International Conference
"Photosynthesis and Crop Production"

PROGRAMME
AND
ABSTRACTS

7-11 October, 2002, Kyiv, Ukraine

Ministry of Education and Science of Ukraine
Ukrainian Society of Plant Physiologists
Institute of Plant Physiology and Genetics

PROGRAMME AND ABSTRACTS

of International Conference

"PHOTOSYNTHESIS AND CROP PRODUCTION"

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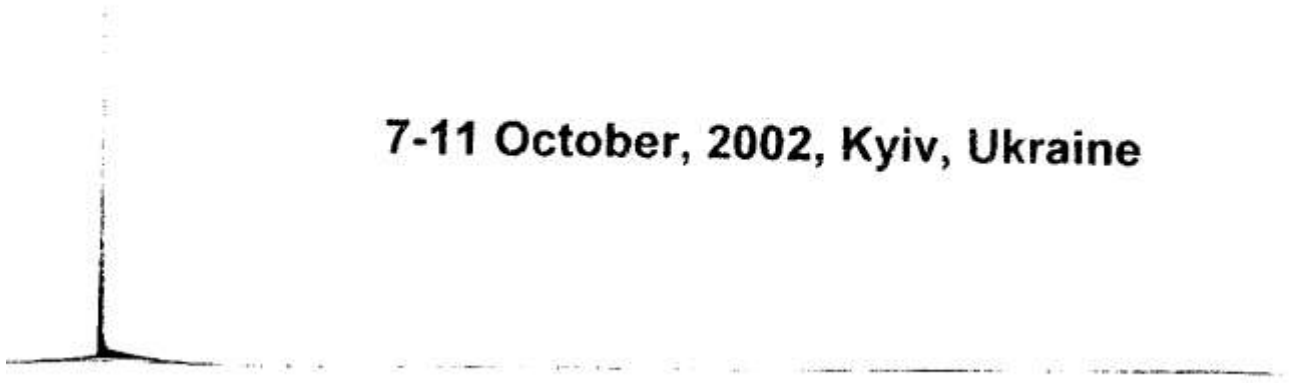

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among the plots studied does not go beyond the accuracy of the experiment. A preliminary conclusion is made, that leaf chlorophyll content in the plants in plots does not depend on fertilization. Due to a high level of sun insolation in the years of investigations, leaf chlorophyll content in sugar beets during vegetative period was somewhat lower compared with average long-term data. It is due to the fact, that required amount of light energy under a high level of insolation, biosynthesis of photosynthetic pigments, namely chlorophylls, lowers and remains at the level of optimal parameters of light regime. We also studied the effect of sugar beet mineral nutrition conditions on the process of assimilating surface forming as the basis of photosynthetic potential of sown areas, which ensures the assimilation of carbon dioxide and photosynthetically active sun radiation by plants. The formation of the assimilating surface of sugar beet during the growing season is due to the level of organic and mineral nutrition. Thus, the development of a larger assimilating surface of the species was noticed at the third levels of mineral and organic system of fertilization. It has been suggested that combination of organic and mineral fertilizers had a considerable effect on yield and quality of plant roots. Analyzing yielding capacity data, one may say that the highest yields of sugar beet roots were harvested when organic and mineral fertilization system was used. Concerning the content of sugar in the sugar beet roots it was found some contradiction with yielding capacity, and it is quite natural, because during the ontogenesis even under favorable weather-climatic conditions and mineral nutrition regimes the plants cannot produce high yields and sugar content simultaneously; mostly it occurs because of insufficient photosynthetic activities of the plants and transportation of photoassimilates under field conditions, that are not always optimal for sugar beet.

EFFICIENCY OF THE USE OF CONTAINER HERBICIDE MIXTURES UNDER SPRING BARLEY AND THEIR EFFECT ON PHOTOSYNTHETIC PRODUCTIVITY OF SOWN AREAS

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Considerable infestation of fields in Ukraine requires further efficient methods to control their number, particularly for resistant species. One of the ways to overcome resistance is to use container herbicide mixtures.

