditions showed a smaller number and less dry matter of lateral branching than plants grown in control conditions. The harmful effect of waterlogging conditions on the growth of roots was greater when compared with that of plants exposed to drought. In the measurements of the root morphological traits, the effect of soil drought on the internal root anatomical characteristic was weaker than the effect of soil waterlogging. A more efficient water use and a lower shoot to root (S:R) ratio were found to be the major reasons for a higher stress resistance. The results suggest that the morphological and anatomical traits of the maize root system may be used in practice as direct or indirect selection criteria in maize breeding.

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QUANTITATIVE ANALYSIS OF THE ROOT SYSTEM STRUCTURE OF TRITICOSECALE CULTIVARS

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Phenotypic expression in the growth of plant root system is a function of genotypic and environmental factors. Some abilities of plants to withstand different environments are closely related to the nature of their root system because every plant species or variety has its own morphological characteristics in the root systems as well as in the aboveground plant parts. In our study a comparative analysis was conducted on the structure of root system of triticosecale cultivars which were one month old. Using the "root box" method, we attempted to investigate the fundamental structures and form of the root system among 8 cultivars of triticosecale with special reference to the spatial arrangement of nodal and lateral roots. In this experiment the growth of roots was quantitatively evaluated basing on the number, length, density and dry matter of the root system (seminal and nodal root axis). In triticocecale cultivars the root system was well developed and was extended mainly by relatively short, uniform in length and many first order lateral roots. None or few nodal roots ran vertically, but most of them ran obliquely in the soil. More than 50 % of the nodal roots showed their angles greater than 30^0 C.

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GENOTYPIC VARIATION IN THE GROWTH OF THE ROOT SYSTEM OF TRITICOSECALE CULTIVARS UNDER WATER STRESS CONDITIONS

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Relatively little research has been conducted to determine different responses to drought among cultivars of the triticosecale. The objective of this study was to identify differences in seedlings growth with special emphasis placed on the root system development. Distinct differences between cultivars of triticosecale became evident in measurements of the characteristics of the lateral root. The drought treatment induced statistically significant decrease in the number of the developed laterals, their total length and dry matter. In the drought resistant cultivars this reduction was smaller in comparison with the sensitive ones. The effect of drought on growth of the seminal root axis in the drought resistant and the drought sensitive cultivars was smaller and statistically not significant. The results showed that the drought resistant cultivars when compared with the drought sensitive ones would demonstrate less abundance in the aboveground part and greater dimensions of the root system. It has been also demonstrated that in the drought resistant cultivars during the recovery period a tendency exists for a more complete return to the level of the control plants. This study showed the possibility that selection of cultivars focused on root system architecture could be facilitated using the "root box" method.

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STABILIZING AND LIMITING FACTORS OF YIELD FORMATION OF SPRING BARLEY

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In the yers 1990 to 1992 and 1996 to 1998 the effect of nitrogen fertilization (rates of 0, 30, 60, 90 and 120 kg $N.ha^{-1}$) and soil fertility on yield formation of spring barley was studied in micro-plot trials. In the first three year trial a main criterion of soil fertility were the grain size structure and humus content (< 1 %, 2 % and > 3,5 %). In the second three year experiment a main criterion was the soil pH level. It follows from the results that the productivity of spring barley, variety Jaspis, grows with graduated content of humus and gradated rates of nitrogen fertilization. Regarding the grain and straw yields of spring barley, the most efficient in most soils is a rate of 60 kg $N.ha^{-1}$. Statistically significantly efficient are rates 90 and 120 kg $N.ha^{-1}$ on soils with medium humus content. Close significant relations were found between the amount of soil humus and barley productivity (r = 0,98) and between the amount of soil humus, nitrogen dose and barley productivity (r = 0,91 to 0,86). A good correlation were found between spring barley productivity and the content of soil total , mineral and mineralizable nitrogen. The soil acidity decreased the productivity of spring barley, variety Jubilant, as many as 25 % compared with neutral soil. With growing rates of nitrogen in neutral soil the yields of grain and straw statistically significantly increased. The yields of spring barley in acid soil stagnated after application of nitrogen fertilizer. Close correlation has been found between the yields of barley and nitrogen dose in neutral soil (r = 0,70 – 0,74). In acid soil significant relations between the spring barley productivity and graduated rates of nitrogen fertilizer were not found (r = 0,24 – 0,26). The share of soil nitrogen in the total uptake by the harvest of spring barley ranges from 95 to 78 % and is practically identical in all studied soils. With growing rates of nitrogen fertilization the share of soil nitrogen decreases. The use of nitrogen from fertilizer by spring barley is higher in soils with high fertility (42 – 47 %) compared with the soils with low humus content (38 – 41 %) and low pH level (25 – 35 %).

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INFLUENCE OF ABIOTIC STRESSES UPON ANATOMICAL STRUCTURE OF WINTER WHEAT GRAINS

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The decrease of yield caused by abiotic stresses of outer surroundings is one of the most serious problems of plant production. The stressed plants obviously show up the changes of anatomical structure of individual organs.

Five representative cultivars of winter wheat (Astella, Olga, Patria, Plodna, Zdar) were cultivated in glasshouse under regulated conditions and stressed by low pH, high temperature and drought. At the end of the experiment the cross sections of mature grains were taken and changes of their anatomical structure were studied. The changes of both pericarp and seedcase as well as of the inner parts are perceptible from the colour photographs taken by the light microscope.

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IMPACT OF DIFFERENT NITROGEN CONCENTRATIONS IN SOLUTION UPON ENERGY CONTENT IN YOUNG WHEAT PLANTS

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One of the significant inputs into this system is nitrogen supplying to the plants. Nitrogen influences not only the velocity of photosynthesis but accumulation of rich in energy assimilates, too. There can't be found any explicitly defined relation between nitrogen amount and values of net energy in literary sources, as there are to be found positive, negative or indifferent data. That is why in this work we watched changes of combustion heat energy values content in dependence on nitrogen concentration. In laboratory we studied energy content in roots and overgrown biomass of young winter wheat plants, cv. Samanta In the experiment we studied influence of five different nitrogen concentration in Hoagland solution No. 3: 1 N, 0.1 N, 0.5 N, 2 N and 4 N. The amount of energy was taken calorimetrically by combustion in calorimeter Laget MS 10 A. The amount of rich in energy matters in individual organs of plants showed distinct drift of growth. The lowest net energy was taken in the phase 14.DC from 10.11 to 15.74 $kJ.g^{-1}$ of root dry matter and from 11.69 to 14.62 $kJ.g^{-1}$ of overground biomass dry matter. The highest net energy was taken in the phase 30.DC (from 13.82 to 15.66 $kJ.g^{-1}$ roots and from 14.01 to 17.39 $kJ.g^{-1}$ overground biomass dry matter). Content of net energy was limited by concentration of nitrogen in the solution. With the roots its influence wasn't shown statistically significantly, although the highest values of net energy were noted with variant 1 N (from 14.07 to 16.41 $kJ.g^{-1}$ of dry matter). Combustion heat values of 1 g of dry matter overground biomass were influenced by nitrogen concentration in the solution, as with variants with extremely high as well as with low concentration we noted statistically significant decrease of net energy values. By way of conclusion it can be stated, that too low and too high concentrations of nitrogen decrease amount of energy in 1 g dry matter. We can state further more, that higher values of net energy were noted with overground biomass (14.31 $kJ.g^{-1}$) compared with roots (14.29 $kJ.g^{-1}$). This is given above all by the accumulation of rich in energy matters of assimilates which had arisen in the course of photosynthesis.

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INFLUENCE OF DIFFERENT NITROGEN CONCENTRATION IN THE SOLUTION UPON RATE OF PHOTOSYNTHESIS AND TRANSPIRATION OF WINTER WHEAT PLANTS

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Photosynthetic rate as a process is influenced by great number of biotic and abiotic factors. One of significant factors, which influences photosynthetic rate is nitrogen. This element effects not only the formation and velocity of leaves senescence but the content of photosynthetically active pigments as well. Besides photosynthesis, studying intensity of transpiration with the plants is helpful. That is why we studied influence of different nitrogen concentration in Hoagland´s solution No. 3: Control variant 1 N, variants with decreased and increased nitrogen concentration in the solution for 0.1 N and 4 N and velocity of photosynthesis and transpiration. These physiological characteristics were taken by gasometric instrument LCA – 4 with representative cultivars of winter wheat: Astella, Estica, Ilona and Samanta from the phase 14.DC to the phase 30.DC. It flows from the taken values, that compared with intensity of transpiration, which did not show any distinct trend, the intensity of photosynthesis distinctly tended to increase of measured values during ontogeny. This increase was to some extent influenced by concentration of nitrogen in solution, as the lowest taken values were found with variant 0.1 N (4.911 $\mu mol.m^{-2}.s^{-1}$) and the highest value were noted with variant 1 N - 5.970 $\mu mol.m^{-2}.s^{-1}$. Compared with this, transpiration was not influenced by nitrogen, although the lowest values were found by variant 1 N – 1.713 $\mu mol.m^{-2}.s^{-1}$ and the highest one with variant 4 N – 2.060 $\mu mol.m^{-2}.s^{-1}$. Velocity of photosynthesis and transpiration was not influenced by cultivar.

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INFLUENCE OF ABIOTIC STRESSES UPON PHOTOSYNTHETIC RATE WITH REPRESENTATIVE TOMATO CULTIVARS

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The yield potential of agricultural crops is effected by acting of adverse weather conditions. Impact of stress factors influences the course of basical physiological processes in plant and subsequently the yield forming. Individual cultivars with their genetic basis have different ability of adaptation to the effecting of stress conditions of environment.

The aim of our work is to study of influence the low temperature upon photosynthetic rate with representative tomato cultivars (Start F, Monika F, Stupické polní rané).

On the basis of the results it can be stated, that under low temperatures impact there occurs considerable decrease of photosynthetic rate, which was taken with the help of LCA-4 analyser. Certain differences were found also among individual cultivars both in decrease of photosynthetic rate under low temperatures impact and by return to the primary photosynthetic level after the stress fading away.

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INFLUENCE OF MOISTURE DEFICIT UPON PHYSIOLOGICAL CHARACTERISTICS AND YIELD FORMATION WITH HOPS

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An important yield-forming factor by hop is affluence of precipitations and their regular distribution during vegetation. Water deficit has an adverse effect to physiological processes by hop plants and to hop bines as well. In the localities, where it is technically possible, the shortage of precipitations can be solved by controlled irrigation schedule. We studied the effect of controlled irrigation schedule upon the photosynthetical accumulation of energy into vegetative and generative hop organs during vegetation. These problems have not been studied with hop plants. Gathered results, which can be summarised to following points showed physiological differences in yield formation of irrigated and non-irrigated hop plants. The experimental plants were "Osvald's clone No. 72". The experiment was established in two variants: variant of irrigated plants and variant of non-irrigated plants. The irrigation was assured by means of drop irrigation distributed above the hop rows. Irrigation regimen was controlled by the prognosis of effective irrigation doses need in a week balance cycle.Net energy per 1 g of dry matter was accumulated in hop plants especially in dependence on the year. Most of energy per 1 g of dry matter was concentrated in the plants from the beginning to the half of the vegetation, during the following period content of net energy was falling down. By the non-irrigated variant it was 16,71 $kJ.g^{-1}$ (1997) and 16,50 $kJ.g^{-1}$ (1998). Yet we can state, that the non-irrigated plants of precipitation do not fully utilise rich in energy matter, what results in higher values of net energy per 1 g of dry matter. The similar trend was presented by individual organs excepting hop bine, with rich in energy matter accumulated in the pre-harvest period, what was caused by distribution of assimilates from leaves into underground organs and hop cones. From all the studied organs, most of net energy per 1 g of dry matter during vegetation was accumulated in leaves. In the aboveground part of irrigated hop plant there were accumulated statistically conclusively more of total net energy than by non-irrigated variant. Greatest differences in content of total energy between irrigated and non-irrigated plants were in the half of July, i.e. in the time of hop cones forming. Increase of total energy amount by irrigated plants was in that time in average 29,00 % in 1997 and 30,54 % in 1998. Irrigation of hop plants had significantly increased the amount of total energy in hop cones. This energy content elevation was from 23,33 to 30,46 % in dependence on the year.