The aim of our studies was to investigate the effect of herbicide mixtures (granstar at dozes of 10, 15, 20 and 25 g/ha with 2.4–D l/ha) on infestation of spring barley fields and, in particular, those of resistant species to auxin-like active herbicides, and on physiological-biochemical processes in spring barley – photochemical activity of isolated chloroplasts, net photosynthesis productivity, chlorophyll accumulation, as well as on the yield and its quality.

We have found that a combination of herbicides of two different kinds (its site of effect is enzyme of acetolactat syntaza) and 2,4–D (auxin-like herbicide) have a positive effect on controlling weeds in the fields of spring barley. The efficiency of their controlling (eliminating), and in particular for resistant species, increased as the doze of granstar in container mixtures with 2,4–D (l/ha) increased, however, it considerably influenced physiological processes in the spring barley.

Thus, with the increase of container mixtures of granstar to 20 and 25 g/ha the total green pigment content in the leaves decreases (20-30% compared with control, no herbicides applied) as phytochemical activity of isolated chloroplasts does. In general, it causes a decrease in net photosynthetic productivity and yielding capacity of the crop.

The highest indices of net photosynthesis productivity are found when container mixtures with 2,4–D of granstar at doze of 10-15 g/ha are applied. Hence, according to the

data received, an available of 2,4–D l/ha in container mixtures is optimal, and it ensures high phytotoxic effect of chemicals on weeds.

PHOTOSTASIS AND ENERGY SENSING IN RESPONSE TO A CHANGING ENVIRONMENT

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A common characteristic of all photoautrophic organisms exposed to changes in environmental factors such as light intensity, temperature, nutrient status or water availability is that they exhibit an imbalance between the energy absorbed through photochemistry relative to the energy utilised through electron transport and cellular metabolism. Regardless of the environmental change, such an imbalance leads to an increased reduction of the PQ pool which reflects increased excitation pressure which can be estimated *in vivo* by pulse amplitude modulated chlorophyll fluorescence spectroscopy. Excitation pressure can be detected whenever $\Phi_{PSII} \cong I > n \cong \vartheta^{-1}$ where Φ_{PSII} is the absorptive cross section of PSII, I is the incident irradiance, n is the number electron sinks and ϑ^{-1} is the turnover of these sinks. The predisposition of photosynthetic organisms to attain a balance in energy budget is defined as photostasis. This minimizes excitation pressure and prevents irreversible, photoinhibitory damage. Photosynthetic organisms with a minimal capacity to adjust photosynthetic capacity and growth acclimate to changes in either temperature or irradiance by adjusting either $\Phi_{PSII} \cong I$ by changing the size of the PSII light harvesting complex and the effective absorption cross section through either xanthophyll cycle-dependent antenna quenching or through PSII reaction centre quenching. In contrast, certain species are able to modulate photosynthetic capacity as well as growth rates in response to temperature and irradiance, and thus, maintain photostasis by adjusting $n \cong \vartheta^{-1}$. At least two sensing mechanisms related to the PQ pool of the thylakoid membranes appear to be involved in detecting changes in excitation pressure and hence energy imbalance: (1) the redox state of the PQ pool appears to regulate both nuclear and chloroplastic photosynthetic gene expression and (2) the transthylakoid pH, and hence chloroplastic pmf, regulates the xanthophyll cycle and non-photochemical quenching of excess light energy. Both sensing mechanisms operate coincidentally to protect the photosynthetic apparatus from chronic photodamage. Thus, the photosynthetic apparatus appears to have a dual function: not only does it function as the traditional energy transformer but it also functions as primary environmental sensor. The concept of energy sensing through electron transport represents a mechanism by which both photoautotrophic and heterotrophic organisms may acclimate to a changing environment.

SCIENTIFIC DETERMINISM AND THE QUEST FOR A COMPLETE UNIFIED THEORY OF BIOLOGY

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This paper aims at drawing certain implicit parallels between some of the most fundamental laws of physics and their equivalent concepts in modern biology. Just as the success of