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CHANGES OF ANATOMICAL STRUCTURE OF WHEAT GRAINS INFLUENCED BY REPRESENTATIVE ABIOTIC STRESSES

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At present times the producers often face the decrease of plant production caused by abiotic stresses of outer surroundings. Most of all it means dry spell in the period of the main crops vegetation, high temperature in the period of seed-filling and grain ripening and low pH caused by acid rains, physiologically acid fertilizers and by limitation of liming. For those reasons it is necessary to find out and cultivate more resistant cultivars. For this goal it is expedient to learn the anatomical structure of the stressed plants seed stock. In the years 1997 – 1999 we studied energy content in grains of representative cultivars of wheat (Astella, Olga, Patria, Plodna, Zdar) under regulated conditions in glasshouse. The plants were cultivated in pot experiments with homogenized soil and balanced level of nutrients. Under control conditions the average temperature of outer environment in the time of grain filling was 23° C by day and 15° C by night. The water potential of the soil was -0,12 MPa by pH 7,0 The second variant of the experiment included three stresses and their mutual combination (low pH, high temperature and drought). The average temperature of outer surroundings was 37,6° C by day and 25, 6° C by night. Water potential was 1,28 MPa by pH value 4,5. After softening in Strasburger solution (distilled water, ethanol 96%, glycerol 1: 1 : 1) by 70° C, the matured grains were cut on hand microtome to cross sections 8 – 10 μm thick. The sections were taken in the middle part of caryopsis, then evaluated and photographed with the help of light microscope Nikon Eclipse E 600. As it is clear from the photographs taken, the changes are visible on the inner part of the caryopsis as well as on the outer layers. There are evident differences in the thickness of pericarp and seedcase, also the size of the cells of endosperm seems to be different. These changes are corresponding with the morphology of grains from stressed plants (their size, shape and surface structure) – the photographs of the grains are available, too.

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THE GROWTH AND WATER UPTAKE BY MAIZE PLANTS IN DRYING SOIL

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The relationship between soil water potential and root growth has been studied well, but to solve problem few studies take into account the participation of different root types and different root parts of the whole root system. For these studies we designed two types of soil compensation lysimeters, vertically and horizontally divided, that provided us to measure water uptake in intact root system by different roots and in different soil depth. One of typical drought-avoidance mechanisms manifested by compensating growth of roots in deep and wetter soil zones (about 0,8 m depth) we identified in our earlier experiments with Zea mays L., hybrid CE (FAO) 330. During maximum compensation root growth, realised mainly in seminal part of whole root system, the rate of seminal roots water uptake increased up to six fold and their relative water uptake increased from 10 % to 30 % of total plant water uptake. Results from horizontally divided lysimeters confirm and specify the findings from vertically divided lysimeters. Under the conditions of unlimited water supply (control variant) 51,4 % of water uptake of the total plant water uptake, during the season, was taken up by the roots in the soil layer 0-33 cm (L1), 42,6 % in the 33-66 cm (L2), and only 6,6 % in the 66-99 cm (L3). The distribution of the roots dry matter had a similar trend. After the application of drought condition of whole rooting profile after anthesis (this treatment simulated the limited stored water), the distribution of the root dry matter in L3 increased evidently from 11,4 % to 22,4 % and water uptake increased from 6,6 % to 20,6 %. But this was insufficient to recover the plant dry matter and grain production, which were only about half of control in this treatment. A similar dry matter distribution also occured in the treatment where soil drying was induced in first two layers, but an unlimited water supply was given to L3 (it simulated the underground water source). The roots dry matter distribution in L3 increased from 11,4 % to 24,4 %, while water uptake increased substantialy from 6,6 % to 45,3 %. The total dry matter production in these plants was about the same as in control plants and grain production per cob even significantly greater (up to 20 %). They suppressed our findings that drought stressed plants with graeter number of seminal roots can produce greater amount of fine compensation roots. Well-watered control plants uptake water mainly from upper L1 and those plants with four SAR the most from L3. But these plants in condition of drying soil in upper soil layer uptake water with greater efficiency in lower layers, better resist to drought as their leaves dry up more slowly, and produced significantly greater amount up to 600 grains per plant in comparison to 400 grains of plants with one SAR of the same maize hybrid. These intragenotype variations in growth, productivity and water uptake due to different number of developed SAR could be probably usefully exploited in the breeding programme as well as in the basic research in the future.

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COMPARATIVE STUDY OF MAGNOLIA X SOULANGEANA LEAVES UNDER DIFFERENT CULTIVATION CONDITIONS

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In vitro plantlets overcome the deep structural and functional changes during acclimation period of transition process to *ex vitro* condition. We found the changes of assimilation pigments complex in *Magnolia x soulangeana* leaves. Content of chlorophyll a, chlorophyll b and carotenoids was determined by sprectrophotometric method in 80 % acetone extract. Mother's leaves on 1, 5, 6 and 8 month old plants grown as *in vitro* cultures and 10, 16 weeks after transfer of the plants to *ex vitro* conditions. One month aged in vitro leaves contained by 14,8 % chlorophyll"a" and 23,8 % chlorophyll "b" less than mother's plant leaves. The content of carotenoids was 34,1 % lower compared to mother plant. The ratio of "a" : "b" chlorophyll was by 12,7 % higher and chlorophyll "a"+"b " : carotenoids by 19,8 % higher than of mother leaves. Ten weeks after the transfer of plantlets to ex vitro conditions the content of assimilation pigments rapidly increased. The content of chlorophyll "a" was only by 0,35 % and chlorophyll "b " by 9,5 % lower than in mother leaves. The content of carotenoids was only by 5,2 % lower than in mother leaves. The ratio of chlorophyll "a" + " b " :carotenoids decreased and was only 29,1 % compared to mother leaves. 16 weeks old plantlets contained assimilation pigments on the level very near to mother leaves. In this time restructuring of assimilation apparatus is probably finalised and can fulfil all functions in photosynthetic processes.

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THE EFFECT OF NATURAL AND ANTHROPOGENIC SUBSTANCES ON PHYTOPLANKTON CELLS

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The subject of the present study was to explain the significance of humic substances and polycarboxylic acids in the assimilation of iron by algae and cyanobacteria. The influence of these organic compounds on this physiological process in algae and cyanobacteria was tested experimentally in the laboratory on cultures of these organisms preincubated under iron-deficient conditions.

The results of the study showed that:

- Seawater humic acids, especially the fraction containing compounds with a molecular weight below 1000 Da, facilitate iron uptake by the green alga *Scenedesmus microspina*;
- Iron (III) can be taken up from and NTA-Fe and PCA-Fe complexes by cells of *Chlorella kessleri* and *Anabaena variabilis* incubated under iron-deficient conditions. The results demonstrate that under such conditions the compounds of anthropogenic origin can also improve the bioavailability of iron with an intensity that varies in different phytoplankton species.

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PRODUCTION POTENTIAL OF WINTER WHEAT IN DIFFERENT SOIL TILLAGE TECHNOLOGIES

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The production processes of winter wheat were observed during 1995 – 1997. The field treatments were carried out in soil conditions of Fluvi – Eutric Gleysol (FEG), typical soil type for the East Slovakian Lowland. Two soil tillage technologies were examined – traditional tillage (TT) and no–tillage (NT). Plant samples were taken in 5 terms representing grown-development phases of wheat (start of shooting, shooting, flowering, start of milk ripeness, milk ripeness). The basic characteristics of production potential determined KOSTREJ et al. (1998).

The production process in spring – summer part of vegetation period of winter wheat was depended at formation and development of quantitative parameters of the production potential of wheat stand. The values of leaf area index (LAI) were 1,02 – 6,24 $m^2.m^{-2}$ in average for TT variant and 1,05 – 5,92 $m^2.m^{-2}$ in average for NT variant. The highest LAI values were ascertained in 1996 when were also the highest grain yields of winter wheat on the both soil tillage variants (7,79 $t.ha^{-1}$ at TT variant and 6,87 $t.ha^{-1}$ at NT variant). The production process was realised at the similar basic values of the production potential on both tillage variants during all experimental years. The values of net assimilation rate (NAR) were higher on variant with traditional tillage (8,72 – 9,77 $g.m^{-2}.day^{-1}$ in average) in comparison with no–tillage variant (7,77 – 8,73 $g.m^{-2}.day^{-1}$ in average). The average values of crop growth rate (CGR) for stand of winter wheat were in range 25,53 – 31,93 $g.m^{-2}.day^{-1}$ for TT variant and 22,86 – 30,25 $g.m^{-2}.day^{-1}$ for NT variant. The maximum values of this parameter were in 1996 on both tillage variants. The ascertained values of production potential of winter wheat, mainly average and maximum LAI and average NAR a CGR, were suitable for winter wheat yields on level 7 – 8 $t.ha^{-1}$ at both soil tillage variants.

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EPIDERMAL CELLS OF MAGNOLIA SOULANGEANA LEAVES IN IN VITRO CONDITIONS AND AFTER ACCLIMATION

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Differentiation of plant epidermal cells is a complete process. Variations on the basic plant cell type, developed in response to different environmental inputs, may mean that discrete cell types share components of the some developmental program, responding to that program differently as the plant growth (GLOVER, 2000, LARKIN et al., 1997).

Differentiation and physiological "maturity" of epidermal cells of *Magnolia x soulangeana* leaves was observed in different growth stages and environment conditions.

The epidermal cells of leaves developed in *in vitro* conditions have had strong watered cells (95,86 %) without cuticle, the stomatal guard was unable to regulate the opening and closing of the stomatal pore. The water lost after transfer this plants into normal atmosphere was very rapid.

Anatomical adjustment after transfer of the explantats to *ex vitro* conditions was going very slowly and manifested successive changes of epidermal cells shape and physiological functions.

The new developed pavement cells have had form a round lobe fixed in. Their surface was coated with the thin cuticle layer. Stomatal guard cells were able to regulate moving of the stomatal pore. The typical trichome with developed cuticle and the suite of socket cells appeared on the good adapted leaf similarly as trichomes on the young mothers plant leaves.

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EFFECT OF CD ON PLANT PRODUCTIONABLE CHANGES

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The influence of various Cd doses on the production of biomass and roots and on the Cd content in spring barley in biological tests was ascertained. In two pot trials with two various soils (clay-loam soil, pH 5,70 and sand-loam soil, pH 7,65 influence of selenate on the Cd mobility and Cd transfer into plant organs of spring barley was determined. The content of cadmium in tested soils and in plant organs was determined after mineralisation by the atomic absorption spectrophotometry method. Soil mobilities of Cd - compounds have shown that in two soils the main Cd compounds were mainly 83-89 % in the mobile form in the HNO_3 2 $mol.dm^{-3}$ extracts. The mobility of Cd was partly reduced by addition of selenate into the soil. Unlike Cd relatively strong blockading function of roots was observed. Investigation of Cd transfer into plant organs with regard to vegetation period shown that Cd content in roots increased with time while oposite trend was in shoots. The increased but non - phytotoxic Cd content in substrate caused unnegligible translokation into grain spring barley in the phase of full rippens, predominantly in the variant by the addition of selenate into the soil.

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EFFECT OF UV-C RADIATION ON REDOX ACTIVITY AND PROTON EXTRUSION IN MAIZE COLEOPTILE SEGMENTS

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H^+ export by plasma membrane redox system has been demonstrated in many types of plant material (for review see LÜTHJE et al., 1997). It was previously showed by KARCZ and STOLAREK (1988) that the exposure of maize coleoptile segments to UV-C radiation brought about the inhibition of proton extrusion and elongation growth. These authors suggested that the suppression of both processes was caused by inhibition of plasma membrane proton pump. On the other hand, the H^+ export may also arise from plasma membrane redox reactions. The present study was undertaken with the purpose of enlarging the role of redox reaction-assiociated H^+ extrusion in the mechanism of UV-C radiation action on plant cells. The experiments were carried out with 10 mm-long maize coleoptile segments cut from 4-day-old etiolated seedlings. Redox activity was determined spectrophotometrically in agreement with the method described by CARRASCO-LUNA et al. (1995). Redox activity and proton secretion were measured with or without chlorinated auxin (4-Cl-IAA). Before experiments the maize seedlings were irradiated with UV-C radiation (300 μW cm^{-2}). We have found that UV-C radiation abolished 4-Cl-IAA-stimulated redox activity and redox-assiociated proton extrusion in maize coleoptile segments.

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THE INFLUENCE OF LOW TEMPERATURE ON GROWTH KINETICS OF WHEAT SUSPENSION CULTURE

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Cell suspension culture of winter wheat (*Triticum aestivum* L.) derived from immature inflorescence of cv. Almari was used to study the effect of a short pre-treatment in temperature 5 °C on its growth kinetics during further 15-days of culture (control at temperature 26 °C). The increase of the number of cells was similar for both conditions, however low temperature slowed down the growth rate between 4-11 days of culture. Results were in agreement with the changes of the settled and packed volume. Dry mass of controlled suspension culture, maintained continuously in 26 °C, increased about 1,5 times more effectively then cooled one. The minimum pH was noticed in the 2nd day of culture for both objects, however much higher acidification of the medium was observed in low temperature pre-treated culture. The uptake of ingredients from medium was lower in pre-cooled cultures. Simultaneously, there was observed the higher than in control values of conductivity and osmolality of medium during all time of cycle culture in pre-treated by low temperature suspension. The results suggest that low temperature is unfavourable for growth kinetics in short-term wheat culture, however we hope that during further growth activity of low temperature should proved differentiation of cells.

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THE INFLUENCE OF THE WATER REGIME ON THE CREATION OF THE ACCUMULATION POTENTION OF THE WINTER WHEAT STAND ON THE EASTSLOVAKIAN LOWLAND

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The production efficiency is determined by two systems of the crop production process and accumulation potential of the stand. The detailed survey about the production possibilities in the conditions of Eastslovakian Lowland is mentioned by REPKA et al. (1984). The water regime is one of the limiting factors on the Eastslovakian Lowland.

The experimental results were achieved in the polyfactorial field experiments on the Eutric Fluvisols in the years 1971-1999.

The resulting production was evaluated from the point of view of the decisive structural elements of the harvest, look like they are the number of plants, of offshoots, of grains in one ear and on the area, the weight of one thousand grains. The values of the hydrotermic coefficient of Seljanin were in the months April-July in the range HK=0.23-3.34, which is in agreement with the conditions of the disasterous drought HK<0.3 till the excess of moisture HK>3.

The dependence of the yields from the hydrotermic coefficient is the moderate positive in April and significantly positive in May. The dependence is moderately negative in June and unambiguously negative (CC= -0.41 to -0.60) in July. The substantial influence on the height of production has especially the number of grains on the area and the weight of one thousand grains. Whereas, the negative correlation has been observed between these structural elements. The influence of the hydrotermic conditions is concerned the apparent positive dependence of the hydrotermic coefficient to number of grains on the area in April and May. In the long-time average neither high weight of one thousand grains (48-50 g) can not eliminate the negative consequence of the low number of grains. The analysed production of the winter wheat at 8,0 t/ha is obtained at structural components of the accumulation potential: the number of grains in one ear – 28, the number of grains on m^2 – 16 800, the weight of one thousand grains – 47.50 g. In regard to these facts the irrigation is needed cca. 50 mm in dry years in months April and May.

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INFLUENCE OF SIMULATED HAILSTORM ON THE YIELD OF MAIZE

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The most frequency of hail is during intensive growing period of maize or during grain formation.

Field trials were established on three sites in sugar beet growing region during 1993-1995). Two hybrids (FAO 300 and FAO 200) were used as an experimental material. Period of dates of damaging were 10 days, starting 30 days after sowing (day 30, 40, 50, …130). Degree of damage was 20, 40, 60, 80 % of the plants; it is equal to re-motion of 1/4, 1/2, 3/4 and whole leaf lamina (stem and husks were not damaged). Damage was realised by ”combing” (ripping) of steel comb.

Mathematical model of ear weigh loses was calculated from measured values on PC.

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CHLOROPHYLL FLUORESCENCE IN SPRING BARLEY, MEADOW FESCUE AND WINTER RAPE LEAVES AS AFFECTED BY OZONE FUMIGATION

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Ozone has been demonstrated to alter basic metabolic processes in plants, including photosynthetic rate and Rubisco activity. Ozone as photooxidant affects the structure and function of biological membranes, thereby O_3 changes chlorophyll fluorescence yield and causes damages of PSII reaction centres (SOLDATINI et al., 1998, GUIDI et al., 1999). The aim of the work was the estimation, if the higher ozone concentration in air causes the changes in chlorophyll fluorescence (F_0 – the initial level of chlorophyll fluorescence; F_m – maximal fluorescence; F_v/F_m – the photochemical efficiency of PS II; half-raise time ($t_{1/2}$) from initial to maximal fluorescence) and photosynthesis rate in leaves of *Hordeum vulgare*, *Festuca pratensis* and *Brassica napus* var. *oleifera*. The seedlings have been fumigated at 180 ppb of ozone for 12 days.

Obtained results showed that ozone fumigation changed only $t_{1/2}$ values: in fescue and barley plants after 6 and 9 days of fumigation, while in rape ones after 6 days. Any changes in the F_v/F_m and F_0 values were not found. Ozone concentration of 180 ppb decreased the photosynthesis rate in all plants, what was connected with lower stomatal conductance. The greatest decline of CO_2 assimilation was observed in barley seedlings.

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THE EFFECT OF SEEDS LASER BIOSTIMULATION ON GROWTH OF FABA BEAN DETERMINATE FORM IN DIFFERENTIATED TEMPERATURE CONDITIONS

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The experiment was conducted at climatic chambers. First row factor were differentiated doses of laser irradiation and the second one were differentiated temperature conditions. Faba bean plants which originated from irradiated seeds germinated 3-4 days earlier than plants from not irradiated seeds. At the lower temperature about 17 % decrease of emergenced plants was observed and emergence were retarded about 7-8 days in comparison to plants growing in the optimal thermal conditions. The emergence of faba bean at optimal and lower temperature increased as a result of seeds irradiation about 9,6 and 7,4 %, respectively. Plants growing in the decrease temperature conditions produced about 46,6 % lower dry matter yield than plants which were grown in optimal thermal conditions. The increase of aboveground parts dry matter yield of plants growing in both thermal conditions was biggest in the case of three and five fold of seeds irradiation: 27,4 and 24,6 %, respectively.

Until now have been done little researches concerning the dependence of seeds irradiation effect on thermal conditions of environment. Some of research workers, which occupied a problem of influence laser light on seeds, obseve the effect thermal-moisture conditions on the development and yielding of plants which were grown from irradiated seeds (INYUSHIN et al., 1981, PODLEŚNA, PODLEŚNY, 1998). Researches of GLADYSZEWSKA (1999) concerning of irradiated tomato seeds germinating at differentiated thermal conditions also confirmed these results.

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THE EFFECT OF SEEDS LASER BIOSTIMULATION ON DETERMINATE FORM OF FABA BEAN GROWTH IN DIFFERENTIATED MOISTURE CONDITIONS

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The experiment was carried out at the Mitscherlich pots in the climatic chambers. The first row factor was differetiated soil moisture and the second one were differentiated doses of laser irradiation. This experiment was conducted for period 120 days. First emergence and the best development of faba bean plants were observed on the soil with 70 % of field water capacity. Seeds which were pre-sowing treated by laser light germinated 2-3 days earlier than seeds without irradiation. The number of germinating seeds icreased as a result of 3 and 5 fold irradiation about 9,4 and 8,6 %, respectively. Flowering and pod setting of plants which were grown from seeds 3 or 5 fold irradiated were earlier about 8 and 5 days, respectively. Plants which were grown from seeds 3 and 5 fold irradiated gave more pods in comparison to plants originated from seeds without irradiation about 18 % and 16 %, respectively. It was found significant effect of pre-sowing seeds irradiation and soil moisture on the value of dry mass of pods with seeds. The obtained results are rather hard to compare with results another authors becouse in the Polish and foreign bibliography we can meet only short mentions concerning this problem and in reference to another species. SEBANEK et al. (1989) found increase of chlorophyll content in the leaves of pea plants which were grown from laser light irradiated seeds. From the researches of AUGSTEN, MICHEL (1981) is evident that irradiation of seeds profitable influences on the increase of nitrate reductase activity in the maize roots. Researches of PODLEŚNY (1999), also indicate on smaller loses in the vegetation these plants from the stand which were grown from irradiated seeds.

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DECREASING OF SUGAR BEET YIELD CAUSED BY LEAF AREA DAMAGE (BETA VULGARIS L.)

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Sugar beet stands are in the absolute majority established by exact sowings to the final row spacing when eventual interspace in crop markedly should affect the yield and the quality of the harvest. In this connection an emphasis is laid on higher density and stand establishment, including keeping of the optimum leaf area in the period of highest productivity of plants. Relationships between damage of leaf area, date of damage and the level of looses are connected with the dynamics of the growth of sugar beet leaves which is highest in July and August. Damage or reduction of assimilation apparatus results in the decline of sugar beet root yield as well as of polarization sugar what can be primarily related to relationships between integral leaf area and productivity of sugar beet stand. BACHMAN (1993) also accentuates the importance of the range and date of damage to the level of decline of sugar production. Field trials were established on three sites in sugar beet growing region of the experimental site Prague. KW Perla was an experimental variety. Dates of damage: after 10 days, starting on 30th day from emergence. Degrees of damage: control 0, 20, 40, 60, 80, 100% loss of leaf area. Results were statistically evaluated by correlation and regression analyses. Models of looses for different indicators: the degree of damage, date of damage, and percentage of loss (decrease) of the root yield and polarization sugar were calculated from the values found. Damage of leaf area had significant impact on the decrease of the root and sugar yield. The yield depression was in direct proportionate to the degree of damage. The highest looses of root and sugar yield were found in the damage in the period between 60-90 days after sowing, the lowest ones were recorded at the beginning and end of the growing season. The level of losses and the identical degree of damage was different in different years. Maximum losses of root yield amounted to 31% and 100% damage of leaves, losses of the yield of polarization sugar were 45% in this year.

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RESPONSES TO WATER STRESS OF EPIPHYTIC FERN GAMETOPHYTE PLATYCERIUM BIFURCATUM

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Water stress is on of the factors responsible for damages of cells and plant issues. In the research gamatophytes of the epiphytic fern *Platycerium bifurcatum* were used. Epiphytes can by divided into CS (continuously supplied), which are supplied with water in a continuous manner and PS (pulse supplied), supplied with this agent periodically. Water stress was induced by mannitol of various concentrations and by desiccation at 35 % realtive humidity of the air. Gametophytes of the fern *Platycerium bifurcatum* are sensitive to desiccation and also to the stress caused by mannitol. A significat decrease of the intensity of photosynthesis level was noted and its degree depends on the concentration of mannitol. The results suggest that this development stage of the fern belongs to the CS plants, which are very sensitive to damages caused by a water stress. In the case of *Platycerium bifurcatum* gametophytes, a 50 % loss of water causes that gas exchange drops to zero. In the course of rehydration, a return of gas exchange to the initial level depends on the time of desiccation (EICKMEIER 1985). The living envirnment of epiphytes is characterised by periodical water deficit, hence in these plants there is a need to produce mechanisms enabling survival in such unfavourable conditions .

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PRODUCTION OF THE GERMAN CHAMOMILE CANOPIES AFFECTED BY A STRESS DISTURBANCE

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German chamomile, *Matricaria recutita* L., belongs to the most popular medicinal plants in phytomedicine and aromatheraphy. Slovakia is one of the European countries in which particular attention has been devoted to research of chamomile in all its aspects. At present good breeding methods, cultivation, harvesting and processing produce the chamomile raw-material with high quality of chamomile essential oils. In regard to the same products which are purchased on the world market, the Slovak chamomile production is comparable and better in plenty of qualities.

This contribution reports on effect of a stress disturbance on production of the German chamomile stands.

Medicinal plant cultivation shows to be economically profitable only when this crop is collected several times a year (annual species) or several times within their life cycle (two-year and perennial plants). Individual chamomile anthodia harvests disturb the stands to a great extent. Disturbance, like the stress, means therefore a partial or overal destruction of monoculture phytobiomass. Of course, each from these harvests bring the new regenerative processes. Simultaneously, it is a signal to metamers (PREVOST, 1967) in middle part parts to production new lateral stems with tip growths capable new chamomile anthodia production. Accordingly, the existence of controlling and compensatory mechanisms and dependence between a sowing density and a total weight population or "law of constant final yield" (YODA et al., 1963), closely related to ecological limits, are clearly demonstrated in chamomile stands.

The plant metamer demography after the chamomile anthodia harvests presents a dynamic model of plant formation, regeneration and further production.

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FLORISTIC – PHYTOCOENOLOGY SPECIALITY FRINGE COMMUNITIES

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Agriculture privatization has given way for changes of species spectrum of agrophytocenoses and their fringe communities. As far as the species composition is concerned fringe communities are very variable and often entirely fragmentary (ŠANDOVÁ, 1978). Syntaxonomically they can be evaluated just as growths or communities with dominant species brought in.

Phytocenological research of fringe communities can bring some problems. The fringe communities often form zone between two communities – the intermediate area. This area is usually very narrow as regards the area, therefore the belt transect (narrow extend oblongs) over classical phytocoenology methods often brings complicated interpretation of vegetation analysis. By (KOPECKÝ, HEJNÝ, 1973, 1978) for classifying of those fringe communities is often used deductive process of syntaxonomy method.

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THE INFLUENCE OF COLD ON THE PHOTOSYNTHETIC ACTIVITY IN LEAVES OF 26 CULTIVARS OF WINTER WHEAT

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The influence of low temperature on chlorophyll a fluorescence of 26 winter wheat cultivars was studied. Measurements were performed at 5 ^{o}C using PAM-2000 Fluorimeter on fully developped leaves after period of vernalization varied from 1 to 9 weeks and also on leaves of the control plants cultivated at 20 ^{o}C. For light-adapted plants following fluorescence parameters were estimated: F'_{o} , F'_{M} and F'_{M} . From these the effective quantum yield of PS II electron transport ("Yield") and photochemical quenching (qP) were calculated. Parameter "Yield" estimated at steady – state equilibrium is very close to the total quantum yield of photosynthesis.

In all varieties under study the effective quantum yield of the PSII was clearly lowered during the 1st week of cold treatment (on the average to ca 63 % of the control plants). However, as soon as after 4th week of vernalization the value of "Yield" reached almost the value characterizing control plants. Such a high value of quantum yield of the PSII was observed as late as to the 7th week of vernalization. At the end of cold treatment period (8th and 9th week at 5 ^{o}C) the quantum yield of the PSII dropped, beeing all the time significantly higher as compared to that observed during first weeks of the cold treatment.

These results indicate the relationship between state of vernalization and the effectivity of photosynthetic apparatus in plant leaves. This supports the possible role of "trophic" mechanism of winter wheat vernalization.

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IN VITRO CULTURES OF IMMATURE MAIZE EMBRYOS

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Two kinds of callus - compact embryogenic (Type I) and friable non-embryogenic (Type II) were initiated from immature embryos (IE) of maize line S245 × Co255. IE and callus were cultured on various agar nutrient media: Murashige and Skooga (MS), Kao and Michaluk (KM), Gamborg (G), Schenk and Hildebrandt (SH) supplemented by 0.5 mg/dm^3 and 2 mg/dm^3 2,4-D. The highest fresh mass of callus was obtained on MS medium (220 mg per 1 IE) followed by G (156 mg), KM (133mg), SH (115mg). The MS medium appeared also to be the best for differentiation of compact type of callus – 26,5 % of tissues demonstrated shoot organogenesis. These results may be related to total nitrogen content in basal medium. The friable callus was preferred for the initiation of cell suspension culture. The cell morphology (area, circularity and length) as well as cell number and nutrient pH were measured after four–month-culture. These parameters were measured after 1, 2, 4, 7, 9 and 15 days of subculture. Cells in suspension culture divided rapidly between 4th and 7th days of culture. That corresponded with decrease of cell area and length as well as increase of cell circularity and also decrease of nutrient pH was observed.

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THE INFLUENCE OF SELECTED GROWING FACTORS VARIABILITY ON SPRING BARLEY (HORDEUM SATIVUM L.) YIELD

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The polyfactorial field experiments were carried out in 1994 to 1997 at the Research Institute of Agroecology Michalovce, experimental working places in Milhostov and Vysoká nad Uhom. The localities are situated in the central part of the East Slovak Lowland with continental character of climate. The bases are located in warm corn-growing region, with fluvisol in Vysoká nad Uhom (1st base) and fluvi-eutric gleysol in Milhostov (2nd base). The weather condition were quite different during the years of experiment, the amout of rainfall vegetation period varied from 193,5 mm to 345,3 mm (1st base) and from 262,3 mm to 301,3 mm (2nd). The average daily temperatures during vegetation period varied from 12,64 °C to 14,20 °C (1st) and from 12,7 °C to 14,20 °C (2nd). The phosphorus, potasium and magnesium in the soils were at the good level, ph/KCl 7,14 (1st), respectively 6,63 (2nd). Humus contents are 2,07 % (1st) and 2,65% (2nd). Spring barley, cultivar SLADKO, at a seeding rate of 4 million germinating seeds per hectare and a row spacing of 125 mm, it was used in the trial.

The aim of experiment was to evaluate the influence of selected growing factors (various tillage and agrotechnic, fertillization, soil type, growing season) on the spring barley yield as well as interactions of these factors on the mentioned crop yield. There were three variants of tillage and agrotechnic (no-till, reduced tillage - 15 cm, conventional tillage 25 cm), five variants of fertillization - including nonfertilled control and the mentioned two soil types and four growing seasons. In regard to statistical valuation by a method of total analysis of of variance the fertillization was found as dominant source of variability of the spring barley yield. The influence of soil type and growing season has just a lower significance in valued time period. The different tillage and agrotechnic has not been a significant on yield variability as separated factor. As the statistically significant source was determined interaction between tillage and agrotechnic x soil type x growing season as well as interacion between soil type x growing season. Other interactions were not significant. The similar results - no significancy, are valid for all interactions of fertillization.

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THE EFFECT OF NITROGEN FERTILIZATION ON THE DRY MATTER FORMATION AND THE ENERGY ACCUMULATION BY SPINACH PLANTS

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In the years 1998 and 1999 in four periods (spring, first half of summer, second half of summer, autumn) was grown spinach, variety Pavana F1, in micro-plot trials in neutral soil (pH > 6,5) and in acid soil (pH < 4,5). The spinach pertain to the plants with low net energy contents in dry matter of leaves. We measured this physiological value during vegetative period by calorimeter Laget MS 10 A and the contents of energy was from 11,52 kJ net energy to 15,61 kJ net energy in 1 g of dry matter of spinach leaves. The graduated rates of nitrogen fertilization (50 and 100 kg $N.ha^{-1}$) increased the energy contents as many as 2,39 $kJ.g^{-1}$ of dry matter compared with control variant without nitrogen fertilizer. The total formation of dry matter during vegetative period, spinach yield and the total accumulation of net energy by spinach plants were higher in neutral soil than in acid soil. The total quantity of produced dry matter and the total accumulated energy by spinach plants increased by graduated rates of nitrogen fertilizer and decreased from spring time of cultivation to autumn time of cultivation in both soils.

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QUALITATIVE PROPERTIES OF ANTHEMIS TINCTORIA AND ANTHEMIS NOBILIS (CHAMAEMELUM NOBILE) UNDER DIFFERENT ENVIRONMENTAL CONDITIONS

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Plant species of *Anthemis* genus in nature grow on dry, sunny places, especially on calcareous substrates, on wood-steppe hillsides, bushes; they are able to vegetate on ruderal (infertile) stands. They tolerate warm and basic soils, more limy ones. They especially well grow on clay-sandy soils with poorer humus content.The species of *Anthemis* genus found broad use in the pharmaceutical and cosmetic industry, and food industry as well. *Camomille* is a popular object for the homeopathy. In all cases the drug are yellow and white flowers. They have a great significance in food industry due to the presence of natural yellow dyes used at the production of diary and butchery products. The main components therein are natural flavonoids and essential oils. *Chamaemelum nobile* is widely utilized in cosmetic industry because of smartly fragrant components in its oil, and as a part of some kinds of tea blends as well.In the work we have studied the content and composition of the essential oil of both species grown at different localities of the Slovakia in three vegetation periods. The quality of oil of species under study partly depended on climatic conditions, which dominate on a particular locality (ČERNÁ et al., 1998). The flower heads were harvested, and essential oil was isolated by hydro distillation. The content of essential oils varied from 0,81 up to 1,89 % (HABÁN et al., 1999). The abundances of main components of the oil from both species regardless some relative deviations were hereditary preserved. In the case of *Anthemis tictoria* also were investigated the content and changes of flavonoids, which are in its flowers significantly present. The content of flavonoids was determined by the standard method (CHRIS–MULLER, 1960). The average content of flavonoids reached values between 1,05 and 2,56 %. The lowest flavonoids content 0,68 % was found in the first developmental phase, while the highest one 3,24 % in the third and fourth developmental phases in ray florets (VAVERKOVÁ et al., 1999). Experimental results have showed variability in essential oils and flavonoids content in flowers of *Anthemis tinctoria* and *Anthemis nobilis* in dependence of environmental conditions (HABÁN et al., 1998).

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THE INFLUENCE OF ABIOTIC MULTISTRESSE PH, CD, N NUTRITION AND WATER STRESS ON THE RATE OF PHOTOSYNTHESIS AND TRANSPIRATION OF THE LEAVES OF BARLEY SEEDLINGS

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The influence of two or more stress factors, acting at the same time on the rate of photosynthesis (P) and transpiration (T) was measured. The rate of leaf P and T was measured in an open system LCA4 (infra-red gas analyser) in two experiments sets on fully developed third leaves of barley seedlings (four week old) growing in nutrient solutions. In the first set of experiments the synergic influence of two levels of pH and three levels of nitrogen nutrition was observed. The highest rate of P was detected in high-level nitrogen nutrition in pH6 treatment. By contrast the lowest rate of P was found in low-level nitrogen nutrition with pH4 treatment. Plants supplied with a low level of nitrogen were highly sensitive to pH. The lowest differences in the rate of P in low pH were plants with optimum nitrogen supply. From these results follows that the plants with optimum balanced nutrition are able to withstand greater changes in pH in the root environment. There were evidently greater differences in the rate of T of plants influenced by pH4 and pH6 and by the low level of nitrogen. The value of transpiration rate (TR) was lowest in pH4 treatments and highest in the pH6 treatment. From this result follows that the plants deficiently supplied by the nitrogen are again more sensitive to the changes of pH. The plant over-supplied by the nitrogen had a low level of rate in the case of low pH4 treatment. The second set of experiments observed the synergic influences of cadmium (in the form of 10^{-5} mol solution of $CdCl_2$) and water stress, involved by the NaCl and PEG (polyethylene- glycol) with the equal water potential. In plants contaminated by heavy metals we observed first of all chloroses of leaves, browning of roots hair, tips of roots and abscise of old leaves. The plants growing in the contaminated medium react mostly by lowering rate of plants growth, disfunction of rate of photosynthesis and TR. In the experiment we compared the influence of two root osmotics: NaCl and PEG. The differences in this two osmotic substances is in the high uptake of Na^+ and Cl^- ions by plants from NaCl and this influenced the uptake of the other ions for example Mg^{2+} and K^+ in a great amount. PEG has great molecular weight, due to which it cannot be absorbed through the plasma-membrane. The high molecular weight is the reason why it is not received into plants and has only osmotic influence on plants. The PEG in the comparable same water potential caused markedly lowering of the rate of P and TR in contrary to the plant treated by NaCl only. Both stress factors PEG and Cd in combination lead to several times increased rate of P and TR than when the plants were treated by PEG alone. The similar tendency was found in plants treated by NaCl and Cd together. The increase of osmotic effect of PEG compared to NaCl can be explained by the higher viscosity of solution or shortage of oxygen in the solution. The changes of the rate of P and T in these two experiments allow to show the differences in physiological functions in plants and their responses to multi-stress conditions.

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DIFFERENCES BETWEEN TWO SPRING BARLEY CULTIVARS ASSIMILATE PARTITIONING AS REACTION TO NITROGEN NUTRITION AND WATER STRESS

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Nitrogen plays an important role in plant growth, development and productivity. Its role was investigated in spring barley plants grown under water stress conditions. The pattern of assimilates partitioning among plant organs is from this viewpoint a critical factor that controls the rate of plant growth and yield formation (GEIGER et al. 1996, INGRAM and BARTELS 1996, LU and NEUMANN 1998, ZIMA 1998).

Responses of two spring barley cultivars (cv. Jubilant and Forum) were estimated in pot experiments either in control or N-additionally fertilized treatments. Nitrogen was added at stem elongation period and water stress conditions were imposed at heading stage. The dynamic of growth parameters of individual organs, leaf area, diffusion resistance, chlorophyll and nitrogen content of leaves and grains both on the main stem and tillers were analysed.

The applied nitrogen changed positively leaf chlorophyll content and influenced assimilate partitioning in individual organs of tested cultivars. The negative effect of nitrogen was observed on ear/grain growth of water stressed plants. The most significant differences were obtained for tiller`s grain number, grain and ear weights and less significant effect was on ears of main stem.

Strong and sharp water stress restricted nitrogen availability, transport and use for the growth of economically important organs.

Cultivar Forum is significantly more tolerant to water stress under conditions of higher N availability than cultivar Jubilant.

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